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*of the University of*  
**Minnesota**

*The College of Engineering and*  
*Architecture*  
*Announcement for the Year*  
**1921-1922**



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1921							1922														
<b>JULY</b>							<b>JANUARY</b>							<b>JULY</b>							
Su	Mo	Tu	W	Th	Fr	Sa	Su	Mo	Tu	W	Th	Fr	Sa	Su	Mo	Tu	W	Th	Fr	Sa	
..	..	..	..	..	1	2	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>	<b>6</b>	<b>7</b>	..	..	..	..	..	..	1	
<b>3</b>	<b>4</b>	<b>5</b>	<b>6</b>	<b>7</b>	<b>8</b>	<b>9</b>	<b>8</b>	<b>9</b>	<b>10</b>	<b>11</b>	<b>12</b>	<b>13</b>	<b>14</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>	<b>6</b>	<b>7</b>	<b>8</b>	
<b>10</b>	<b>11</b>	<b>12</b>	<b>13</b>	<b>14</b>	<b>15</b>	<b>16</b>	<b>15</b>	<b>16</b>	<b>17</b>	<b>18</b>	<b>19</b>	<b>20</b>	<b>21</b>	<b>9</b>	<b>10</b>	<b>11</b>	<b>12</b>	<b>13</b>	<b>14</b>	<b>15</b>	
<b>17</b>	<b>18</b>	<b>19</b>	<b>20</b>	<b>21</b>	<b>22</b>	<b>23</b>	<b>22</b>	<b>23</b>	<b>24</b>	<b>25</b>	<b>26</b>	<b>27</b>	<b>28</b>	<b>16</b>	<b>17</b>	<b>18</b>	<b>19</b>	<b>20</b>	<b>21</b>	<b>22</b>	
<b>24</b>	<b>25</b>	<b>26</b>	<b>27</b>	<b>28</b>	<b>29</b>	<b>30</b>	<b>29</b>	<b>30</b>	<b>31</b>	..	..	..	..	<b>23</b>	<b>24</b>	<b>25</b>	<b>26</b>	<b>27</b>	<b>28</b>	<b>29</b>	
<b>31</b>	..	..	..	..	..	..	..	..	..	..	..	..	..	<b>30</b>	<b>31</b>	..	..	..	..	..	
<b>AUGUST</b>							<b>FEBRUARY</b>							<b>AUGUST</b>							
..	1	2	3	4	5	6	..	..	..	1	2	3	4	..	..	1	2	3	4	5	
<b>7</b>	<b>8</b>	<b>9</b>	<b>10</b>	<b>11</b>	<b>12</b>	<b>13</b>	<b>5</b>	<b>6</b>	<b>7</b>	<b>8</b>	<b>9</b>	<b>10</b>	<b>11</b>	<b>6</b>	<b>7</b>	<b>8</b>	<b>9</b>	<b>10</b>	<b>11</b>	<b>12</b>	
<b>14</b>	<b>15</b>	<b>16</b>	<b>17</b>	<b>18</b>	<b>19</b>	<b>20</b>	<b>12</b>	<b>13</b>	<b>14</b>	<b>15</b>	<b>16</b>	<b>17</b>	<b>18</b>	<b>13</b>	<b>14</b>	<b>15</b>	<b>16</b>	<b>17</b>	<b>18</b>	<b>19</b>	
<b>21</b>	<b>22</b>	<b>23</b>	<b>24</b>	<b>25</b>	<b>26</b>	<b>27</b>	<b>19</b>	<b>20</b>	<b>21</b>	<b>22</b>	<b>23</b>	<b>24</b>	<b>25</b>	<b>20</b>	<b>21</b>	<b>22</b>	<b>23</b>	<b>24</b>	<b>25</b>	<b>26</b>	
<b>28</b>	<b>29</b>	<b>30</b>	<b>31</b>	..	..	..	<b>26</b>	<b>27</b>	<b>28</b>	..	..	..	..	<b>27</b>	<b>28</b>	<b>29</b>	<b>30</b>	<b>31</b>	..	..	
..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	
<b>SEPTEMBER</b>							<b>MARCH</b>							<b>SEPTEMBER</b>							
..	..	..	..	1	2	3	..	..	..	1	2	3	4	..	..	..	..	1	2	3	4
<b>4</b>	<b>5</b>	<b>6</b>	<b>7</b>	<b>8</b>	<b>9</b>	<b>10</b>	<b>5</b>	<b>6</b>	<b>7</b>	<b>8</b>	<b>9</b>	<b>10</b>	<b>11</b>	<b>3</b>	<b>4</b>	<b>5</b>	<b>6</b>	<b>7</b>	<b>8</b>	<b>9</b>	
<b>11</b>	<b>12</b>	<b>13</b>	<b>14</b>	<b>15</b>	<b>16</b>	<b>17</b>	<b>12</b>	<b>13</b>	<b>14</b>	<b>15</b>	<b>16</b>	<b>17</b>	<b>18</b>	<b>10</b>	<b>11</b>	<b>12</b>	<b>13</b>	<b>14</b>	<b>15</b>	<b>16</b>	
<b>18</b>	<b>19</b>	<b>20</b>	<b>21</b>	<b>22</b>	<b>23</b>	<b>24</b>	<b>19</b>	<b>20</b>	<b>21</b>	<b>22</b>	<b>23</b>	<b>24</b>	<b>25</b>	<b>17</b>	<b>18</b>	<b>19</b>	<b>20</b>	<b>21</b>	<b>22</b>	<b>23</b>	
<b>25</b>	<b>26</b>	<b>27</b>	<b>28</b>	<b>29</b>	<b>30</b>	..	<b>26</b>	<b>27</b>	<b>28</b>	<b>29</b>	<b>30</b>	<b>31</b>	..	<b>24</b>	<b>25</b>	<b>26</b>	<b>27</b>	<b>28</b>	<b>29</b>	<b>30</b>	
..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	
<b>OCTOBER</b>							<b>APRIL</b>							<b>OCTOBER</b>							
..	..	..	..	..	..	1	..	..	..	..	..	..	1	1	2	3	4	5	6	7	
<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>	<b>6</b>	<b>7</b>	<b>8</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>	<b>6</b>	<b>7</b>	<b>8</b>	<b>8</b>	<b>9</b>	<b>10</b>	<b>11</b>	<b>12</b>	<b>13</b>	<b>14</b>	
<b>9</b>	<b>10</b>	<b>11</b>	<b>12</b>	<b>13</b>	<b>14</b>	<b>15</b>	<b>9</b>	<b>10</b>	<b>11</b>	<b>12</b>	<b>13</b>	<b>14</b>	<b>15</b>	<b>15</b>	<b>16</b>	<b>17</b>	<b>18</b>	<b>19</b>	<b>20</b>	<b>21</b>	
<b>16</b>	<b>17</b>	<b>18</b>	<b>19</b>	<b>20</b>	<b>21</b>	<b>22</b>	<b>16</b>	<b>17</b>	<b>18</b>	<b>19</b>	<b>20</b>	<b>21</b>	<b>22</b>	<b>22</b>	<b>23</b>	<b>24</b>	<b>25</b>	<b>26</b>	<b>27</b>	<b>28</b>	
<b>23</b>	<b>24</b>	<b>25</b>	<b>26</b>	<b>27</b>	<b>28</b>	<b>29</b>	<b>23</b>	<b>24</b>	<b>25</b>	<b>26</b>	<b>27</b>	<b>28</b>	<b>29</b>	<b>29</b>	<b>30</b>	<b>31</b>	..	..	..	..	
<b>30</b>	<b>31</b>	..	..	..	..	..	<b>30</b>	..	..	..	..	..	..	..	..	..	..	..	..	..	
..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	
<b>NOVEMBER</b>							<b>MAY</b>							<b>NOVEMBER</b>							
..	..	1	2	3	4	5	..	1	2	3	4	5	6	..	..	..	1	2	3	4	
<b>6</b>	<b>7</b>	<b>8</b>	<b>9</b>	<b>10</b>	<b>11</b>	<b>12</b>	<b>7</b>	<b>8</b>	<b>9</b>	<b>10</b>	<b>11</b>	<b>12</b>	<b>13</b>	<b>5</b>	<b>6</b>	<b>7</b>	<b>8</b>	<b>9</b>	<b>10</b>	<b>11</b>	
<b>13</b>	<b>14</b>	<b>15</b>	<b>16</b>	<b>17</b>	<b>18</b>	<b>19</b>	<b>14</b>	<b>15</b>	<b>16</b>	<b>17</b>	<b>18</b>	<b>19</b>	<b>20</b>	<b>12</b>	<b>13</b>	<b>14</b>	<b>15</b>	<b>16</b>	<b>17</b>	<b>18</b>	
<b>20</b>	<b>21</b>	<b>22</b>	<b>23</b>	<b>24</b>	<b>25</b>	<b>26</b>	<b>21</b>	<b>22</b>	<b>23</b>	<b>24</b>	<b>25</b>	<b>26</b>	<b>27</b>	<b>19</b>	<b>20</b>	<b>21</b>	<b>22</b>	<b>23</b>	<b>24</b>	<b>25</b>	
<b>27</b>	<b>28</b>	<b>29</b>	<b>30</b>	..	..	..	<b>28</b>	<b>29</b>	<b>30</b>	<b>31</b>	..	..	..	<b>26</b>	<b>27</b>	<b>28</b>	<b>29</b>	<b>30</b>	..	..	
..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	
<b>DECEMBER</b>							<b>JUNE</b>							<b>DECEMBER</b>							
..	..	..	1	2	3	..	..	..	..	..	1	2	3	..	..	..	..	..	..	1	2
<b>4</b>	<b>5</b>	<b>6</b>	<b>7</b>	<b>8</b>	<b>9</b>	<b>10</b>	<b>4</b>	<b>5</b>	<b>6</b>	<b>7</b>	<b>8</b>	<b>9</b>	<b>10</b>	<b>3</b>	<b>4</b>	<b>5</b>	<b>6</b>	<b>7</b>	<b>8</b>	<b>9</b>	
<b>11</b>	<b>12</b>	<b>13</b>	<b>14</b>	<b>15</b>	<b>16</b>	<b>17</b>	<b>11</b>	<b>12</b>	<b>13</b>	<b>14</b>	<b>15</b>	<b>16</b>	<b>17</b>	<b>10</b>	<b>11</b>	<b>12</b>	<b>13</b>	<b>14</b>	<b>15</b>	<b>16</b>	
<b>18</b>	<b>19</b>	<b>20</b>	<b>21</b>	<b>22</b>	<b>23</b>	<b>24</b>	<b>18</b>	<b>19</b>	<b>20</b>	<b>21</b>	<b>22</b>	<b>23</b>	<b>24</b>	<b>17</b>	<b>18</b>	<b>19</b>	<b>20</b>	<b>21</b>	<b>22</b>	<b>23</b>	
<b>25</b>	<b>26</b>	<b>27</b>	<b>28</b>	<b>29</b>	<b>30</b>	<b>31</b>	<b>25</b>	<b>26</b>	<b>27</b>	<b>28</b>	<b>29</b>	<b>30</b>	..	<b>24</b>	<b>25</b>	<b>26</b>	<b>27</b>	<b>28</b>	<b>29</b>	<b>30</b>	
..	..	..	..	..	..	..	..	..	..	..	..	..	..	<b>31</b>	..	..	..	..	..	..	

# CALENDAR

1921-1922

1921			
September	17	Saturday	Payment of fees closes, except for new students
September	20-27	Week	Examinations for removal of conditions and entrance examinations (see p. 4) Physical examinations for all new students
September	26	Monday	First semester evening extension classes begin
September	26-27		Registration days for College of Engineering and Architecture
September	27	Tuesday	Payment of fees for new students closes
September	28	Wednesday	Fall quarter begins, 8:00 a.m.
October	15	Saturday	Class Scrap Day; all classes dismissed the fourth hour
October	20	Thursday	Senate meeting, 4:30 p.m.
November	5	Saturday	Home Coming Day; classes dismissed the third and fourth hours
November	11	Friday	Armistice Day; a holiday
November	24	Thursday	Thanksgiving Day; a holiday
December	15	Thursday	Senate meeting, 4:30 p.m.
December	21	Wednesday	Fall quarter ends, Christmas vacation begins, 4:50 p.m.
1922			
January	3	Tuesday	Registration for winter quarter
January	4	Wednesday	Christmas vacation ends, winter quarter begins, 8:30 a.m.
January	20	Friday	First semester evening extension classes close
January	30	Monday	Second semester evening extension classes begin
February	16	Thursday	Senate meeting, 4:30 p.m.
February	22	Wednesday	Washington's Birthday; a holiday
March	23	Thursday	Winter quarter ends, spring vacation begins, 5:20 p.m.
March	28	Tuesday	Registration for spring quarter
March	29	Wednesday	Spring vacation ends, spring quarter begins, 8:00 a.m.
May	18	Thursday	Senate meeting, 4:30 p.m.
May	19	Friday	Second semester evening extension classes close
May	30	Tuesday	Memorial Day; a holiday

June	11	Sunday	Baccalaureate service
June	13	Tuesday	Spring quarters closes, 4:50 p.m.
June	14	Wednesday	Fiftieth annual commencement
June	17-19		Registration days for summer session
June	20	Tuesday	Summer session begins
July	28	Friday	Summer session closes

*Schedule of Condition Examinations, 1921\**

Friday,	September 23,	9 a.m.	Physics Architecture, Chemistry, and Civil Engineering
Saturday,	September 24,	9 a.m.	Mathematics and Mechanics and Electrical Engineering
		2 p.m.	Drawing and Descriptive Geometry and Mechanical Engineering
Monday,	September 26,	9 a.m.	Rhetoric

Condition examinations are ordinarily held in the classrooms of the respective departments. The fee is \$1. Students purposing to take such examinations are to notify the departments concerned in advance, and make all arrangements with the particular instructors. Where conflicts occur in examination periods, new arrangements should be made with the instructors concerned.

Condition examinations at times other than those scheduled require faculty authorization as special examinations, and involve a fee of \$5.

\* Spring quarter subjects only, except for students not in college in the winter or spring quarter of 1920-21.

# COLLEGE OF ENGINEERING AND ARCHITECTURE

## FACULTY AND STAFF

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CYRUS NORTHROP, LL.D., President Emeritus  
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WILLIAM R. APPLEBY, M.A., Professor of Metallurgy  
LEON ARNAL, Architecte Diplôme Government France, Professor of Archi-  
tectural Design  
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ROY G. BLAKEY, Ph.D., Professor of Economics  
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PETER CHRISTIANSON, B.S., E.M., Professor of Metallurgy  
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BEN W. FEILD, Captain, U.S.A., Assistant Professor of Military Science  
and Tactics  
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ROBERT W. FRENCH, B.S. in C.E., Assistant Professor of Drawing and  
Descriptive Geometry  
ISAAC W. GEIGER, Ph.D., Assistant Professor of Analytical Chemistry  
OSCAR E. HARDER, Ph.D., Associate Professor of Metallography  
EVERHARD P. HARDING, Ph.D., Associate Professor of Technological  
Chemistry  
CARL A. HERRICK, M.E., Assistant Professor of Mathematics and Mechanics  
RAYMOND R. HERRMANN, E.E., Assistant Professor of Mathematics and  
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WILLIAM F. HOLMAN, Ph.D., Professor of Mathematics and Mechanics  
C. MOREAU JANSKY, JR., M.A., Assistant Professor of Electrical Engineering  
ROBERT T. JONES, B.S. in Arch., Assistant Professor of Architecture

6 COLLEGE OF ENGINEERING AND ARCHITECTURE

ROY C. JONES, M.S. in Arch., Assistant Professor of Architectural Design  
RAYMOND E. KIRK, M.S., Assistant Professor of General Inorganic  
Chemistry

WILLIAM H. KIRCHNER, B.S., Professor of Drawing and Descriptive  
Geometry

MAURICE B. LAGAARD, C.E., Assistant Professor of Structural Engineering  
FRED C. LANG, C.E., Assistant Professor of Highway Engineering

FRANCIS P. LEAVENWORTH, M.A., Professor of Astronomy

WILLIAM M. McCLINTOCK, M.A., Assistant Professor of Mathematics and  
Mechanics

GEORGE A. MANEY, C.E., M.S., Assistant Professor of Structural Engineering

CHARLES A. MANN, Ph.D., Professor of Chemical Engineering

FREDERICK M. MANN, M.S. in Arch., C.E., Professor of Architecture

JOHN V. MARTENIS, M.E., Associate Professor of Mechanical Engineering

EDWIN R. MARTIN, E.E., Assistant Professor of Electrical Engineering

LOUALLIN F. MILLER, M.A., Professorial Lecturer in Physics

GEORGE H. MONTILLON, M.S., Assistant Professor of Chemical Engineering

EDGAR B. MOOMAU, First Lieutenant, U.S.A., Assistant Professor of Military  
Science and Tactics

HOWARD D. MYERS, B.S. in C.E., Assistant Professor of Drawing and  
Descriptive Geometry

HOWARD S. NOBLE, B.A., M.B.A., Assistant Professor of Accounting

HARRY J. OSTLUND, B.A., Assistant Professor of Economics

\*JOHN I. PARCEL, B.A., B.S. in C.E., Professor of Structural Engineering

LEVI B. PEASE, M.S., Professor of Metallurgy

GEORGE C. PRIESTER, B.E., M.S., Assistant Professor of Mathematics and  
Mechanics

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and Assistant Director of the Experimental Engineering Laboratories

HAL M. ROSE, First Lieutenant, U.S.A., Assistant Professor of Military  
Science and Tactics

JOHN H. ROWEN, M.A., Professorial Lecturer in Mechanical Engineering

FRANK B. ROWLEY, B.S., M.E., Professor of Mechanical Engineering and  
Director of the Experimental Engineering Laboratories

HENRY H. RUTHERFORD, Lieutenant Colonel, U.S.A., Professor of Military  
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WILLIAM T. RYAN, E.E., Associate Professor of Electrical Engineering

GEORGE D. SHEPARDSON, M.A., M.E., D.Sc., Professor of Electrical  
Engineering

EDWARD G. SHERBURNE, Major, U.S.A., Assistant Professor of Military  
Science and Tactics

\*S. CARL SHIPLEY, B.S., M.E., Professor of Machine Construction and  
Superintendent of Shops

CHARLES F. SHOOP, B.S., B.S. in M.E., Associate Professor of Mechanical  
Engineering

\* On leave of absence, 1920-21.

- CHARLES F. SIDENER, B.S., Professor of Analytical Chemistry  
RODERICK W. SILER, B.S., Assistant Professor of Mathematics and Mechanics  
M. CANNON SNEED, Ph.D., Associate Professor of General Inorganic Chemistry  
FRANK W. SPRINGER, E.E., Professor of Electrical Engineering  
J. WARREN STEHMAN, M.A., Assistant Professor of Economics  
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JOHN T. TATE, Ph.D., Professor of Physics  
JOSEPH M. THOMAS, Ph.D., Professor of Rhetoric  
LAURENCE T. WALKER, Major, U.S.A., Assistant Professor of Military Science and Tactics  
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JAMES T. WATSON, JR., Captain, U.S.A., Assistant Professor of Military Science and Tactics  
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LEON ARCHIBALD, B.Sc., Instructor in Drawing and Descriptive Geometry  
CECIL C. BEAN, M.A., Instructor in Rhetoric  
CHARLES BOEHNLEIN, B.S., M.E., Instructor in Mathematics and Mechanics  
LEONARD F. BOON, E.E., Instructor in Civil Engineering  
ALFRED BRANDT, Sergeant, U.S.A., Instructor in Military Science and Tactics  
HENRY W. BROWN, Sergeant, U.S.A., Instructor in Military Science and Tactics  
KENNA B. CALDWELL, Sergeant, U.S.A., Instructor in Military Science and Tactics  
JOHN O. CEDERBERG, JR., Instructor in Drawing and Descriptive Geometry  
EDWIN E. CLARK, B.S., Instructor in Mathematics and Mechanics  
JOSEPH E. CUMMINGS, M.A., Instructor in Economics  
HENRY DAHL, Sergeant, U.S.A., Instructor in Military Science and Tactics  
RALPH L. DOWDELL, Met. E., Instructor in Metallography  
AUBREY R. DUNKUM, Sergeant, U.S.A., Instructor in Military Science and Tactics  
WILLIAM P. DUNN, B.D., M.A., Instructor in Rhetoric  
HENRY C. T. EGGERS, E.E., Instructor in Drawing and Descriptive Geometry  
EDMUND B. FELDMAN, B.C.E., Instructor in Civil Engineering  
WILLIAM R. FINKE, Sergeant, U.S.A., Instructor in Military Science and Tactics  
JOHN E. FINLEY, C.E., Instructor in Drawing and Descriptive Geometry  
PAUL C. GAUGER, B.S. in Arch., Lecturer in Architecture  
VICTOR GAUVREAU, M.E., Instructor in Machine Design  
RALPH W. HAMMETT, B.S. in Arch., Instructor in Architecture  
HENRY E. HARTIG, E.E., Instructor in Mathematics and Mechanics  
JOSEPH HAVLICEK, Sergeant, U.S.A., Instructor in Military Science and Tactics

CASPER HECKEMEYER, Sergeant, U.S.A., Instructor in Military Science and Tactics

WILLIAM L. HOGAN, Sergeant, U.S.A., Instructor in Military Science and Tactics

CARL E. JOHNSON, Instructor in Architecture

EDGERTON W. KIBBEY, Instructor in Drawing and Descriptive Geometry

JOHN H. KUHLMAN, B.A., B.E., Instructor in Electrical Engineering

CLARENCE G. LANGE, Sergeant, U.S.A., Instructor in Military Science and Tactics

OSCAR C. LEE, B.S., Instructor in Mathematics and Mechanics

JOSEPH LEES, Sergeant, U.S.A., Instructor in Military Science and Tactics

CARROLL E. LEWIS, B.S., Instructor in Drawing and Descriptive Geometry

FRED LILLIE, Sergeant, U.S.A., Instructor in Military Science and Tactics

WALKER LINDSEY, Sergeant, U.S.A., Instructor in Military Science and Tactics

EDMUND T. MCCANN, Sergeant, U.S.A., Instructor in Military Science and Tactics

JOHN H. MOFFETT, Met.E., Instructor in Foundry Practice

ARTHUR R. NICHOLS, B.S., Lecturer in Architecture

JOSEPH W. NILSON, Instructor in Machine Shop Practice

HARLEY G. OVERHOLT, B.S., Instructor in Mathematics and Mechanics

BEN W. PALMER, M.A., LL.B., Lecturer in Political Science

FRANK E. PEACOCK, B.S., Instructor in Mathematics and Mechanics

VICTOR H. PELZ, M.S., Instructor in Economics

NORVILLE C. PERVIER, M.S., Instructor in Chemistry

ARTHUR P. PETERSON, B.S., Instructor in Drawing and Descriptive Geometry

ORRIN W. POTTER, M.E., Instructor in Drawing and Descriptive Geometry

ARCHIE D. POWER, M.A., Instructor in Physics

EDWARD P. QUIGLEY, Instructor in Forging

PAUL W. RHAME, Instructor in Mechanical Engineering

PRESTICE B. RHODES, Sergeant, U.S.A., Instructor in Military Science and Tactics

WILLIAM H. RICHARDS, Instructor in Woodworking

HARRY W. ROBBINS, M.A., Instructor in Rhetoric

OSWALD ROGNLEY, M.A., Instructor in Physics

ROBERT F. SCHUCK, E.E., Instructor in Drawing and Descriptive Geometry

GEORGE M. SCHWARTZ, M.A., Instructor in Geology and Mineralogy

CLARENCE SHELTON, Sergeant, U.S.A., Instructor in Military Science and Tactics

HERMAN SMITH, Sergeant, U.S.A., Instructor in Military Science and Tactics

HARRY E. STRIDER, Sergeant, U.S.A., Instructor in Military Science and Tactics

GEORGE W. SWENSON, B.S.E., Instructor in Electrical Engineering

MILO E. TODD, B.A., E.E., Instructor in Electrical Engineering

GEORGE L. TUVE, B.S., M.E., Instructor in Mechanical Engineering

JOSEPH VALASEK, B.S., Instructor in Physics



WILLIAM S. WILLIAMS, B.S., Instructor in Drawing and Descriptive  
Geometry

JOHN C. WORRELL, B.S., Instructor in Civil Engineering

## ASSISTANTS AND FELLOWS

HARRY W. DIXON, Engineer, Assistant in Power Plant Operation

HENRY FORBES, Assistant in Electrical Engineering

LUDVIG C. LARSON, B.S. (E.E.), Teaching Fellow in Electrical Engineering

EMANUEL C. MANDERFELD, B.S. (E.E.), Teaching Fellow in Electrical  
Engineering

HARRY MARTINSON, Assistant in Machine Shop Practice

CARL PETERSON, Assistant in Woodworking

FRED TEAL, Assistant in Forging

JOHN A. WIDING, Assistant in Foundry Practice

## SPECIAL LECTURERS

P. G. DOWNTON, Electric Storage Battery Company, *Electric Vehicles and  
Batteries.*

FRED DUSTIN, Former Electrical Inspector, City of Minneapolis, *Practical  
Operation of the Rules for Safe Electrical Construction.*

CHARLES L. PILLSBURY, *Valuation of Public Utilities.*

## GENERAL INFORMATION

### HISTORY

The College of Engineering and Architecture had its beginning in the College of Agriculture and the Mechanic Arts which was authorized by the legislative act of 1868. Courses in civil and mechanical engineering were first offered in 1871. In the reorganization of the University, in 1872, the College of the Mechanic Arts was established. It became the College of Engineering, Metallurgy, and the Mechanic Arts in 1892, and the College of Engineering and the Mechanic Arts in 1897. A course in electrical engineering was first offered in 1887. Architecture and architectural engineering were announced in 1912 and in 1916 the college received its present name.

### THE PURPOSE OF THE COLLEGE

The purpose of this college is to give the students a broad foundation in the fundamental principles of engineering and architecture, together with sufficient knowledge of professional practice to enable them to apply them. It is not possible in college to educate a fully trained engineer, as the application of the principles to the practice of engineering is to be learned through experience. There are certain subjects, such as surveying and drafting, in which some proficiency is required. This enables a student upon graduation to fill satisfactorily a subordinate position while obtaining a basis for growth and advancement.

It is intended that all of the technical courses given in this college shall be taught by men who have had practical experience in their respective fields in addition to their professional training.

The field of engineering is very broad and is continually becoming more extensive. From the technical lines of design, construction, maintenance, and operation of engineering works, which have always belonged to him, the trained engineer has been drawn into the business world to occupy positions of an executive character. To meet the demand for such service, this college recognizes the importance of the broader training of engineers in economic and commercial principles and industrial relations.

Withal, it is intended that the young graduate shall have obtained material assistance in developing those traits of character which will make him a loyal and exemplary citizen and a true gentleman.

### DEGREES

The College of Engineering and Architecture offers four-year courses of study in civil, mechanical, and electrical engineering, and architecture. These courses lead to the degree of Bachelor of Science in Civil, Mechanical, or Electrical Engineering, or in Architecture.

This college also offers work in the Graduate School leading to the degree of Master of Science in the appropriate branch of Engineering or in Architecture.

The professional degree of Civil, Mechanical, or Electrical Engineer will be conferred upon those who have received the degree of Bachelor of Science in Civil, Mechanical, or Electrical Engineering, after four years of engineering experience in positions of responsibility, and who complete the equivalent of one year's college work either in residence or in absentia under the direction of the faculty, and present a satisfactory thesis.

Students who entered the college prior to the fall of 1919 may obtain the Engineer's degree upon the satisfactory completion of one year's post-graduate study, including a thesis.

Candidates for the Engineer's degrees must register in the Graduate School.

#### FEEES AND EXPENSES

The annual fee for students in this college is \$90 for residents and \$120 for non-residents, one third of which is due at the beginning of each quarter. Fellows, scholars, assistants, and instructors are not required to pay University fees or tuition when they are regularly enrolled in the Graduate School.

#### FEEES

Tuition fee (per quarter):

Residents of Minnesota.....	\$30.00
Non-residents .....	40.00
Deposit (first quarter only).....	5.00
Military deposit (required of all students taking Military Drill).....	15.00
Health fee (per quarter).....	2.00
Minnesota Union or Shevlin Hall (per quarter).....	1.00
Post-office box (per quarter).....	.20
Special fees:	
Examination for removal of conditions.....	1.00
Examinations for credit (after the first quarter in residence).....	5.00
Special examinations.....	5.00
Chemistry deposit .....	5.00

#### PENALTY FEEES:

*Registration penalties.*—A penalty for late registration, late change of registration, or late payment of fees shall be two dollars (\$2.00) and one dollar (\$1.00) additional for each day of delay after classes begin, provided that no student shall pay more than twelve dollars (\$12.00) of penalty in any given quarter.

NOTE.—Students desiring to enter this college who have not the specified credits in higher algebra and solid geometry, but who present the full fifteen acceptable units will be admitted subject to their taking the necessary course or courses for the satisfaction of these requirements during their first quarter, and without credit. They must expect, however, to attend the University summer session in the following summer in order to obtain the regular third quarter's work in mathematics or in mathematics and drawing. To avoid this irregularity in their courses, students are urged to obtain the required higher algebra and solid geometry in high school or the University summer session or Extension Division before entering this college.

## ENTRANCE REQUIREMENTS

1. English, four units, or English, three units and foreign language, two units.
2. Mathematics, elementary algebra, one unit; plane geometry, one unit; higher algebra, one half unit; and solid geometry, one half unit. (See note.)
3. Enough additional work to make in all fifteen units, of which not more than four may be in Group F.

For all students who intend to enter the College of Engineering and Architecture it is very desirable that physics as well as chemistry be included in the high-school course. Students entering the course in architecture without chemistry must take this subject in the University.

No students will be admitted to this college at the beginning of the winter quarter unless they present the complete entrance requirements including algebra and solid geometry.

## LIST OF ENTRANCE REQUIREMENTS

Only those subjects included in the following groups may be counted toward admission.

The term *unit* means not less than five recitations of forty minutes each week for a period of thirty-six weeks. In laboratory, drawing, and other manual courses, twice this amount of time is required for one unit.

GROUP A. ENGLISH: 3 or 4 units.

GROUP B. LANGUAGES: Latin, Greek, German, French, Italian, Spanish, Scandinavian, 1 to 4 units each.

GROUP C. HISTORY AND SOCIAL SCIENCES: Ancient and modern history, 1 unit each; English and senior American history, one half unit each; American government, economics, economic history of England, and economic history of the United States, one half unit each; commercial geography and history of commerce, one half unit each.

GROUP D. MATHEMATICS: Elementary algebra and plane geometry, 1 unit each; higher algebra, solid geometry, and trigonometry, one unit each.

GROUP E. NATURAL SCIENCES: Physics and chemistry, 1 unit each; botany and zoology, one half or 1 unit each; physiology, astronomy, geology, and physiography, one half unit each.

GROUP F. VOCATIONAL SUBJECTS: Business law and business arithmetic, one half unit each; elementary and advanced bookkeeping, 1 unit each; stenography and typewriting, 1 or 2 units. Freehand drawing, mechanical drawing, and shopwork, 1 or 2 units each. Agriculture, 1 to 4 units. Normal training subjects, 1 to 3 units.

## SPECIAL STUDENTS

In exceptional cases applicants are admitted to the college as special students without fulfilling the complete entrance requirements and without registering for a degree. Such students must be of mature years, and must give satisfactory evidence of ability to do with credit the work applied for. Admission of students of this class requires in each specific case the approval of the Students' Work Committee and the dean.

## ADVANCED STANDING

Students who have pursued courses of study in other colleges of recognized standing may receive advanced credit under the rules of the University and of the college.

## REGISTRATION

For detailed information concerning registration see the printed program of the college at the end of this bulletin. Registration in the fall quarter will occur on September 26 and 27; for the winter quarter on January 3; and for the spring quarter on March 28. Students must register in person (not by mail) on the date set; fees must be paid in advance of this date as no student will be permitted to register until he presents a receipt for fees.

## CREDIT HOURS

In all of the above courses a credit is such an amount of work as will require three hours a week of a student's time. One hour of recitation is assumed to require two hours of outside preparation. In the case of laboratory work (drawing, surveying, and shopwork) which does not require outside preparation, three hours of work count for one credit. The credit allowed for lectures varies from one third to one credit a lecture a week, depending upon the amount of outside preparation required of the student for the lecture.

## CREDIT FOR OUTSIDE WORK

Credit for certain courses, as a result of work done outside of the regular classes, may be obtained by satisfactorily passing comprehensive examinations.

Work done outside of class includes work done by correspondence, by the aid of a private tutor, by individual study, through practical experience, or otherwise.

The comprehensive examination will be of such thoro and searching character as to determine whether the student has done all the work of the course. It should require at least three times the work of the usual final or condition examination and will be conducted by a committee of three, appointed by the head of the department in which the course is given.

Permission to take the examination must be obtained from the Students' Work Committee, and the usual fee of \$5 for a special examination must be paid unless it be taken within six weeks after first entering the University.

## EXTENSION COURSES

Certain courses in engineering and architecture are offered by the Extension Division of the University in evening classes and by correspondence. Persons who are unable to attend the regular University courses may obtain instruction in this manner. Definite information regarding extension work will be found in the bulletins of the General Extension Division.

#### ATTENDANCE

It is expected that all students registered in this college will be regular in attendance at all class exercises and that they will do all the work of the course. Neglect of work, as indicated by irregularity in attendance or low scholarship, will be sufficient reason for exclusion from class. "Any student who has unexcused absences equal to the number of credits in a course, but in no case less than two, shall be dropped from the class with a record of failure in the course." *Senate, May 11, 1921.*

#### SCHOLARSHIP

Every student in this college must complete all the mathematics and physics of the sophomore year before he will be allowed to register for any junior courses.

#### REQUIREMENTS FOR GRADUATION

To be recommended for the Bachelor's degree from this college, the student must complete all of the courses prescribed in the corresponding curriculum together with sufficient electives to make a total of at least 204 credits.

#### SCHOLARSHIPS AND PRIZES

For scholarships and prizes in this college, see the bulletin of general information. Special attention is called to the free and service scholarships.

#### THESES

Every candidate for a graduate degree such as the degree of Engineer or Architect is required to prepare a thesis on some subject particularly relating to his course. The thesis must embody the result of some research made by him, a special design, or an original report upon some engineering or architectural problem. It must be creditable from a literary, as well as from a technical, point of view.

#### CHANGES IN BULLETIN

The faculty of the College of Engineering and Architecture reserves the right to cancel or change without notice any course printed in this bulletin. The bulletin is a statement of present conditions, and is subject to modification in any particular by faculty action.

## COURSES OF STUDY

### CIVIL, MECHANICAL, AND ELECTRICAL ENGINEERING

The freshman year is the same for all engineering courses. The freshman year for courses in architecture is found on pages 24 and 26.

#### FRESHMAN YEAR

(Civil, Electrical, Mechanical)

(For students who enter with credit in both higher algebra and solid geometry.)

Course no.	Title	Credits	Rec.	Lect.	Lab.
<i>Fall Quarter</i>					
M. & M. 11	Applied Mathematics and Mechanics.....	5	5	..	..
Chem. 4* or	General Inorganic Chemistry.....	4	..	3	3
Chem. 14	General Inorganic Chemistry.....	5	..	3	6
Draw. 1	Engineering Drawing.....	3	..	..	9
Mech. Eng.	Shop .....	2	..	..	6
G. E. 11	Orientation .....	1	..	2	..
	Military Drill.....	0	..	..	3
<i>Winter Quarter</i>					
M. & M. 12	Applied Mathematics and Mechanics.....	5	4	..	2
Chem. 5* or	General Inorganic Chemistry.....	4	..	3	3
Chem. 15	General Inorganic Chemistry.....	5	..	3	6
Draw. 2	Engineering Drawing .....	3	..	..	9
Mech. Eng.	Shop .....	2	..	..	6
G. E. 12	Orientation .....	1	..	1	..
	Hygiene and First Aid.....	0	..	1	..
	Military Drill.....	0	..	..	3
<i>Spring Quarter</i>					
M. & M. 13	Applied Mathematics and Mechanics.....	5	4	..	2
Chem. 16	Qualitative Chemical Analysis.....	5	..	3	6
Draw. 3	Engineering Drawing .....	3	..	..	9
Mech. Eng.	Shop .....	2	..	..	6
G. E. 13	Orientation .....	1	..	2	..
	Military Drill.....	0	..	..	3

\* Students who enter without credit in high-school chemistry must register for Chemistry 14, 15, and 16 instead of 4, 5, and 16.

#### FRESHMAN YEAR

(Civil, Electrical, Mechanical)

(For students who enter without credit in both higher algebra and solid geometry.)

Course no.	Title	Credits	Rec.	Lect.	Lab.
<i>Fall Quarter</i>					
M. & M. 9	Higher Algebra .....	0	3	..	..
M. & M. 10	Solid Geometry.....	0	3	..	..
Chem. 4* or	General Inorganic Chemistry.....	4	..	3	3
Chem. 14	General Inorganic Chemistry.....	5	..	3	6
Mech. Eng.	Shop .....	2	..	..	6
G. E. 11	Orientation .....	1	..	2	..
	Military Drill.....	0	..	..	3

*Winter Quarter*

M. & M. 11	Applied Mathematics and Mechanics.....	5	5	..	..
Chem. 5* or	General Inorganic Chemistry.....	4	..	3	3
Chem. 15	General Inorganic Chemistry.....	5	..	3	6
Draw. 1	Engineering Drawing.....	3	..	..	9
Mech. Eng.	Shop .....	2	..	..	6
G. E. 12	Orientation .....	1	..	1	..
	Hygiene and First Aid.....	0	..	1	..
	Military Drill.....	0	..	..	3

*Spring Quarter*

M. & M. 12	Applied Mathematics and Mechanics.....	5	4	..	2
Chem. 16	Qualitative Chemical Analysis.....	5	..	3	6
Draw. 2	Engineering Drawing.....	3	..	..	9
Mech. Eng.	Shop .....	2	..	..	6
G. E. 13	Orientation .....	1	..	2	..
	Military Drill.....	0	..	..	3

*Summer Session*

M. & M. 13	Applied Mathematics and Mechanics.....	5	4	..	2
Draw. 3	Engineering Drawing.....	3	..	..	9

\* Students who enter without credit in high-school chemistry must register for Chemistry 14, 15, and 16 instead of 4, 5, and 16.

FRESHMAN YEAR

(Civil, Electrical, Mechanical)

(For students who enter without credit in higher algebra, only.)

Course no. Title Credits Rec. Lect. Lab.

*Fall Quarter*

M. & M. 9	Higher Algebra .....	0	3	..	..
Chem. 4* or	General Inorganic Chemistry.....	4	..	3	3
Chem. 14	General Inorganic Chemistry.....	5	..	3	6
Draw. 1	Engineering Drawing.....	3	..	..	9
Mech. Eng.	Shop .....	2	..	..	6
G. E. 11	Orientation .....	1	..	2	..
	Military Drill.....	0	..	..	3

*Winter Quarter*

M. & M. 11	Applied Mathematics and Mechanics.....	5	5	..	..
Chem. 5* or	General Inorganic Chemistry.....	4	..	3	3
Chem. 15	General Inorganic Chemistry.....	5	..	3	6
Draw. 2	Engineering Drawing.....	3	..	..	9
Mech. Eng.	Shop .....	2	..	..	6
G. E. 12	Orientation .....	1	..	1	..
	Hygiene and First Aid.....	0	..	1	..
	Military Drill.....	0	..	..	3

*Spring Quarter*

M. & M. 12	Applied Mathematics and Mechanics.....	5	4	..	2
Chem. 16	Qualitative Chemical Analysis.....	5	..	3	6
Draw. 3	Engineering Drawing.....	3	..	..	9
Mech. Eng.	Shop .....	2	..	..	6
G. E. 13	Orientation .....	1	..	2	..
	Military Drill.....	0	..	..	3

*Summer Session*

M. & M. 13	Applied Mathematics and Mechanics.....	5	4	..	2
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\* Students who enter without credit in high-school chemistry must register for Chemistry 14, 15, and 16 instead of 4, 5, and 16.



## COURSES OF STUDY

17

### FRESHMAN YEAR

(Civil, Electrical, Mechanical)

(For students who enter without credit in solid geometry, only.)

Course no.	Title	Credits	Rec.	Lect.	Lab.
<i>Fall Quarter</i>					
M. & M. 10	Solid Geometry.....	0	3	..	..
M. & M. 11	Applied Mathematics and Mechanics.....	5	5	..	..
Chem. 4* or	General Inorganic Chemistry.....	4	..	3	3
Chem. 14	General Inorganic Chemistry.....	5	..	3	6
Mech. Eng.	Shop .....	2	..	..	6
G. E. 11	Orientation .....	1	..	2	..
	Military Drill.....	0	..	..	3
<i>Winter Quarter</i>					
M. & M. 12	Applied Mathematics and Mechanics.....	5	4	..	2
Chem. 5* or	General Inorganic Chemistry.....	4	..	3	3
Chem. 15	General Inorganic Chemistry.....	5	..	3	6
Draw. 1	Engineering Drawing.....	3	..	..	9
Mech. Eng.	Shop .....	2	..	..	6
G. E. 12	Orientation .....	1	..	2	..
	Hygiene and First Aid.....	0	..	1	..
	Military Drill.....	0	..	..	3
<i>Spring Quarter</i>					
M. & M. 13	Applied Mathematics and Mechanics.....	5	4	..	2
Chem. 16	Qualitative Chemical Analysis.....	5	..	3	6
Draw. 2	Engineering Drawing.....	3	..	..	9
Mech. Eng.	Shop .....	2	..	..	6
G. E. 13	Orientation .....	1	..	..	3
	Military Drill.....	0	..	..	3
<i>Summer Session</i>					
Draw. 3	Engineering Drawing.....	3	..	..	9

\* Students who enter without credit in high-school chemistry must register for Chemistry 14, 15, and 16 instead of 4, 5, and 16.

## CIVIL ENGINEERING

(For freshman year, see pages 15 to 17.)

In addition to the prescribed courses in each curriculum, sufficient electives must be taken to complete a total of at least 204 credits for graduation. This is an average of at least 17 credits per quarter.

### SOPHOMORE YEAR

Course no.	Title	Credits	Rec.	Lect.	Lab.
<i>Fall Quarter</i>					
M. & M. 24	Applied Mathematics and Mechanics.....	5	5	..	..
Phys. 3	Elements of Mechanics and Sound.....	3	1	3	..
Phys. 4	Elements of Mechanics Laboratory.....	1	..	..	2
Rhet. 4	Rhetoric and Composition.....	3	3	..	..
Draw. 21	Drafting .....	2	..	..	6
C. E. 11	Surveying .....	3	1	..	8
	Military Drill.....	0	..	..	3

*Winter Quarter*

M. & M. 25	Applied Mathematics and Mechanics.....	5	5	..	..
Phys. 23	Heat .....	3	1	3	..
Phys. 24	Heat Laboratory .....	1	..	..	2
Rhet. 5	Rhetoric and Composition .....	3	3	..	..
Draw. 22	Drafting .....	2	..	..	6
C. E. 12	Surveying .....	3	1	..	8
	Military Drill.....	0	..	..	3

*Spring Quarter*

M. & M. 26	Technical Mechanics.....	5	5	..	..
Phys. 43	Magnetism and Electricity.....	3	1	4	..
Phys. 44	Electrical Laboratory.....	1	..	..	2
Rhet. 6	Rhetoric and Composition.....	3	3	..	..
Draw. 23	Drafting .....	2	..	..	6
C. E. 13	Surveying .....	3	1	..	8
	Military Drill.....	0	..	..	3

JUNIOR YEAR

Course no. Title Credits Rec. Lect. Lab.

*Fall Quarter*

M. & M. 131	Technical Mechanics.....	3	3	..	..
M. & M. 134	Strength of Materials.....	2	2	..	..
M. & M. 141	Materials-Testing Laboratory.....	1	..	..	3
C. E. 31	Stresses in Structures.....	3	..	..	6
C. E. 14	Surveying .....	3	1	..	8
C. E. 51	Highways and Pavements.....	3	2	..	3

\*One or more electives

*Winter Quarter*

M. & M. 132	Technical Mechanics.....	3	3	..	..
M. & M. 135	Strength of Materials.....	3	3	..	..
C. E. 32	Stresses in Structures.....	3	1	..	6
C. E. 21	Railway Engineering.....	3	1	..	6
C. E. 51	Highways and Pavements.....	3	1	..	3

\*One or more electives

*Spring Quarter*

M. & M. 133	Technical Mechanics.....	2	2	..	..
M. & M. 136	Hydraulics .....	3	3	..	..
M. & M. 143	Hydraulics Laboratory.....	1	..	..	3
C. E. 33	Elementary Structural Design.....	3	1	..	6
C. E. 22	Railway Engineering .....	3	1	..	6
C. E. 53	Municipal Engineering.....	3	1	2	..

\*One or more electives

*Summer Camp*

C. E. 23 Summer camp is held in the vacation preceding the senior year for 6 weeks beginning about August 12. Nine credits. Required of all students taking the Civil Engineering Course.

\* For list of elective courses, see pages 28 and 29.

## COURSES OF STUDY

19

### SENIOR YEAR

Course no.	Title	Credits	Rec.	Lect.	Lab.
<i>Fall Quarter</i>					
C. E. 161	Hydrology .....	4	2	..	6
C. E. 131	Bridge Analysis.....	4	1	..	6
C. E. 141	Reinforced Concrete.....	3	1	1	3
C. E. 121	Railway Engineering.....	3	..	1	6

\*One or more electives

Course no.	Title	Credits	Rec.	Lect.	Lab.
<i>Winter Quarter</i>					
C. E. 142	Reinforced Concrete.....	3	1	..	6
E. E. 42	Electric Power.....	4	3	..	4
Options (one required):					
C. E. 162	1. { Water Supply.....	3	..	1	6
	{ Elective .....	3	..	2	6
C. E. 132	2. { Bridge Design.....	3	1	..	9
C. E. 231	{ Indeterminate Stresses.....	3	..	1	6
C. E. 122	3. { Railway Engineering.....	3	2	..	6
C. E. 124	{ Transportation .....	3	1	2	..

\*One or more electives

### *Spring Quarter*

M. E. 149	Heat Engines.....	4	3	..	3
Options (one required):					
C. E. 163	1. { Sanitary Engineering.....	3	..	1	6
C. E. 165	{ Water Power.....	4	..	2	6
C. E. 263	{ Hydraulic Laboratory.....	2	..	..	6
C. E. 143	2. { Foundations .....	3	..	1	6
C. E. 133	{ Bridge Design.....	3	1	..	9
C. E. 123	3. { Railway Engineering.....	3	1	1	6
C. E. 125	{ Transportation .....	3	1	2	..

\*One or more electives

### SENIOR YEAR

Course no.	Title	Credits	Rec.	Lect.	Lab.
<i>Fall Quarter</i>					

(For students who have completed Courses C.E. 23, 131, 141, 142.)

Required:					
C. E. 161	Hydrology .....	4	2	..	6
M. E. 149	Heat Engines.....	4	3	..	4
C. E. 121	Railway Engineering.....	3	..	1	6
Options (one required):					
C. E. 162	1. { Water Supply.....	3	..	1	6
	{ *Elective .....	3	..	..	..
C. E. 132	2. { Bridge Design.....	3	1	..	9
C. E. 231	{ Indeterminate Structures.....	4	..	..	8
C. E. 124	3. { Transportation .....	3	1	2	..
	{ *Elective .....	3	..	..	..

\* For list of elective courses, see pages 28 and 29.

*Winter Quarter*

	Required:				
E. E. 42	Electric Power.....	4	3	..	2
	Options (one required):				
C. E. 163	1. { Sanitary Engineering.....	3	..	1	6
C. E. 164	1. { Water Power.....	3	..	1	6
	*Elective .....	6	..	..	..
C. E. 133	2. { Bridge Design.....	3	..	1	6
C. E. 245	2. { Reinforced Concrete Analysis.....	4	..	..	8
	*Elective .....	6	..	..	..
C. E. 122	3. { Railway Engineering.....	3	..	1	6
C. E. 125	3. { Transportation .....	3	..	3	..
	*Elective .....	6	..	..	..

ELECTRICAL ENGINEERING

(For freshman year, see pages 15 to 17.)

In addition to the prescribed courses in each curriculum sufficient electives must be taken to complete a total of at least 204 credits for graduation. This is an average of at least 17 credits per quarter.

SOPHOMORE YEAR

Course no.	Title	Credits	Rec.	Lect.	Lab.
<i>Fall Quarter</i>					
M. & M. 24	Applied Mathematics and Mechanics.....	5	5	..	..
Phys. 3	Elements of Mechanics and Sound.....	3	1	3	..
Phys. 4	Mechanics Laboratory .....	1	..	..	2
Rhet. 4	Rhetoric and Composition.....	3	3	..	..
Draw. 26	Drafting .....	2	..	..	6
E. E. 11	Elements of Electrical Engineering.....	3	2	2	..
	Military Drill.....	0	..	..	3
<i>Winter Quarter</i>					
M. & M. 25	Applied Mathematics and Mechanics.....	5	5	..	..
Phys. 23	Heat .....	3	1	3	..
Phys. 23	Heat Laboratory.....	1	..	..	2
Rhet. 5	Rhetoric and Composition... ..	3	3	..	..
Draw. 27	Drafting .....	2	..	..	6
E. E. 13	Elements of Electrical Engineering.....	3	2	..	2
	Military Drill.....	0	..	..	3
<i>Spring Quarter</i>					
M. & M. 26	Technical Mechanics.....	5	5	..	..
Phys. 43	Magnetism and Electricity.....	4	1	5	..
Phys. 44	Electrical Laboratory .....	1	..	..	2
Rhet. 6	Rhetoric and Composition.....	3	3	..	..
M. E. 16	Shop .....	2	..	..	6
E. E. 15	Elements of Electrical Engineering.....	3	2	..	2
	Military Drill.....	0	..	..	3

\* For list of elective courses, see pages 28 and 29.

COURSES OF STUDY

JUNIOR YEAR

Course no.	Title	Credits	Rec.	Lect.	Lab.
<i>Fall Quarter</i>					
M. & M. 131	Technical Mechanics.....	3	3	..	..
M. & M. 134	Strength of Materials.....	2	2	..	..
M. & M. 141	Materials-Testing Laboratory.....	1	..	..	3
E. E. 111	Direct Current Machinery.....	3	3	..	..
E. E. 112	Direct Current Machinery Laboratory.....	2	..	..	4
Phys. 144	Electrical Measurements.....	3	1	..	6

\*One or more electives

*Winter Quarter*

M. & M. 132	Technical Mechanics.....	3	3	..	..
M. & M. 135	Strength of Materials.....	3	3	..	..
E. E. 113	Direct Current Machinery.....	3	3	..	..
E. E. 114	Direct Current Machinery Laboratory.....	2	..	..	4
M. E. 33	Mechanism and Kinematics.....	3	2	..	3

\*One or more electives

*Spring Quarter*

M. & M. 133	Technical Mechanics.....	2	2	..	..
M. & M. 136	Hydraulics.....	3	3	..	..
M. & M. 143	Hydraulics Laboratory.....	1	..	..	3
E. E. 115	Direct Current Machinery.....	3	3	..	..
E. E. 116	Direct Current Machinery Laboratory.....	2	..	..	4
M. E. 37	Machine Design.....	3	..	..	..

\*One or more electives

SENIOR YEAR

Course no.	Title	Credits	Rec.	Lect.	Lab.
<i>Fall Quarter</i>					
E. E. 121	Alternating Currents.....	3	3	..	..
E. E. 122	Alternating Currents Laboratory.....	2	..	..	4
E. E. 132	Electrical Design†.....	2	2	..	4
M. E. 144	Heat Engines†.....	3	2	..	3

\*One or more electives

*Winter Quarter*

E. E. 123	Alternating Currents.....	3	3	..	..
E. E. 124	Alternating Currents Laboratory.....	2	..	..	4
E. E. 134	Electrical Design.....	2	2	..	4
M. E. 145	Heat Engines†.....	3	2	..	3

\*One or more electives

\* For list of elective courses, see pages 28 and 29.

*Spring Quarter*

E. E. 125	Alternating Currents.....	3	3	..	..
E. E. 126	Alternating Currents Laboratory.....	2	..	..	4
E. E. 136	Electrical Design†.....	2	2	..	4
M. E. 146	Heat Engines†.....	3	2	..	..

\*One or more electives

† Students specializing in chemistry or physics may substitute electives in such departments for Courses E.E. 132, 134, 136 and M.E. 144, 145, 146.

‡ Students specializing in business may substitute an approved elective in such department for Course E.E. 136.

NOTE.—Electrical engineering students are eligible to the Signal Corps Unit of the R.O.T.C., in connection both with the required military drill of the freshman and sophomore years, and also with the advanced elective course of the junior and senior years.

MECHANICAL ENGINEERING

(For freshman year, see pages 15 to 17.)

In addition to the prescribed courses in each curriculum, sufficient electives must be taken to complete a total of at least 204 credits for graduation. This is an average of at least 17 credits per quarter.

SOPHOMORE YEAR

Course no.	Title	Credits	Rec.	Lect.	Lab.
<i>Fall Quarter</i>					
M. & M. 24	Applied Mathematics and Mechanics.....	5	5	..	..
Phys. 3	Elements of Mechanism and Sound.....	3	1	3	..
Phys. 4	Mechanics Laboratory.....	1	..	..	2
Rhet. 4	Rhetoric and Composition.....	3	3	..	..
Draw. 28	Drafting.....	2	..	..	6
M. E. 14	Shop.....	4	..	..	12
	Military Drill.....	0	..	..	3
<i>Winter Quarter</i>					
M. & M. 25	Applied Mathematics and Mechanics.....	5	5	..	..
Phys. 23	Heat.....	3	1	3	..
Phys. 24	Heat Laboratory.....	1	..	..	2
Rhet. 5	Rhetoric and Composition.....	3	3	..	..
Draw. 29	Drafting.....	2	..	..	6
M. E. 15	Shop.....	4	..	..	12
	Military Drill.....	0	..	..	3
<i>Spring Quarter</i>					
M. & M. 26	Technical Mechanics.....	5	5	..	..
Phys. 43	Magnetism and Electricity.....	4	1	4	..
Phys. 44	Electrical Laboratory.....	1	..	..	2
Rhet. 6	Rhetoric and Composition.....	3	3	..	..
M. E. 41¶	Automotives.....	2	2	..	..
M. E. 21¶	Mechanical Technology.....	1	..	1	..
M. E. 31	Elementary Machine Design.....	2	0	..	6
	Military Drill.....	0	..	..	3

NOTE.—It is recommended that each student in the Mechanical Engineering Department spend at least one summer vacation in machine-shop practice.

¶ Students who intend to elect courses in the School of Business during their junior and senior years and have satisfactory recommendation may be permitted to substitute Principles of Accounting Ec. 27, 4 credits in place of M.E. 21, 1 credit, and M.E. 41, 2 credits.

\* For list of elective courses, see pages 28 and 29.

JUNIOR YEAR

Course no.	Title	Credits	Rec.	Lect.	Lab.
<i>Fall Quarter</i>					
M. & M. 131	Technical Mechanics.....	3	3	..	..
M. & M. 134	Strength of Materials.....	2	2	..	..
M. & M. 141	Materials-Testing Laboratory.....	1	..	..	3
M. E. 42	Steam Engines.....	3	3	..	..
M. E. 81	Elementary M. E. Laboratory.....	2	..	..	6
M. E. 32	Mechanism.....	4	4	..	..

\*One or more electives

*Winter Quarter*

M. & M. 132	Technical Mechanics.....	3	3	..	..
M. & M. 135	Strength of Materials.....	3	3	..	..
M. E. 43	Steam Engines and Boilers.....	3	3	..	..
M. E. 82	Mechanical Engineering Laboratory.....	2	..	..	6
M. E. 34	Kinematics and Machine Design.....	4	2	1	6

\*One or more electives

*Spring Quarter*

M. & M. 133	Technical Mechanics.....	2	2	..	..
M. & M. 136	Hydraulics.....	3	3	..	..
M. & M. 143	Hydraulics Laboratory.....	1	..	..	3
M. E. 61	Measurement of Power.....	2	2	..	2
M. E. 83	Mechanical Engineering Laboratory.....	2	..	..	6
M. E. 35	Machine Design.....	3	..	2	6
E. E. 43	Electric Power.....	3	2	..	3

\*One or more electives

SENIOR YEAR

Course no.	Title	Credits	Rec.	Lect.	Lab.
<i>Fall Quarter</i>					
M. E. 151	Thermodynamics.....	3	2	..	..
E. E. 44	Electric Power.....	3	..	..	8
	Engineering Design as approved.....	3	..	..	8
M. E. 182	Advanced Steam Laboratory.....	2	..	..	6
M. E. 190	Seminar.....	1	..	1	1

\*One or more electives

*Winter Quarter*

E. E. 45	Electric Power.....	3	2	..	3
M. E. 150	Gas Engines and Producers.....	3	2	..	..
M. E. 183	Power- and Gas-Engine Laboratory.....	2	..	..	6
	Engineering Design as approved.....	3	..	..	8
M. E. 191	Seminar.....	1	..	1	1

\*One or more electives

*Spring Quarter*

	Engineering Design as approved.....	3	..	..	8
M. E. 184	Advanced Engineering Laboratory.....	2	..	..	6
M. E. 193	Engineering Practice.....	2	..	2	..
M. E. 192	Seminar.....	1	..	1	1

\*One or more electives

\* For list of elective courses, see pages 28 and 29.

ARCHITECTURE  
GENERAL COURSE

FRESHMAN YEAR

Course no.	Title	Credits	Rec.	Lect.	Lab.
<i>Fall Quarter</i>					
M. & M. 11†	Applied Mathematics and Mechanics.....	5	5	..	..
Draw. 31	Graphics .....	2	..	2	..
Rhet. 4†	Rhetoric and Composition.....	3	3	..	..
Arch. 31	Elements of Architecture.....	4	..	2	10
Arch. 21	Freehand Drawing.....	2	..	..	6
G. E. 11	Orientation .....	1	..	2	..
	Military Drill.....	0	..	..	3
<i>Winter Quarter</i>					
M. & M. 12	Applied Mathematics and Mechanics.....	5	4	..	2
Draw. 32	Graphics .....	2	..	2	..
Rhet. 5	Rhetoric and Composition.....	3	3	..	..
Arch. 32	Elements of Architecture.....	4	..	1	8
Arch. 22	Freehand Drawing.....	2	..	..	6
G. E. 12	Orientation .....	1	..	1	..
	Hygiene and First Aid.....	0	..	1	..
	Military Drill.....	0	..	..	3
<i>Spring Quarter</i>					
M. & M. 13	Applied Mathematics and Mechanics.....	5	4	..	2
Draw. 33	Graphics .....	2	..	2	..
Rhet. 6	Rhetoric and Composition.....	3	3	..	..
Arch. 33	Elements of Architecture.....	4	..	1	8
Arch. 23	Freehand Drawing.....	2	..	..	6
G. E. 13	Orientation .....	1	..	2	..
	Military Drill.....	0	..	..	3

SOPHOMORE YEAR

Course no.	Title	Credits	Rec.	Lect.	Lab.
<i>Fall Quarter</i>					
M. & M. 9†	Calculus for Architects.....	4	4	..	..
Phys. 3	Elements of Mechanics and Sound.....	3	1	3	..
Arch. 24	Freehand Drawing.....	2	..	..	4
Arch. 34	Design .....	4	..	..	12
Arch. 14	History of Architecture.....	2	..	2	..
Arch. 44	Elements of Construction.....	2	..	1	5
	Military Drill.....	0	..	..	3

† Students entering without high-school chemistry will take Chem. 1, 2, and 3 in place of rhetoric in the freshman year and will take rhetoric instead of economics and business law in the junior year.

‡ Students who enter without higher algebra, solid geometry, or both, must complete these subjects in their first quarter. It will be necessary for these students to attend the following Summer School to complete their freshman mathematics or mathematics and drawing. The curricula arranged for freshman engineers, on pages 15 to 17 will serve as a guide in arranging these programs.



COURSES OF STUDY

*Winter Quarter*

M. & M. 92	Mechanics for Architects.....	4	4	..	..
Phys. 23	Heat .....	3	1	3	..
Arch. 25	Freehand Drawing.....	2	..	..	6
Arch. 35	Design .....	4	..	..	12
Arch. 15	History of Architecture.....	2	..	2	..
Arch. 45	Elements of Construction.....	2	..	1	5
	Military Drill.....	0	..	..	3

*Spring Quarter*

M. & M. 93	Strength of Materials for Architects.....	4	4	..	..
Phys. 43	Magnetism and Electricity.....	4	1	4	..
Arch. 26	Freehand Drawing.....	2	..	..	6
Arch. 36	Design .....	4	..	..	12
Arch. 16	History of Architecture.....	2	..	2	..
Arch. 46	Elements of Construction.....	2	..	1	5
	Military Drill.....	0	..	..	3

JUNIOR YEAR

Course no.	Title	Credits	Rec.	Lect.	Lab.
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*Fall Quarter*

Arch. 18	History of Architecture.....	2	..	2	..
Arch. 27	Freehand Drawing .....	2	..	..	2
Arch. 37	Design .....	7	..	..	21
C. E. 38	Stresses .....	3	..	1	5
Econ. 8	General Economics .....	3	3	..	..

*Winter Quarter*

Arch. 18	History of Architecture.....	2	..	2	..
Arch. 28	Freehand Drawing .....	2	..	..	6
Arch. 38	Design .....	7	..	..	21
C. E. 39	Structural Design .....	3	..	1	5
Econ. 9	General Economics .....	3	3	..	..

*Spring Quarter*

Arch. 19	History of Architecture.....	2	..	2	..
Arch. 29	Freehand Drawing .....	2	..	..	2
Arch. 39	Design .....	7	..	..	21
C. E. 41	Reinforced Concrete.....	3	..	1	5
P. S. 27	Business Law.....	3	3	..	..

SENIOR YEAR

Course no.	Title	Credits	Rec.	Lect.	Lab.
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*Fall Quarter*

Arch. 131	Design .....	10	..	..	30
Arch. 151	Architectural Seminar.....	1	..	1	..
Arch. 141	Materials of Construction.....	2	..	2	..
Arch. 161	History of Sculpture and Painting.....	2	..	2	..
E. E. 40	Electric Wiring and Equipment.....	2	..	2	..

*Winter Quarter*

Arch. 132	Design .....	10	..	..	30
Arch. 152	Estimating .....	1	..	1	..
Arch. 142	Materials of Construction .....	2	..	2	..
Arch. 162	Landscape Design.....	2	..	1	5
C. E. 171	Building Sanitation.....	2	2	..	..

|| See note (†) on previous page.

*Spring Quarter*

Arch. 133	Design .....	10	..	..	30
C. E. 17	Surveying .....	1	..	1	..
Arch. 153	Business Relations.....	2	..	2	..
Arch. 163	Allied Arts.....	2	..	2	..
Arch. 143	Materials of Construction.....	2	..	..	..
M. E. 154	Heating and Ventilating.....	2	2	1	3

NOTE.—Students entering with deficiency in entrance mathematics will not be allowed to register in Architecture 31 and Drawing 31 until the second quarter. Such students must enter the summer quarter to complete the resulting deficiencies in freshman required work. Otherwise they may not enter the sophomore year.

Students entering deficient in entrance chemistry must register in chemistry in place of rhetoric.

ARCHITECTURE  
CONSTRUCTION OPTION

FRESHMAN YEAR

Course no. Title Credits Rec. Lect. Lab.

*Fall Quarter*

M. & M. 11	Applied Mathematics and Mechanics.....	5	5	..	..
Draw. 31	Graphics .....	2	..	2	..
Chem. 4* or	Chemistry .....	4	..	3	6
Chem. 14	Chemistry .....	5	..	3	6
Arch. 31	Elements of Architecture.....	4	..	2	10
Arch. 21	Freehand Drawing .....	2	..	..	6
G. E. 11	Orientation .....	1	..	2	..
	Military Drill.....	0	..	..	3

*Winter Quarter*

M. & M. 12	Applied Mathematics and Mechanics.....	5	4	..	2
Draw. 32	Graphics .....	2	..	2	..
Chem. 5* or	Chemistry .....	4	..	3	6
Chem. 15	Chemistry .....	5	..	3	6
Arch. 32	Elements of Architecture.....	4	..	1	8
Arch. 22	Freehand Drawing .....	2	..	..	6
G. E. 12	Orientation .....	1	..	1	..
	Hygiene and First Aid.....	0	..	1	..
	Military Drill.....	0	..	..	3

*Spring Quarter*

M. & M. 13	Applied Mathematics and Mechanics.....	5	4	..	2
Draw. 33	Graphics .....	2	..	2	..
Chem. 16*	Chemistry .....	5	..	3	6
Arch. 33	Elements of Architecture.....	4	..	1	8
Arch. 23	Freehand Drawing .....	2	..	..	6
G. E. 13	Orientation .....	1	..	2	..
	Military Drill.....	0	..	..	3

\* Students who enter without credit in high-school chemistry must register for Chemistry 14, 15, and 16 instead of 4, 5, and 16.

SOPHOMORE YEAR

Course no. Title Credits Rec. Lect. Lab.

*Fall Quarter*

M. & M. 24	Applied Mathematics and Mechanics.....	5	5	..	..
Phys. 3	Elements of Mechanics and Sound.....	3	1	3	..
Phys. 4	Elements of Mechanics Laboratory.....	1	..	..	2
Rhet. 4	Rhetoric and Composition.....	3	3	..	..
Arch. 34	Architectural Design.....	4	..	..	12

COURSES OF STUDY

Winter Quarter

M. & M. 25	Applied Mathematics and Mechanics.....	5	5	..	..
Phys. 23	Heat and Light.....	3	1	3	..
Phys. 24	Heat and Light Laboratory.....	1	..	..	2
Rhet. 5	Rhetoric and Composition.....	3	3	..	..
Arch. 35	Architectural Design.....	4	..	..	12

Spring Quarter

M. & M. 26	Technical Mechanics.....	5	5	..	..
Phys. 43	Electricity and Magnetism.....	3	1	3	..
Phys. 44	Electricity and Magnetism Laboratory.....	1	..	..	2
Rhet. 6	Rhetoric and Composition.....	3	3	..	..
Arch. 36	Architectural Design.....	4	..	..	12

JUNIOR YEAR

Course no.	Title	Credits	Rec.	Lect.	Lab.
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Fall Quarter

M. & M. 4131	Technical Mechanics.....	3	3	..	..
M. & M. 134	Strength of Materials.....	2	2	..	..
M. & M. 141	Materials-Testing Laboratory.....	1	..	..	3
C. E. 38	Stresses and Structural Design.....	3	..	1	8
Arch. 14	History of Architecture.....	2	..	2	..
Arch. 47	Building Construction.....	4	..	1	10
Econ. 8	Economics.....	3	3	..	..

Winter Quarter

M. & M. 132	Technical Mechanics.....	3	3	..	..
M. & M. 135	Strength of Materials.....	2	2	..	..
C. E. 39	Stresses and Structural Design.....	3	..	1	8
Arch. 15	History of Architecture.....	2	..	2	..
Arch. 48	Building Construction.....	4	..	1	10
Econ. 9	Economics.....	3	3	..	..

Spring Quarter

M. & M. 133	Technical Mechanics.....	2	2	..	..
M. & M. 136	Hydraulics.....	3	3	..	..
M. & M. 143	Hydraulics Laboratory.....	1	..	..	2
C. E. 41	Stresses and Structural Design.....	3	..	1	8
Arch. 16	History of Architecture.....	2	..	2	..
Arch. 49	Building Construction.....	4	..	1	10
P. S. 27	Business Law.....	3	3	..	..

SENIOR YEAR

Course no.	Title	Credits	Rec.	Lect.	Lab.
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Fall Quarter

M. E.	Heat Engines.....	2	2	..	..
C. E.	Structural Design.....	4	..	1	12
Arch. 141	Materials of Construction.....	2	..	2	..
E. E.	Electrical Equipment.....	3	..	2	3
Arch. 17	History of Architecture.....	2	..	2	..
Arch. 151	Architectural Seminar.....	1	..	1	..
	*Elective.....	3	..	..	..

*Winter Quarter*

M. E.	Heat Engines .....	2	2	..	..
C. E.	Structural Design .....	4	..	..	12
Arch. 142	Materials of Construction .....	2	..	2	..
C. E.	Building Sanitation .....	3	2	..	3
Arch. 18	History of Architecture .....	2	..	2	..
Arch. 152	Estimating .....	1	..	1	..
	*Elective .....	3	..	..	..

*Spring Quarter*

C. E.	Structural Design .....	4	..	..	12
Arch. 153	Business Relations .....	2	..	2	..
M. E.	Heating and Ventilating .....	3	2	1	3
Arch. 19	History of Architecture .....	2	..	2	..
C. E. 16	Surveying .....	3	..	..	6
	*Elective .....	3	..	..	..

\* For list of elective courses, see pages 28 and 29.

ELECTIVE COURSES OPEN TO SOPHOMORES

No.	Title	Credits	Prerequisites
A. B. 1-2	General Zoology .....	10	None
Ast. 4-5	Introduction to Astronomy ..	10	Trigonometry
Ast. 7	Navigation .....	3	Trigonometry
Ast. 11	Descriptive Astronomy .....	5	None
Ast. 308	Field Ast. for Engr. ....	3	Trig., 1 qtr. survey
Bact. 1	General Bacteriology .....	5	Chemistry 10 credits
Econ. 3-4	Principles of Economics .....	10	None
Econ. 8-9	General Economics .....	6	None
Econ. 25-26	Principles of Accounting .....	8	Economics 3-4
Eng. 1-2-3	English Survey .....	9	9 credits in rhetoric
Eng. 44-45	American Literature .....	6	English A-B-C
Rhet. 4-5-6	Composition for Technical Students .....	9	None
Rhet. 31	Technical Writing .....	3	Rhetoric 4-5-6
Pub. Sp. 41-2-3	Public Speaking .....	9	Rhet. 1-2-3
Geol. 1-2	General Geology .....	10	Chemistry
Geol. 21-22	Mineralogy .....	6	Chemistry
German 1-2-3	Beginning German .....	15	None
German 4-5-6	Beginning German .....	9	None
German 10	Reading German .....	5	2 years prep. German.
Hist. 1-2	Modern World .....	10	None
Hist. 5-6	American History .....	10	None
Phil. 2	Logic .....	5	None
Pol. Sci. 1	American Government .....	5	None
Psy. 1-2-3	General Psychology .....	6-9	None
French 1-2	Beginning French .....	10	None
French 3-4	Introduction to French .....	10	French 1-2
Spanish 1-2	Beginning Spanish .....	10	None
Spanish 3-4	Introduction to Spanish .....	10	Spanish 1-2
Sociology 1	Introduction to Sociology .....	5	None

For detailed schedules of classes see the bulletins of respective departments.

## COURSES OF STUDY

29

### ELECTIVE COURSES OPEN TO JUNIORS AND SENIORS

In addition to all courses open to sophomores.

No.	Title	Credits	Prerequisites
Ast. 62f	Practical Astronomy.....	3	Ast. 4 or 11 or trigonometry
Ast. 140w	Least Squares .....	3	Calculus
Econ. 91f	Principles of Organization & Management .....	3	Seniors without prerequisites
Econ. 51f-52w- 53s	Business Law.....	9	Juniors with Economics 8-9, or 10 credits in economics or political science
Econ. 73w	Railway Traffic and Rates..	3	Economics 3-4
Econ. 74s	Transportation Problems....	3	Economics 57
Econ. 85f	Principles of Marketing....	3	Economics 3-4 or 10 other credits in economics
Econ. 131f- 132w-133s	Cost Accounting .....	9	Economics 25-26
Econ. 154s	Public Utilities.....	3	Economics 54
Econ. 167w- 168s	Industrial Relations .....	6	Economics 8-9
Pub. Sp. 55f- 56w-57s	Argument and Debate.....	9	Public Speaking 41-42-43
Geol. 15s	Minerals and Rocks.....	1	Geology 1
Geol. 105f	Rock Study .....	3	Geology 22 or 25
German 53f- 54w-55s	Conversation .....	3	German 11 or 14 10 credits in history
Hist. 25f	World Politics.....	5	Chemistry 8
Met. 22f-23w	Metallurgy .....	3	Chemistry
Met. 150w	Metallography .....	3	Metallography 150
Met. 151s	Adv. Metallography .....	3	Chemistry
Met. 156w	Metallography .....	3	Metallography 156
Met. 157s	Adv. Metallography .....	3	Public Speaking 1
P. S. 11f-w	Municipal Government.....	5	
French 50f- 51w-52s	Conversation .....	3	French 3-4
Spanish 50f- 51w-52s	Conversation .....	3	Spanish 3-4
Physics 31f-s	Optics .....	3	Mechanics
Physics 32f-s	Optics Laboratory .....	3	Mechanics

For detailed schedule of classes see the bulletin of respective departments.

## DEPARTMENTAL STATEMENTS

### ARCHITECTURE

Professors FREDERICK M. MANN, LEON ARNAL; Associate Professor JAMES H. FORSYTHE; Assistant Professors SAMUEL C. BURTON, ROBERT T. JONES, ROY C. JONES; Instructors RALPH HAMMETT, CARL E. JOHNSON; Lecturers PAUL C. GAUGER, ARTHUR R. NICHOLS.

#### COURSES

No.	Title	Credits	Required of	Prerequisite courses
		per qu.		
4f-5w-6s	Elements of Architecture..	6	Soph. S.L.A.	Soph. standing
10f-11w-12s	Freehand Drawing .....	2	S.L.A.	None
14f-15w-16s	History of Architecture..	2	Soph. Arch.	33
17f-18w-19s	History of Architecture..	2	Jr. Arch.	16
21f-22w-23s	Freehand Drawing.....	2	Fr. Arch.	None
24f-25w-26s	Freehand Drawing.....	2	Soph. Arch.	23
27f-28w-29s	Freehand Drawing.....	2	Jr. Arch.	26
31f-32w-33s	Elements of Architecture..	4	Fr. Arch.	None
34f-35w-36s	Arch. Design, Elementary.	4	Soph. Arch.	33
37f-38w-39s	Arch. Design, Intermediate	7	Jr. Arch.	36
44f-45w-46s	Elements of Construction..	2	Soph. Arch.	33
47f-48w-49s	Building Construction.....	4	Jr. Constr.	33
83f-84w	Decoration and Allied Arts .....	2	Sr. S.L.A.	Sr. standing
131f-132w-133s	Arch. Design, Advanced... 10	10	Sr. Arch.	39
141f-142w-143s	Materials of Construction.	2	Sr. Arch.	C.E. 41
151f	Arch. Seminar .....	1	Sr. Arch.	Sr. standing
152w	Estimating .....	1	Sr. Arch.	Sr. standing
153s	Business Relations .....	2	Sr. Arch.	Sr. standing
161f	History of Sculpture and Painting .....	2	Sr. Arch.	14-15-16
162w	Landscape Design.....	2	Sr. Arch.	39
163s	Allied Arts.....	2	Sr. Arch.	29

The General Course affords training for the general practice of architecture and, while giving adequate attention to structural studies, lays particular stress on the study of architectural design.

The Construction Course is formulated for those who wish to specialize more in the engineering aspects of architecture with the view of practicing in association with one specializing more particularly in design.

Students who wish to extend and broaden their course in architecture can arrange a five-year schedule leading to the degree of Bachelor of Science in the College of Science, Literature, and the Arts; and Bachelor of Science in Architecture, in the College of Engineering and Architecture.

4f-5w-6s. ELEMENTS OF ARCHITECTURE. Beginning course for students in the Science, Literature, and Arts Course in Architecture and Decoration. Parallel to Course 31-32-33, with addition of instrumental and freehand drawing. Six credits per quarter. MR. FORSYTHE, MR. BURTON.

- 10f-11w-12s. **ELEMENTARY FREEHAND DRAWING.** For Science, Literature, and the Arts students. Architectural ornament, details of the figure in charcoal, memory drawing. Two credits per quarter. MR. BURTON, MR. JOHNSON.
- 14f. **ARCHITECTURAL HISTORY.** Technical study of the architecture of ancient Egypt, Assyria, Persia, and Greece, with emphasis on the latter. Study of political, social, and economic conditions affecting the architecture of this period. Illustrated lectures and library research. Two credits. MR. FORSYTHE.
- 15w. **ARCHITECTURAL HISTORY.** Technical study of the architecture of ancient Rome and of the Renaissance in Italy to the end of the fifteenth century. Study of political, social, and economic conditions. Illustrated lectures and library sketches and research. Two credits. MR. FORSYTHE.
- 16s. **ARCHITECTURAL HISTORY.** Technical study of the architecture of the Renaissance of the sixteenth and seventeenth centuries in Italy. Architecture of the Renaissance in Spain. Illustrated lectures and library research. Two credits. MR. FORSYTHE.
- 17f. **ARCHITECTURAL HISTORY.** Technical study of the architecture of the Middle Ages; in Italy, France, and England; sources and influences in the development of the Romanesque and Gothic styles, particularly in France. Lectures and library research. Two credits. MR. MANN.
- 18w. **ARCHITECTURAL HISTORY.** Technical study of developed Gothic architecture in France and England. Early Renaissance architecture in France and England, its sources and affecting influences. Lectures and library research. Two credits. MR. MANN.
- 19s. **ARCHITECTURAL HISTORY.** Technical study of the development of architecture from the seventeenth century to and including the present time, particularly in France, England, and America. Lectures and library research. Two credits. MR. MANN.
- 21f-22w-23s. **ELEMENTARY FREEHAND DRAWING.** Drawing with charcoal, pencil, pen and ink, and color from architectural ornament and details of the figure; drawing from memory. Two credits per quarter. MR. BURTON, MR. JOHNSON.
- 24f-25w-26s. **FREEHAND DRAWING.** Drawing from the antique in charcoal, pastel, and pencil. Painting from still life in oils and water color. Study of the elementary principles of composition and of color arrangement. Two credits per quarter. MR. BURTON, MR. JOHNSON.
- 27f-28w-29s. **FREEHAND DRAWING.** Drawing and painting from the antique and from life; figure composition. Two credits per quarter. MR. BURTON.
- 31f. **ELEMENTS OF ARCHITECTURE.** Exercises in instrumental drawing and architectural lettering. Theory and practice of wash rendering. Lectures and library research. Four credits. MR. FORSYTHE, MR. R. T. JONES, MR. HAMMETT.

- 32w-33s. **ELEMENTS OF ARCHITECTURE.** Original problems in the architectural treatment of walls, floors, windows, and mouldings. Elements of building construction. Lectures and library research. Four credits per quarter. MR. FORSYTHE, MR. R. T. JONES, MR. HAMMETT.
- 34f-35w-36s. **ARCHITECTURAL DESIGN.\*** Original problems dealing in general with elements of elevation and their composition into simple architectural units. Sketch problems dealing with elementary plan compositions. Individual criticism and library research. Four credits per quarter. MR. R. C. JONES.
- 37f-38w-39s. **ARCHITECTURAL DESIGN.\*** Original problems dealing in general with the elements of plan. Composition of simple complete buildings. Sketch problems dealing with plan composition. Individual and general criticism and library research. Seven credits per quarter. MR. ARNAL.
- 44f-45w-46s. **ELEMENTS OF CONSTRUCTION.** Preparation of working drawings of frame and masonry buildings. Specifications. Measured drawings of details of construction. Written reports of buildings under construction. Two credits per quarter. MR. R. T. JONES.
- 47f-48w-49s. **BUILDING CONSTRUCTION.** Details of light and heavy construction. Working drawings and specifications. Superintendance. Written reports on buildings under construction. Four credits per quarter. MR. R. T. JONES.
- 83f-84w. **DECORATION AND ALLIED ARTS.** History of ornament and decoration; furniture and decorative materials; theory and use of color. For students in the Science, Literature, and the Arts Course in Architecture and Decoration. Three credits per quarter. MR. MANN.
- 131f-132w-133s. **ARCHITECTURAL DESIGN.\*** Original problems dealing with composition of single buildings or groups of buildings and those of special character. Subjects of decorative or imaginative interest. Sketch problems. Ten credits per quarter. MR. ARNAL.
- 141f-142w-143s. **MATERIALS OF CONSTRUCTION.** Technology of materials. Physical properties, process of manufacture and uses in construction. Two credits per quarter. MR. R. T. JONES.
- 151f. **ARCHITECTURAL SEMINARS.** Special topics and topics of current interest. Papers and discussions. One credit. MR. MANN.

\* Work in all the design courses is carried on simultaneously and students pass from one to the next in sequence in varying lengths of time, according to their accomplishment and irrespective of University time units. The normal time required to complete the design courses is three years. Some students find that they require a longer period and some are able to complete the design work in less time. Those who fall into the former group unit extend their time for graduation and to those able to complete the work in shorter time special advanced work is open.



- 152w. ARCHITECTURAL SEMINAR. Estimating. Principles of the quantity survey; cost analysis. One credit. MR. GAUGER.
- 153s. BUSINESS RELATIONS. Relations of the architect, owner, and builder; professional ethics and practice; and office administration. Two credits. MR. MANN.
- 161f. HISTORY OF SCULPTURE AND PAINTING. Historical study of ancient, Renaissance, and modern sculpture and of the Renaissance and modern schools of painting. Two credits. MR. BURTON.
- 162w. LANDSCAPE DESIGN. Theory and practice of landscape design. Lectures and design problems. Two credits. MR. NICHOLS.
- 163s. DECORATION AND THE ALLIED ARTS. Color theory. History of decoration and ornament, furniture, weaving, glass-making, etc. Two credits. MR. MANN.

## ASTRONOMY

Professor F. P. LEAVENWORTH.

## COURSE

No.	Title	Credits	Required of	Prerequisite courses
30s	Field Astronomy for Engineers...	3	Elective	Trigonometry 1 quarter surveying
30s.	FIELD ASTRONOMY FOR ENGINEERS. Elements of general and practical astronomy. Field work with the surveyor's transit and with the sextant for determining latitude, longitude, clock error, and azimuth. MR. LEAVENWORTH.			

## CHEMISTRY

Professors PAUL H. M.-P. BRINTON, CHARLES A. MANN, CHARLES F. SIDENER; Associate Professors EVERHART P. HARDING, M. CANNON SNEED; Assistant Professors ISAAC W. GEIGER, RAYMOND E. KIRK, GEORGE H. MONTILLON; Instructor NORVILLE C. PEVERIER.

## COURSES

No.	Title	Credits	Required of	Prerequisite courses
		per qu.		
4f-5w	General Inorganic Chemistry..	4	Fr.	High-school chem.
14f-15w	General Inorganic Chemistry..	5	Fr.	None
16s	Qualitative Analysis .....	5	Fr.	5 or 15
28f,w	Quantitative Analysis .....	3	Elective	16
60s	Power-Plant Chemistry .....	3	Elective	28
176f-177w	Applied Electrochemistry.....	3 or 4	Elective	Physics

4f-5w. GENERAL INORGANIC CHEMISTRY. Designed for those who have had one year of high-school chemistry. A study of the general laws of chemistry and of the non-metals, the metals, and their compounds. Four credits per quarter. MR. KIRK.

- 14f-15w. GENERAL INORGANIC CHEMISTRY. For those who have had no high-school chemistry. Includes a study of the general laws of chemistry and of the non-metals, the metals, and their compounds. Five credits per quarter. MR. PERVIER.
- 16s. QUALITATIVE ANALYSIS. Laboratory work in systematic qualitative analysis with lectures on solution, ionization, chemical and physical equilibrium, oxidation and reduction, and other subjects pertinent to qualitative analysis. Five credits. MR. KIRK, MR. PERVIER.
- 28f,w. QUANTITATIVE ANALYSIS. A short introductory course covering the general principles and methods of quantitative analysis, both gravimetric and volumetric. Typical problems are assigned and attention given to proper laboratory practice. Three credits. MR. SIDENER, MR. BRINTON, MR. GEIGER.
- 60s. POWER-PLANT CHEMISTRY. Proximate analysis of coal determination of calorific power; technical analysis of fuel gases and furnace gases; examination of boiler water; lubricating oils. Three credits. MR. HARDING.
- 176f-177w. APPLIED ELECTROCHEMISTRY. Application of the electric current to chemical processes. Laws and phenomena of electrochemistry, primary and secondary batteries, electroplating, electric furnace construction and operation, and the products of electrolysis of the electric furnace. MR. MANN, MR. MONTILLON.

CIVIL ENGINEERING

Professors FREDERICK BASS, ALVIN S. CUTLER, JOHN I. PARCEL;\* Assistant Professors GEORGE A. MANEY, OTTO S. ZELNER, FRED C. LANG, MAURICE B. LAGAARD; Instructors EDMUND B. FELDMAN, JOHN C. WORRELL, LEONARD F. BOON.

COURSES

No.	Title	Credits per qu.	Required of	Prerequisite courses
11f-12w-13s	Surveying .....	3	Soph. C.E.	Math.13, Draw.
14f	Surveying .....	3	Jr. C. E.	C. E. 13
16s	Surveying .....	3	Sr. Arch. Eng. elec- tive M. E., E. E.	
17s	Surveying .....	1	Sr. Arch.	Math. 13
21w-22s	Surveying .....	3	Jr. C. E.	C. E. 11
23su	Summer Camp.....	9	Jr. C. E.	C. E. 22
121f-122w- 123s	Railway Engineering .....	3	Elective, sr. C. E.	C. E. 23
124w-125s	Transportation .....	3	Elective, sr. C. E.	C. E. 123
31f-32w	Stresses in Structures.....	3	Jr. C. E.	Math.23, Draw.23
33s	Elementary Structural Design.	3	Jr. C. E.	C. E. 32
131f	Bridge Analysis .....	4	Sr. C. E.	C. E. 33
132w-133s	Bridge Design .....	3	Sr. C. E.	C. E. 131
37f	Structural Engineering.....	3	Elective M. E., E. E.	Math. 23

\* On leave of absence, 1921-22.

DESCRIPTION OF COURSES

No.	Title	Credits Required of per qu.	Required of	Prerequisite courses
38f	Stresses .....	3	Jr. Arch.	Math. 93
39w	Structural Design .....	3	Jr. Arch.	C. E. 38
41s	Reinforced Concrete .....	3	Jr. Arch.	Math. 93
141f-142w	Reinforced Concrete .....	3	Sr. C. E.	M. & M. 141
143s	Foundations .....	3	Sr. C. E.	Math. 136
144f	Reinforced Concrete .....	2	Elective (sr. M. E., sr. E. E.)	Math. 133 and 134
51f-52w	Highways and Pavements.....		Jr. C. E.	C. E. 12
53s	Municipal Engineering .....		Jr. C. E.	
161f	Hydrology .....	4	Sr. C. E.	
162w	Water Supply .....	4	Sr. C. E.	Math. 136
163s	Sanitary Engineering .....	3	Sr. C. E.	Math. 136
164w-165s	Water Power .....	3	Sr. C. E.	Math. 136
171w	Building Sanitation .....	2	Sr. Arch.	
221f-222w-				
223s	Railway Administration.....			C. E. 122
224f	Railway Terminals and Yards			C. E. 122
261f	Water and Sewage Purification			C. E. 162
262w	Water-Supply Problems .....			C. E. 162
263s	Hydraulic Laboratory .....			C. E. 164
251w	Highway Laboratory.....			C. E. 51-52
252	Highway Administration .....			C. E. 51
272f	City-Planning .....			C. E. 51-52
273w	Industrial Sanitation .....			
264f	Water Power .....			C. E. 164
265w	Drainage and Flood Control...			C. E. 161
266s	River Improvement .....			C. E. 161
231f-232w-				
233s	Indeterminate Structures .....			C. E. 133, 142
234f-235w-				
236s	Advanced Structural Design...			C. E. 133, 142
243w-244s	Cement and Concrete Labora- tory .....			C. E. 142
237w-238s	Structural Laboratory.....			C. E. 133
245-246-247	Reinforced Concrete Analysis..			C. E. 142

SURVEYING

- 11f. SURVEYING. Field problems; use of chain, compass, transit, and level. Computation and platting of surveys made in the field. Determination of area by D. M. D. method and planimeter. Three credits. MR. BOON.
- 12w. SURVEYING. Lectures and drawing-room. Platting of maps, profiles, and cross-sections. Computation of earthwork quantities. United States public land surveys. Conventional signs. Three credits. MR. ZELNER, MR. BOON.
- 13s. SURVEYING. Adjustments of instruments, profile and differential leveling, transit surveys, circular curves. Three credits. MR. CUTLER, MR. BOON.
- 14f. SURVEYING. A complete topographical survey, stadia method, is made and platted. Three credits. MR. ZELNER.

- 16w. SURVEYING. A short course in the use, care, and adjustment of surveying instruments. Methods of leveling and transit surveys. Offered to students other than civil engineers. Three credits. MR. ZELNER.
- 17s. SURVEYING. Special course for senior architects. One credit. MR. ZELNER.
- 21w. SURVEYING. A study of United States Geological Survey and railroad topographic maps with special reference to the location of a railway. A general survey of the problem of railway location, including grades, curvature, rise and fall, etc. Three credits. MR. ZELNER, MR. BOON.
- 22s. SURVEYING. Field and drafting-room. Simple, compound, and spiral curves. Observations for determination of meridian. Elements of hydrographic and precise surveying. All preparatory to more extended work in summer camp. Three credits. MR. CUTLER, MR. ZELNER.
- 23su. SUMMER CAMP. Six weeks immediately preceding the beginning of the senior year. Continuation of Course 22, including extended railroad, topographic, hydrographic, and triangulation surveys. Nine credits. MR. CUTLER, MR. ZELNER.

#### RAILWAY ENGINEERING

- 121f. RAILWAY ENGINEERING. Train resistance, ruling and momentum grades, curvature, distance, rise and fall as factors in location and operation of railroads. Train-loading, acceleration, retardation; locomotives and equipment. Operating costs governing grade revision. Three credits. MR. CUTLER.
- 122w. RAILWAY ENGINEERING. Lectures, office work, and field inspection. Design and operations of various types of yards and terminals, and terminal facilities, including the hump, engine house, coal and water station. Signalling and interlocking. Three credits. MR. CUTLER.
- 123s. RAILWAY ENGINEERING. Design and construction of railroad buildings and structures; culverts, wooden trestles, switches, crossovers, crossing frogs, etc. Method of computing earthwork, and estimates and reports. Distribution of material by means of mass diagram. Three credits. MR. CUTLER.
- 124w. TRANSPORTATION. Railway, highway, ocean and inland waterway transport, motive power and car equipment, operating problems, railway, water, and joint terminal problems, typical design and equipment. Cost and value of service, valuation, regulation, present systems and organizations. Three credits. MR. CUTLER, MR. BOON.
- 125s. TRANSPORTATION. Specific illustrative problems: Twin City and Mississippi Valley traffic situation, Mississippi River experiment, New York Barge Canal, Great Lakes traffic, St. Lawrence River project, Panama Canal status. Rapid transit, motor transport. Three credits. MR. CUTLER.

221f-222w-223s. RAILWAY ADMINISTRATION. An analysis of railway organization and methods of management and operation. Principles of valuation and rate-making. MR. CUTLER.

224f. RAILWAY TERMINALS AND YARDS. A continuation of Course 123. MR. CUTLER.

#### STRUCTURAL ENGINEERING

31f. STRESSES IN STRUCTURES. Algebraic and graphic analysis of various types of roof and bridge trusses for fixed loading. Three credits. MR. FELDMAN.

32w. STRESSES IN STRUCTURES. Moving loads and influence lines. Standard engine loadings and equivalent uniform loads. Three credits. MR. FELDMAN.

33s. ELEMENTARY STRUCTURAL DESIGN. Designing principles and methods. Complete design and detail drawing of framed mill building bent. Three credits. MR. FELDMAN.

131f. BRIDGE ANALYSIS. Stresses in simple span railway bridge trusses of the larger type. Baltimore, Petit, Whipple, and "K" trusses. Four credits. MR. MANEY, MR. \_\_\_\_\_

132w. BRIDGE DESIGN. Design and detail drawing of railway plate girder viaduct. Three credits. MR. MANEY, MR. \_\_\_\_\_

133s. BRIDGE DESIGN. Complete design and detail drawing of railway pin truss span. Three credits. MR. MANEY, MR. \_\_\_\_\_

37f. STRUCTURAL ENGINEERING. (For Electrical and Mechanical Engineers.) Analysis of stresses in simple structural frames. Roof trusses, crane trusses, mill building bent. Three credits. MR. LAGAARD.

38f. STRESSES IN STRUCTURES. Application of laws of equilibrium to simple structures. Special emphasis is placed on graphic methods. Three credits. MR. LAGAARD.

39w. STRUCTURAL DESIGN. General principles of structural design. Girders, columns, and roof trusses. Three credits. MR. LAGAARD.

41s. REINFORCED CONCRETE. Brief course in theory and designing methods with special reference to buildings. Three credits. MR. LAGAARD.

141f. REINFORCED CONCRETE. Principles of reinforced concrete. Theory of beams, slabs, and columns and the application to ordinary structures. Three credits. MR. MANEY.

142w. REINFORCED CONCRETE DESIGN. Continuation of 141 with especial emphasis on the practical features of the design of buildings, bridges, retaining walls, etc. Three credits. MR. MANEY.

- 143s. MASONRY AND FOUNDATIONS. Brief study of masonry structures in general. Theory of earth pressure; walls, footings, dams, ordinary and deep foundations. Three credits. MR. MANEY.
- 144f. REINFORCED CONCRETE. A short course for mechanical and electrical engineers embracing the principal features of 141. Two credits. MR. LAGAARD.
- 231f-232w-233s. STATICALLY INDETERMINATE STRUCTURES. General theory deflections and statically indeterminate stresses and their application to continuous girders, swing bridges, arches, redundant members, secondary stresses, and wind stresses in office buildings. MR. MANEY.
- 234f-235w-236s. ADVANCED STRUCTURAL DESIGN. Fundamental theory of stresses applied to special problems. Stress distribution in girders, riveted joints. Bending of straight bar. Built-up compression members. Impact and fatigue. Relative economy in design. Comparative study of specifications. MR. MANEY.
- 237w-238s. STRUCTURAL LABORATORY. Similar to 243, but dealing mainly with experimental problems in structural steel. Strain gauge study of actual stress distribution in beams, columns, and riveted joints. MR. LAGAARD, MR. MANEY.
- 243w-244s. CEMENT AND CONCRETE LABORATORY. Laboratory technic and experimental investigation of special problems in cement, concrete, and reinforced concrete. MR. LAGAARD.
- 245f-246w-247s. REINFORCED CONCRETE ANALYSIS. Critical review of the literature of reinforced concrete and study of the advanced theory. Study of test data and analysis of stresses in reinforced concrete structures. MR. MANEY, MR. LAGAARD.

#### HIGHWAY ENGINEERING

- 51f. HIGHWAYS AND PAVEMENTS. Elementary course with field inspection, relating to the economics, location, construction, and maintenance of highways and pavements. Three credits. MR. LANG, MR. WORRELL.
- 52w. HIGHWAYS AND PAVEMENTS. Continuation of Course 51, with laboratory practice. Three credits. MR. LANG, MR. WORRELL.
251. HIGHWAY LABORATORY. Investigations in cooperation with State Highway Department. MR. LANG, MR. WORRELL.
252. HIGHWAY ADMINISTRATION. Problems of highway administration and finance. MR. LANG.

#### HYDRAULIC ENGINEERING

- 164w-165s. WATER POWER. Types of low, medium, and high-head developments. Details of developments. Dams. Turbine settings and characteristics. MR. BASS.

- 263s. HYDRAULIC LABORATORY. Study of special hydraulic problems in laboratory, drafting-room, and field. \_\_\_\_\_
- 264f. WATER POWER. Detailed design of hollow reinforced concrete arch and high masonry dams. Design of power house from forebay to tail-race for typical developments. Pipe lines, reservoirs, surge tanks. Inspection of plants. \_\_\_\_\_
- 265w. DRAINAGE AND FLOOD CONTROL. Study of special problems. \_\_\_\_\_
- 266s. RIVER IMPROVEMENTS. River hydraulics and the maintenance of regimens. The improvement of rivers for navigation, etc. The economics of water transportation. \_\_\_\_\_

## MUNICIPAL AND SANITARY ENGINEERING

- 53s. MUNICIPAL ENGINEERING. Development of municipal public works. City-planning, transportation, and housing. The principles of public health and sanitation. Public water supplies, sewerage and sewage disposal, refuse collection and disposal, the sanitation of buildings. Three credits. MR. BASS.
- 161f. HYDROLOGY. Rainfall, evaporation, transpiration, percolation, run-off. Flood and low-water flows of streams. Storage for use in water supply, water power, irrigation, and navigation. Mass curves and frequency curves. Four credits. MR. BASS.
- 162w. WATER-SUPPLY ENGINEERING. Sources of water supply; quality of water. Laboratory methods of testing water; wells, surface-water intakes, conduits and pipe lines, distribution systems, and purification plants. Selection of pumping machinery and motive power. MR. BASS.
- 163s. SANITARY ENGINEERING. Quantities of sewage and storm water; precipitation and run-off. Sanitary sewer system for a small community; storm-water system for a city district. Stream pollution and sewage disposal. MR. BASS.
- 171w. BUILDING SANITATION. The location and orientation of buildings; lighting, ventilation, water supply, plumbing, sewage, and refuse disposal. MR. BASS, MR. ROWLEY.
- 261f. WATER AND SEWAGE PURIFICATION. Continuation of Course 163. Design of water purification and sewage disposal. MR. BASS.
262. WATER AND SEWAGE PURIFICATION. Continuation of Course 162. MR. BASS.
- 272f. CITY-PLANNING. The physical elements of the city; topography, drainage, geology. Public works and structures. Street arrangements; rapid transit; railroad terminals. City-districting. Subsurface structures. Esthetic features of the city; the civic center; parks; boulevards; public buildings. MR. BASS, MR. MANN.

273w. INDUSTRIAL SANITATION. Principles of public health. Methods in use for prevention of disease. Sanitation and hospital service in factory buildings and grounds. Housing problems. Welfare work. MR. BASS.

DRAWING AND DESCRIPTIVE GEOMETRY

Professor WILLIAM H. KIRCHNER; Assistant Professors ROBERT W. FRENCH, HOWARD D. MYERS; Instructors LEON ARCHIBALD, JOHN O. CEDERBERG, HENRY C. T. EGGERS, EDGERTON W. KIBBEY, CARROLL E. LEWIS, ARTHUR P. PETERSON, ORRIN W. POTTER, ROBERT F. SCHUCK, WILLIAM S. WILLIAMS.

COURSES

No.	Title	Credits	Required of	Prerequisite courses
		per qu.		
1f,w,su	Engineering Drawing .....	3	Fr. Eng.	Solid geometry
2w,s,su	Engineering Drawing .....	3	Fr. Eng.	1
3s,f,su	Descriptive Geometry .....	3	Fr. Eng.	2, Math. 12
4f,su-5w,su-6s,su	Engineering Drawing and Descriptive Geometry .....	2	Fr. Chem.	Solid geometry
7w,su-8s,su	Engineering Drawing and Descriptive Geometry .....	3	Fr. Chem.	Solid geometry
9f,w,s	Drafting .....	2-6	Chem. elective	6 or 8
10f	Solid Geometry (3 hrs.).....	0	Fr. who lack h.-s. credit in it	
11f	Engineering Drawing .....	4	Fr. Mines	....
12w	Engineering Drawing .....	3	Fr. Mines	11f
13s	Engineering Drawing .....	3	Fr. Mines	12w
14f	Descriptive Geometry .....	3	Soph. Mines	13s, Math. 5s
15w	Drafting .....	2	Soph. Mines	14f
21f,w,su	Drafting .....	2	Soph. C. E.	3
22w,s,su	Drafting .....	2	Soph. C. E.	21
23s,su	Drafting .....	2	Soph. C. E.	22
26f,w,su	Drafting .....	2	Soph. E. E.	3
27w,s,su	Drafting .....	2	Soph. E. E.	26
28f,w,su	Drafting .....	2	Soph. M. E.	3
29w,s,su	Drafting .....	2	Soph. M. E.	28
31f,w	Graphics .....	2	Fr. Arch.	....
32w,s	Graphics .....	2	Fr. Arch.	31
33s,su	Graphics .....	2	Fr. Arch.	32
39f,w,s	Lettering for Engineers.....	2	Jr. sr., elective	Soph. draw.
41-42-43				
f,w,s,su	Technical Drawing .....	2	Fr. Dent., S.L.A.	....
44f,w,s	Lettering .....	1	Soph. elective	....
45f,w,s	Alphabets .....	2-4	Elective	....
47f-48w-49s	Drawing, Engraving, and Decoration .....	3	Elective	....
71w,s	Graphical Representation.....	2	Elective	Dr. 27, E. E. III
III-				
112f,w,s	Advanced Descriptive Geometry .....	2	Elective	3, calculus
113f,w,s	Perspective .....	3	Elective	33
115f,w,s	Geometry .....	3	Elective	Calculus



- 1f,w,su. ENGINEERING DRAWING. The elements of drafting including an introductory course in the methods of representation and constructive geometry. Graphs and formulas. Sketching, lettering, working drawings, conventions, standards, tracing, and blue printing. Three credits. MR. KIRCHNER, MR. MYERS, MR. ARCHIBALD, MR. EGGERS, MR. KIBBEY, MR. LEWIS, MR. PETERSON, MR. POTTER, MR. SCHUCK, MR. WILLIAMS.
- 2w,s,su. ENGINEERING DRAWING. A continuation of Course 1.
- 3s,f,su. DESCRIPTIVE GEOMETRY. An elementary course in the methods of representation, correlated in part with analytical geometry. Graphical and algebraic solutions. Lectures, demonstrations, and drawing-room exercises. Three credits. MR. KIRCHNER, MR. MYERS, MR. ARCHIBALD, MR. EGGERS, MR. KIBBEY, MR. LEWIS, MR. PETERSON, MR. POTTER, MR. SCHUCK, MR. WILLIAMS.
- 4f,su-5w,su-6s,su. ENGINEERING DRAWING AND DESCRIPTIVE GEOMETRY. The elements of drafting, including the study of polyhedra and other problems of solid and constructive geometry. An elementary course in descriptive geometry including graphical methods of representation, correlated in part with analytical geometry. Required of freshmen in the course in chemical engineering who satisfy the entrance requirements in mathematics. Two credits per quarter. MR. POTTER, MR. SCHUCK.
- 7w,su-8s,su. ENGINEERING DRAWING AND DESCRIPTIVE GEOMETRY. This course covers the same subject-matter as Course 4-5-6. It is required of freshmen in the course in chemical engineering who take solid geometry during the first quarter. Three credits per quarter. MR. POTTER, MR. SCHUCK.
- 9f,w,s. DRAFTING. Developments and intersections. Assembly drawings, outline drawings, diagrammatic layout, and detail drawings of experimental and industrial installations. Open to chemical engineering students who have completed Course 6 or 8. Two to 6 credits as elected. MR. SCHUCK.
- 10f(su). SOLID GEOMETRY. Lines and planes in space, dihedral and polyhedral angles; polyhedrons, cylinders, cones, similarity, prismoid formula, sphere area, volumes, numerical exercises in area, volumes, weights. Three hours per week but without credit. MR. ARCHIBALD, MR. LEWIS, MR. PETERSON, MR. SCHUCK, MR. WILLIAMS.
- 11f. ENGINEERING DRAWING. (Mines.) Sketching, lettering, representation, elements of drafting, details of machines and structures, interpretation of working drawings. Four credits. MR. ARCHIBALD, MR. POTTER.

- 12w. ENGINEERING DRAWING. (Mines.) Continuation of Course 11. The elements of general drafting, mechanical drawing as a language. Lines, views, dimensions, standards, signs, abbreviations, and explanatory notes. Three credits. MR. ARCHIBALD, MR. POTTER.
- 13s. ENGINEERING DRAWING. (Mines.) Continuation of Course 12. The elements of general drafting. Maps and sketches. Brush and pen conventions. Three credits. MR. ARCHIBALD, MR. POTTER.
- 14f. DESCRIPTIVE GEOMETRY. (Mines.) Projection; central and special cases, principles and application, representation of lines, planes, and solids, and of their relations; tangencies, intersections, and developments. Recitations, lectures, and solution of problems. Three credits. MR. KIRCHNER, MR. MYERS.
- 15w. DRAFTING. (Mines.) Graphics, machine drafting, and structural drafting. Instruction in drafting-room methods. Two credits. MR. MYERS, MR. PETERSON.
- 21f,w,s,su. DRAFTING. (C.E.) Drawing of structures and machines. Detail, assembly, and construction drawings. The solution of problems of simple structures. The application of descriptive geometry to drafting-room problems. Two credits. MR. FRENCH, MR. MYERS.
- 22w,s,su. DRAFTING. (C.E.) Continuation of Course 21. Drafting problems in concrete, highway, and topographical work as met by the civil-engineering draftsman in practice. Intersections, developments, and other practical geometric problems. Two credits. MR. FRENCH, MR. MYERS.
- 23s,su. DRAFTING. (C.E.) A continuation of Course 22. Two credits. MR. FRENCH, MR. MYERS.
- 26f,w,su. DRAFTING. (E.E.) The application of descriptive geometry to drafting-room problems. Sheet metal work, belting, conveyors, and connections. Working drawings and tracing. Two credits. MR. EGGERS, MR. LEWIS, MR. PETERSON.
- 27w,s,su. DRAFTING. (E.E.) The application of elementary formulas in the proportioning of simple machine parts. Outline and assembly drawings, electrical conventions, circuit diagrams, the development of simple formulas, and graphical methods. Two credits. MR. EGGERS, MR. LEWIS, MR. PETERSON.
- 28f,w,su. DRAFTING. (M.E.) The application of descriptive geometry to drafting-room problems. Sheet metal work, belting, conveyors, and connections. Working drawings and tracing. Two credits. MR. EGGERS, MR. LEWIS, MR. POTTER.

- 29w,s,su. DRAFTING. (M.E.) The application of elementary formulas in the proportioning of simple machine parts. Outline and assembly drawings, structural drafting, the development of simple formulas, and graphical methods. Two credits. MR. EGGERS, MR. LEWIS, MR. POTTER.
- 31f,w-32w,s-33s,su. GRAPHICS. Architectural shades and shadows. Pure and applied perspective. Exercises in constructive geometry with applications. Theorems, methods, and the solution of problems. Two credits. MR. KIRCHNER.
- 39f,w,s. LETTERING FOR ENGINEERS. The analysis of the alphabets. Exercises in Roman and Gothic lettering. Design and composition of the paragraph and the title. Two credits. MR. KIRCHNER.
- 41-42-43f,w,s,su. TECHNICAL DRAWING. A general course in the theory and practice of drawing. Sketching, lettering, tracing, conventions, renderings, blue printing, and mechanical drawing. Also the preparation of conventional charts and diagrams of particular interest to dentists, designed to meet the needs of dental students. Two credits per quarter. MR. CEDERBERG, MR. SCHUCK.
- 44f,w,s. LETTERING. A practical course in plain lettering and the making of graphs and charts. Open to sophomores, juniors, and seniors. One credit per quarter. MR. KIRCHNER.
- 45f,w,s. ALPHABETS. Construction and analysis of various types of letterings. Demonstrations and exercises. Open to juniors and seniors. Two or four credits as elected. MR. KIRCHNER.
- 47f-48w-49s. DRAWING, ENGRAVING, AND DECORATION. A study of the graphic arts and processes with special emphasis on their application to the art of printing. Open to juniors and seniors. Three credits per quarter. MR. KIRCHNER.
- 71w,s. GRAPHICAL REPRESENTATION—CIRCUITS. Schematic, connection, wiring, and pictorial diagrams of electrical circuits. Two credits. MR. EGGERS.
- 111-112f,w,s. ADVANCED DESCRIPTIVE GEOMETRY. Methods of representation; parallel and central projection. Curves and surfaces. Geometrography, axonometry, and photogrammetry. Two credits per quarter. MR. KIRCHNER.
- 113f,w,s. PERSPECTIVE. The principles and practice of perspective, including shadows, reflections, distortions, corrections, systems, methods, the practical problem, and inverse construction. Three credits. MR. KIRCHNER.
- 115f,w,s. GEOMETRY. Pure and applied. Transformations, perspective, kinematics, stereotomy, graphic statics, graphic calculus, nomography. Three credits per quarter. MR. KIRCHNER.

## ECONOMICS

Professors GEORGE W. DOWRIE, ROY G. BLAKEY, JEREMIAH S. YOUNG; Assistant Professors Z. CLARK DICKINSON, HOWARD S. NOBLE, HARRY J. OSTLUND, J. WARREN STEHMAN; Instructors JOSEPH E. CUMMINGS, VICTOR H. PELZ.

## COURSES

No.	Title	Credits per qu.	Required of	Prerequisite courses
8f-9w	General Economics (for engineers) .....	3	Elective	None
27s	Principles of Accounting (for engineers) .....	4	Elective	None
51f-52w-53s	Business Law .....	9	Elective	10 cr. econ. or pol. sc.
57w	Business Finance (for engineers) .....	3	Elective	8-9-10 or equiv.
73w	Railway Traffic and Rates ...	3	Elective	3-4
74s	Transportation Problems.....	3	Elective	57
85f	Principles of Marketing.....	3	Elective	3-4 and 10 other cr. in econ.
91f	Principles of Organization and Management (for engineers)	3	Elective	Seniors without prereq. or juniors with 8-9-10 or equiv.
131f-132w-				
133s	Cost Accounting .....	3	Elective	25-26
154s	Public Utilities .....	3	Elective	54
167w-168s	Industrial Relations .....	6	Elective	8-9-10

8f-9w. GENERAL ECONOMICS. (For engineers.) Principles of economics with special emphasis upon their application to current problems such as money, banking, conservation, insurance, international commerce, monopolies, transportation, labor socialism, public ownership, and finance. Three credits. MR. BLAKEY and others.

27s. PRINCIPLES OF ACCOUNTING. (For engineers.) The purpose and principles of account classification; capital and revenue; accruals; valuation; depreciation; preparation and interpretation of balance sheets, income accounts and other statements. Three hours of lecture and one laboratory period a week. Four credits. MR. OSTLUND.

57w. BUSINESS FINANCE. (For engineers.) A study of the principles of financing business concerns. Banking facilities from the viewpoint of the business man. The organization and financial management of corporations with special reference to the various types of corporate securities. Three credits. MR. STEHMAN.

51f-52w-53s.\* BUSINESS LAW. (See Political Science 51-52-53.)

\* All quarters must be completed before credit is given for any quarter.

- 73w. RAILWAY TRAFFIC AND RATES. Railway transportation from standpoint of the business man and shipper. Freight-shipping documents. Classification and tariffs, time and preference freight, private car lines, industrial trackage and terminal service, express rates and service, special passenger rates. Three credits. MR. CUMMINGS.
- 74s. TRANSPORTATION PROBLEMS. An intensive study of certain important problems such as valuation, public ownership, operation, and regulation. Three credits. MR. CUMMINGS.
- 85f. PRINCIPLES OF MARKETING. A general course dealing with the mechanics and operation of markets: classification, organization, market agencies as factors in production. The price-making process: control of supply, assumption of risk, incidence of marketing costs. Wastes of competition. Three credits.
- 91f. PRINCIPLES OF ORGANIZATION AND MANAGEMENT. (For engineers.) Types of operating organization; specialization; coordination of men and departments, planning; delegation of authority; means of control; establishment and maintenance of standards for materials, operation, machinery; scientific management; personnel problems. Three credits. MR. PELZ.
- 131f-132w-133s.\* COST ACCOUNTING. General principles of cost accounting; elements of costs; methods of arriving at costs, and of distribution overhead; application of cost-accounting principles to selling, banking, mining, farming, etc. Three credits per quarter. MR. NOBLE.
- 154s. PUBLIC UTILITIES. Economic and legal bases of classification. Relative advantages of public ownership and regulation. Central and municipal regulation compared. The basis of rates; relative rates; rates and service. Summary of the theories of valuation. Three credits.
- 167w-168s. INDUSTRIAL RELATIONS. Labor (personnel) policy in business management. Problems and methods as to employment, promotion, training, health, and safety, employees' service, employers' representation, wages, hours, stability of work, and working conditions. Studies of actual business practice, written report. Three credits per quarter. MR. DICKINSON.

## ELECTRICAL ENGINEERING

Professors GEORGE D. SHEPARDSON, FRANK W. SPRINGER; Associate Professor WILLIAM T. RYAN; Assistant Professors CYRIL M. JANSKY, JR., EDWIN R. MARTIN; Instructors JOHN H. KUHLMAN, GEORGE W. SWENSON, MILO E. TODD.

\* All quarters must be completed before credit is given for any quarter.

## COURSES

No.	Title	Credits	Required of	Prerequisite courses
		per qu.		
11f-13w-15s	Elements of Elec. Eng....	3	Soph. E. E.	Reg. in physics
111f-113w-115s	Direct-Current Machinery ..	3	Jr. E. E.	11-13-15
112f-114w-116s	Direct-Current Mach. Lab...	2	Jr. E. E.	Reg. in 111-113-115
121f-123w-125s	Alternating Currents .....	3	Sr. E. E.	115
122f-124w-126s	Alternating-Current Lab...	2	Sr. E. E.	Reg. in 121-123-125
221w-223s-225f	Transients .....	2	Elective	121
132f	Electrical Design .....	2	Sr. E. E.	115
134w-136s	Electrical Design .....	2	Sr. E. E.	121
232f-234w-236s	Advanced Design .....	2	Elective	136
237s	Power Transmission Line Design .....	3	Elective	134-142
40f	Electrical Wiring and Equipment .....	2	Sr. Arch.	Physics
41f	Electric Power .....	3	Sr. Mines	Physics
42w	Electric Power .....	4	Sr. Civil	Physics
43s-44f-45w	Electric Power .....	3	M. E. & Chem.	Physics
143f or w or s	Power-Plant Operation ...	1	Elective	116 or 45
146f or w or s	Batteries and Electric Ve- hicles .....	1	Elective	113 or 45
144w	Railway Elec. Engineering	2	Elective	115 or 42 or 45
145s	Railroad Electrification...	2	Elective	144
141f	Central Stations .....	2	Elective	Reg. in 121
142w	Electrical Transmission ...	2	Elective	141
147f or w or s	Elec. Equip. of Buildings	2	Elective	115 or 41 or 45
151f or w	Electric Lighting .....	2	Elective	111 or 40 or 43
152f or w	Photometric Laboratory...	1-2	Elective	Reg. in 151
251w-253s	Illuminating Engineering..	2	Elective	151
252w-254s	Illuminating Laboratory...	2	Elective	Reg. in 251
61f-63w-65s	Electrical Communication..	3	R.O.T.C. Elec.	
164f	Telegraph and Telephone Apparatus .....	2-3	Elective	65
165w-166s	Telegraph and Telephone Circuits .....	2-3	Elective	Reg. in 123
161f-162w-163s	Radio Communication....	3	R.O.T.C. Elec.	Reg. in 121
167f-168w-169s	Radio Station Operation..	1	Elective	Ar
171w-172s	Undergraduate Thesis ....	3-6	Elective	121
183f-184w-185s	Special Electrical Lab....	2	Elective	116
281w-282s	Advanced A. C. Measure- ments .....	2	Elective	126
284f-285w-286s	Precise Electrical Measure- ments .....	2	Elective	122
271f-272w-273s	Graduate Thesis.....	9-18	Gr.	125
275f-276w-277s	Electrical Eng. Research		Gr.	
91s	Inspection Trip .....	1	Elective	11
191f-192w-193s	Seminar .....	1	Elective	111
291f-292w-293s	Graduate Seminar.....	1	Elective	126
294f-295w-296s	Electrical Ignition.....	2	Elective	124
297s	Electrochem. Eng. ....	2	Elective	116 or 45

11f-13w-15s. ELEMENTS OF ELECTRICAL ENGINEERING. Introduction to the development, principles, materials, safety, and general application of electrical engineering. Class and laboratory. Open to students registered for physics. Three credits per quarter. MR. SHEPARDSON, MR. SWENSON, MR. TODD.

- 111f-113w-115s. DIRECT-CURRENT MACHINERY. Electrical engineering measuring instruments and their use, units, theory of dynamo-electric machinery, methods of regulation, construction and operation of generators and motors, methods of testing. Three credits per quarter. MR. SPRINGER.
- 112f-114w-116s. DIRECT-CURRENT MACHINERY LABORATORY. To be taken with Course 111-113-115. Electrical engineering measurements, calibration of instruments, operation and characteristic curves of generator and motor. Lectures and practice. Two credits per quarter. MR. MARTIN, MR. SWENSON.
- 121f-123w-125s. ALTERNATING CURRENTS. Phenomena, measurement, and use of alternating currents, theory of the transformer, generator, and motor, types of apparatus. Three credits per quarter. MR. RYAN.
- 122f-124w-126s. ALTERNATING-CURRENT LABORATORY. To be taken with Course 121-123-125. Experimental study of alternating currents, regulation and efficiency tests of alternators, transformers, motors, and rotaries. Two credits per quarter. MR. SPRINGER, MR. RYAN.
- 221w. TRANSIENT ELECTRICAL PHENOMENA. Mathematical study of the electric circuit containing resistance, inductance, and capacity. Abnormal currents and voltages upon switching circuits containing iron core inductances. Two credits per quarter. MR. JANSKY.
- 223s. TRANSIENT ELECTRICAL PHENOMENA. Current and voltage distribution in circuits containing distributed resistance, inductance, and capacity. Distortion in telephone lines and its correction. Two credits per quarter. MR. JANSKY.
- 225f. TRANSIENT AND HIGH FREQUENCY PHENOMENA. Transient phenomena in coupled circuits. Distribution of current and flux in conductors at high and low frequencies. Change of resistance with frequency. Theoretical study of special problems. Two credits per quarter. MR. JANSKY.
- 132f-134w-136s. ELECTRICAL DESIGN. The design of direct-current generators and motors, and alternating-current transformers; complete work-drawings and specifications to accompany each design. The design of alternating-current generators and motors and switchboards. Two credits per quarter. MR. KUHLMAN.
- 232f-234w-236s. ELECTRICAL DESIGN. Special problems. Two credits per quarter. MR. KUHLMAN.
- 237s. POWER TRANSMISSION LINE DESIGN. Preparation of detailed plans and specifications for the construction of high-voltage transmission lines and distributing systems. Economic electrical and mechanical principles and calculations. Overhead and underground lines. Transmission line supports. Three credits. MR. RYAN.

- 40f. **ELECTRIC WIRING AND EQUIPMENT.** Elementary principles of direct and alternating current circuits. Interior wiring and electrical equipment of buildings. Elements of calculation of illumination. Some detailed study of plans and specifications. For senior architects. Two credits. MR. TODD.
- 41f. **ELECTRIC POWER.** Elementary principles of continuous currents, generators, and motors. Elementary principles of alternating currents, generators, transformers, and motors. Measurement of power. Elementary principles of transmission and distribution. Lectures, recitations, and laboratory work. For senior students in the School of Mines. Open to seniors in Architecture. Three credits. MR. RYAN, MR. SWENSON.
- 42w. **ELECTRIC POWER.** Similar to Course 41f. For seniors in Civil Engineering. MR. RYAN, MR. SWENSON.
- 43s-44f-45w. **ELECTRIC POWER.** An elementary study of the problems involved in the generation, distribution, measurement, and utilization of electric power. Lectures, recitations, and laboratory work, supplemented by numerous problems. For seniors in Mechanical Engineering and Chemistry. Three credits. MR. MARTIN.
- 141f. **CENTRAL STATIONS.** Electric-power generating stations and distributing systems; load diagrams; selection of prime movers and units; cost of electrical energy; methods of charging; maintenance of plants; emergencies. Two credits. MR. RYAN.
- 142w. **ELECTRICAL TRANSMISSION.** Considerations involved in the designing and building of transmission lines, Kelvin's law and its limitations, the transmission line as a mechanical structure, lightning arresters, study of particular high-tension lines. Two credits. MR. RYAN.
- 143f-w-or s. **POWER-PLANT OPERATION.** Practice in operation and care of gas producer, gas engine, boilers, engines, turbines, dynamos, battery, switchboards, and auxiliary apparatus of the University lighting plant. One credit. MR. RYAN, MR. DIXON.
- 144w. **RAILWAY ELECTRICAL ENGINEERING.** History, development, economics, principles of mechanics applied to electric train movements, motor characteristics, control systems, substations, railway problems, speed-time curves, and time schedules. Lectures and recitations. Two credits. MR. MARTIN.
- 145s. **RAILROAD ELECTRIFICATION.** Reasons for electrification, study of European and American systems, trolley and third-rail construction, variation in locomotive design, performance as compared to steam locomotives, electrical features, results of electrification as to service and economy. Lectures, assignments. Two credits. MR. MARTIN.



- 146f-w-or s. BATTERIES AND ELECTRIC VEHICLES. Theory of the storage battery as used in electric trucks and automobiles; electric automobile equipment; charging devices, such as mercury arc and vibrating rectifiers and special synchronous converters. One credit. MR. RYAN, MR. MARTIN.
- 147w. ELECTRIC EQUIPMENT OF BUILDINGS. Lectures on electrical equipment of modern office and factory buildings. Detailed study of plans and specifications. Inspection and reports on jobs under construction and after completion. Special lectures. Two credits.
- 151f or w. ELECTRIC LIGHTING. Principles of vision, photometers, and measurement of light, methods and calculations of illumination, various sources of light, development of electric illuminants, distribution systems. Lectures and problems. Two credits. MR. SHEPARDSON, MR. MARTIN.
- 152f or w. PHOTOMETRIC LABORATORY. Photometric studies of incandescent and arc electric lamps, gas and oil lamps. Bench and radical photometers and illuminometers. One or two credits as elected. MR. SHEPARDSON, MR. MARTIN.
- 251w-253s. ILLUMINATING ENGINEERING. Performance of electric and gas lamps, reflectors and diffusers, luminous efficiency, distribution, color characteristics, physiological phenomena, methods of determining location, kind, and quantity of light for obtaining desired illumination. Two credits per quarter. MR. SHEPARDSON.
- 252w-254s. ILLUMINATION LABORATORY. Laboratory tests of shades and fixtures. Tests of lighting installations. Two credits per quarter. MR. SHEPARDSON, MR. MARTIN.
- 61f. ELEMENTS OF COMMUNICATION. Telegraph. Importance of communication. Comparison of methods. General theory of telegraph apparatus. Simplex, duplex, and induction telegraphs. Ground telegraphy. Locating grounds. Batteries and battery charging. Lectures with laboratory practice. Two credits. MR. SHEPARDSON, MR. SWENSON.
- 63w-65s. ELEMENTS OF COMMUNICATION. Telephone. Nature of speech sounds. Essential parts of telephone system. General theory and construction of telephone apparatus. Telephone circuits. Cable-testing and splicing. Lecture and laboratory study of commercial and military telephone apparatus. Two credits per quarter. MR. SHEPARDSON, MR. SWENSON.
- 161f. RADIO COMMUNICATION. Phase relations in high-frequency circuits. Mathematical theory of damped wave transmitting and receiving circuits. Inductance and capacity measurements, using damped waves. The electron tube as a detector and amplifier. Signal Corps apparatus. Three credits. MR. JANSKY.

- 162w. RADIO COMMUNICATION. Theory and measurement of logarithmic decrement. Undamped wave transmitting and receiving circuits. Heterodyne reception. The arc, high-frequency generator, and electron tube as sources of high-frequency power. High-frequency measurements, using undamped waves. Three credits. MR. JANSKY.
- 163s. RADIO COMMUNICATION. Mathematical theory of the electron tube and its use in the radio circuit. Design of electron tube oscillator and amplifier circuits. Radio telephony, modulation, carrier frequencies. Direction-finding apparatus and selective circuits for interference elimination. Three credits. MR. JANSKY.
- 164f. TELEGRAPH AND TELEPHONE APPARATUS. Theoretical and experimental study of apparatus used for signaling, telegraphy, and telephony. Lecture and laboratory. Two or three credits as elected. MR. SHEPARDSON, MR. SWENSON.
- 165w-166s. TELEGRAPH AND TELEPHONE CIRCUITS. Theoretical and experimental study of telegraph and telephone circuits and the phenomena of long-line transmission. Applications of hyperbolic functions. Phenomena, loading, repeaters. Inductive disturbances, transpositions. Multiplex telephony. Two or three credits per quarter as elected. MR. SHEPARDSON, MR. SWENSON.
- 167f-168w-169s. RADIO-STATION OPERATION. For men already proficient, licensed, radio operators. Includes maintaining schedule in the radio station and the interpretation of the data obtained on radio communication methods and apparatus. Open only to a limited number by permission. Three credits per quarter. MR. JANSKY.
- 171w-172s. UNDERGRADUATE THESIS. An investigation of some approved problem in electrical engineering. Three to six credits per quarter as elected. MR. SHEPARDSON, MR. SPRINGER, MR. RYAN, MR. JANSKY, MR. MARTIN, MR. SWENSON.
- 183w-184s-185f. SPECIAL ELECTRICAL LABORATORY. Efficiency tests and special problems. Two credits per quarter.
- 186w or s. HIGH-TENSION TESTING. Low-frequency pressure to 320,000 volts, high-frequency to several million volts, applied to study of dielectric phenomena, such as testing high-tension transmission cables, transformer oil, transmission line insulators. Laboratory and library reference course. Two credits. MR. SPRINGER.
- 281w-282s. ADVANCED ALTERNATING CURRENT MEASUREMENTS. Vector treatment of circuit networks. Bridge circuits for the measurement of resistance, inductance, and capacity at audio and radio frequencies. Two credits per quarter. MR. JANSKY.

- 284w-285s-286f. PRECISE ELECTRICAL-ENGINEERING MEASUREMENTS. Lectures and laboratory work. Precise measurements of resistance, voltage, current, self-induction, and capacity; standardization of measuring instruments. MR. SPRINGER.
- 271f-272w-273s. GRADUATE THESIS. An investigation of an approved problem in electrical engineering. The major work of the graduate year will center about the thesis, which should constitute a real contribution to knowledge. Three to six credits per quarter as elected.
- 275f-276w-277s. ENGINEERING RESEARCH. Investigation of special problems in laboratory or library. MR. SHEPARDSON, MR. SPRINGER, MR. RYAN, MR. MARTIN, MR. JANSKY.
- 91S. ENGINEERING INSPECTION TRIP. Personally conducted inspection of factories, power plants, and other places of engineering interest, usually including Milwaukee, Chicago, and Gary. Occupies the Easter recess, costing about \$50 for each person. Open to seniors, juniors, and sophomores. One credit.
- 191f-192w-193s. SEMINAR. Weekly discussion of current electrical periodicals. One credit per quarter. MR. SHEPARDSON.
- 291f-292w-293s. GRADUATE SEMINAR. Continuation of Course 191-192-193. One credit per quarter.
- 294f-295w-296s. ELECTRICAL IGNITION AND AUTOMOBILE ELECTRICAL ACCESSORIES. Oscillographic, rotating mirror, rotating gap, and electrical measurements applied to the study of ignition apparatus; characteristics of automobile accessories, such as generators, starters, controllers, electrical transmitting devices, etc. Laboratory and lectures. Two credits per quarter. MR. SPRINGER.
- 297s. ELECTROCHEMICAL ENGINEERING. Theoretical and experimental study of the engineering problems of electrolytic and electrothermal processes. Two credits. MR. SHEPARDSON.

## EXPERIMENTAL ENGINEERING LABORATORIES

Professor FRANK B. ROWLEY, Director; Assistant Professor BURTON J. ROBERTSON, Assistant Director.

## COURSES

No.	Title	Credits	Required of	Prereq. courses
C.E.51f	Highways & Pavements.....	3	Jr. C. E.	C. E.12
C.E.52w	Highways & Pavements.....	3	Jr. C. E.	C. E.12
C.E.237w				
C.E.238s	Structural Laboratory§.....	3-5		C. E. 133
C.E.243w				
C.E.244s	Cement & Concrete Lab.§....	3-5		C. E. 143

No.	Title	Credits	Required of	Prerequisite courses
C.E.251	Highway Laboratory§.....	3-5		C. E. 51, 52
C.E.261	Water & Sewage Purification§	3-5		C. E. 162
C.E.263s	Hydraulic Laboratory.....	3-5		C. E. 164
M.&M.82w	Strength of Materials with Laboratory .....	3	Jr. Ch. E.	81
M.&M.83s	Hydraulics with Laboratory...	2	Jr. Ch. E.	23
M.&M.141f	Materials Testing Laboratory..	1	Jr.	With M. M. 134
M.&M.143s	Hydraulics Laboratory .....	1	Jr.	With M. M. 136
M.&M.144w	Materials-Testing Laboratory..	4 actual hours	Jr.E.M.&Met.E.	
M.E.81f	Elementary M. E. Laboratory.	2	Jr. M. E.	Reg. 42 or equiv.
M.E.82w	M. E. Laboratory.....	2	Jr. M. E.	M. E. 81
M.E.83s	M. E. Laboratory.....	2	Jr. M. E.	M. E. 82
M.E.84f	Elementary Lab. (General)...	4 actual hours	Jr.E.M.&Met.E.	
M.E.144f	Heat Engines§ .....	3	Sr. E. E.	
M.E.145w	Heat Engines§ .....	3	Sr. E. E.	144
M.E.147w	Heat Engines§ .....	4	Jr. Ch. E.	
M.E.148s	Heat Engines .....	4	Jr. Ch. E.	
M.E.149w	Heat Engines .....	4	Sr. C. E.	
M.E.181w	Advanced Lab. (General)§...	4 actual hours	Sr.E.M.&Met.E.	
M.E.182f	Advanced Steam Lab.§.. ....	2	Sr. M. E.	M. E. 151
M.E.183w	Power & Gas Engine Lab.§...	2	Sr. M. E.	Reg. in 150
M.E.184s	Advanced Engineering Lab.§..	2	Sr. M. E.	M. E. 182, 183
M.E.287f	Engineering Research§ .....	3-9	Elective	
M.E.288w	Engineering Research§ .....	3-9	Elective	
M.E.289s	Engineering Research§ .....	3-9	Elective	

NOTE.—Experimental work relating to various branches of engineering is carried on in the Experimental Engineering Laboratories. The following courses are offered by the departments indicated. Work of a special character, such as advanced research, may be arranged through consultation with the heads of the departments and Professor Rowley.

§ Elective courses.

### GENERAL ENGINEERING COURSES

No.	Title	Credits per qu.	Required of	Prerequisite courses
G.E.11f-				
12w-13s	Orientation .....	1	Freshmen	
G.E.81f,w,s	Estimating .....	3	Jr., sr., elective	Sophomore courses
G.E.101w	Engineering Contracts and Specifications .....	3		Seniors only
G.E.111s	Valuation of Public Utilities	1		Seniors only
G.E.124w	Engineering Relations .....	1		Elec. E. E. 121

11f-12w-13s. A series of general lectures covering all phases of engineering and allied courses. Illustrated by lantern slides and moving pictures. Given by various members of the staff.

81f,w,s. ESTIMATING. Cost estimates of engineering structures including buildings, bridges, culverts, sewage and water-works systems, roads, and pavements. Itemized tabulation of construction units and general methods of arriving at costs of contemplated construction. Open to junior and senior engineers. Three credits. MR. FRENCH.

- 101W. CONTRACTS AND SPECIFICATIONS. A study of engineering specifications. Classes of specifications; essential features; clauses, details. Bids and bidders, engineering contracts. Examples. Lectures, recitations and practice in writing specifications. Three credits. MR. FLATHER.
- 111S. VALUATION OF PUBLIC-UTILITY PROPERTIES. Cost of organizing and securing capital, discounts on bonds, fees; franchise values. Depreciation and obsolescence, deferred maintenance. Public utilities, fair rates and returns regulation of natural monopolies. One credit.
- 124W. ENGINEERING RELATIONS. Lectures, assigned reading, and discussions on the human side of engineering. Relations of the engineer to employer, employees, customers, and public. Engineering code of ethics. Bridging between college and business. Practical training of engineering graduates. One credit. MR. SHEPARDSON and non-resident lecturers.

GEOLOGY AND MINERALOGY

Professor WILLIAM H. EMMONS; Instructor GEORGE M. SCHWARTZ.

COURSES

No.	Title	Credits	Required of	Prerequisite courses
5f	Engineering Geology.....	3	Elective soph. C. E.	None
6w	Applied Geology.....	3	Elective	5f

- 5f. ENGINEERING GEOLOGY. Materials of the earth and geologic processes. Application of geology to engineering problems. Lectures, rock study, and field excursions. Three credits. MR. SCHWARTZ.
- 6w. APPLIED GEOLOGY FOR CIVIL ENGINEERS. Occurrence, properties, production, and uses of building stones, cements, clay, fuels, and road metals. A brief introduction to the study of ore deposits and historical geology. Lectures and reference work. Three credits. MR. SCHWARTZ.

HYGIENE AND FIRST AID

Associate Professor LOUIS J. COOKE.

COURSE

No.	Title	Credits	Required of	Prerequisite courses
1w	Hygiene and First Aid to the Sick and Injured.....	0	Fr.	None

- 1w. HYGIENE AND FIRST AID TO THE SICK AND INJURED. Lectures, demonstrations, and recitations. Promotion of health. Sources, routes, and prevention of communicable diseases. One hour per week during the winter quarter. DR. COOKE.

## MATHEMATICS AND MECHANICS

Professors WILLIAM E. BROOKE, WILLIAM F. HOLMAN; Associate Professor HANS H. DALAKER; Assistant Professors CARL A. HERRICK, RAYMOND R. HERRMANN, WILLIAM M. MCCLINTOCK, GEORGE C. PRIESTER, RODERICK W. SILER, HUGH B. WILCOX; Instructors CHARLES BOEHNLEIN, EDWIN E. CLARK, HENRY E. HARTIG, OSCAR C. LEE, HARLEY G. OVERHOLT, FRANK E. PEACOCK.

## COURSES

No.	Title	Credits per qu.	Required of	Prerequisite courses
9f(su)	H.-S. Higher Algebra (3 hrs.).....	0	Fr. who lack h.-s. credit in it	
10f(su)	Solid Geometry (3 hrs.).....	0	Fr. who lack h.-s. credit in it	
11f,w	Applied Math. and Mech.....	5	Fr.	Higher algebra & solid geometry
12w,s	Applied Math. and Mech.....	5	Fr.	11
13s(su)	Applied Math. and Mech.....	5	Fr.	12
24f,w	Applied Math. and Mech.....	5	Soph.	13
25w,s	Applied Math. and Mech.....	5	Soph.	24
26s(su)	Technical Mechanics .....	5	Soph.	25
131f	Technical Mechanics .....	3	Jr.	23 or 25
132w	Technical Mechanics .....	3	Jr.	131
133s	Technical Mechanics .....	2	Jr.	132
134f	Strength of Materials.....	2	Jr.	With 131
135w	Strength of Materials.....	3	Jr.	134
136s	Hydraulics .....	3	Jr.	132
141f	Materials-Testing Laboratory .....	1	Jr.	With 134
143s	Hydraulics Laboratory.....	1	Jr.	With 136
144w	Materials-Testing Laboratory .....	4 lab. hrs.	Jr.E.M.& Met.E.	
81f	Technical Mechanics .....	4	Jr. Chem.	23
82w	Strength of Materials (with Lab.).	3	Jr. Chem.	81
83s	Hydraulics (with Laboratory).....	2	Jr. Chem.	81
91f	Calculus for Architects.....	4	Soph. Arch.	13
92w	Mechanics for Architects.....	4	Soph. Arch.	91
93s	Strength of Materials for Archi- tects .....	4	Soph. Arch.	92
151f	Differential Equations .....	3	Elective	23
152w	Advanced Calculus .....	3	Elective	151
153s	Advanced Calculus .....	3	Elective	152
154f	Modern Analysis .....	3	Elective	153
155w	Modern Analysis .....	3	Elective	154
156s	Modern Analysis .....	3	Elective	155
161f	Advanced Technical Mechanics... 3	3	Elective	133
162w	Advanced Technical Mechanics... 3	3	Elective	161
163s	Advanced Technical Mechanics... 3	3	Elective	162
164f	Advanced Dynamics .....	3	Elective	153
165w	Advanced Dynamics .....	3	Elective	164
166s	Advanced Dynamics .....	3	Elective	165
171f	Math. Theory of Elasticity.....	3	Elective	135
172w	Math. Theory of Elasticity.....	3	Elective	171
173s	Math. Theory of Elasticity.....	3	Elective	172
146f	Materials of Engineering.....	3	Elective	134
147w	Materials of Engineering.....	3	Elective	134
148s	Materials of Engineering.....	3	Elective	134

- 9f(su). HIGHER ALGEBRA (High School). Fundamental rules, fractions, linear simultaneous equations, graphs, theory of exponents, surds, complex quantities, quadratic equations, numerical exercises, slide rule. Without credit. MR. McCLINTOCK, MR. WILCOX, MR. BOEHNLEIN, MR. CLARK, MR. HARTIG, MR. LEE, MR. OVERHOLT, MR. PEACOCK.
- 10f(su). SOLID GEOMETRY. See Course 10f under Department of Drawing and Descriptive Geometry.
- 11f,w. APPLIED MATHEMATICS AND MECHANICS. Theory of quadratic equations, interpretation of complex results, graphical representation, indeterminate equations, ratio, proportion, variation, progressions, series, undetermined coefficients, binomial theorem, logarithms, theory of equations, derivatives, Horner's method. Five credits. MR. McCLINTOCK, MR. WILCOX, MR. BOEHNLEIN, MR. CLARK, MR. HARTIG, MR. LEE, MR. OVERHOLT, MR. PEACOCK.
- 12w s. APPLIED MATHEMATICS AND MECHANICS. Trigonometry. Five credits. MR. McCLINTOCK, MR. WILCOX, MR. BOEHNLEIN, MR. CLARK, MR. HARTIG, MR. LEE, MR. OVERHOLT, MR. PEACOCK.
- 13s(su). APPLIED MATHEMATICS AND MECHANICS. Analytic geometry. Five credits. MR. McCLINTOCK, MR. WILCOX, MR. BOEHNLEIN, MR. CLARK, MR. HARTIG, MR. LEE, MR. OVERHOLT, MR. PEACOCK.
- 24f,w. APPLIED MATHEMATICS AND MECHANICS. Calculus and applied mechanics. Five credits. MR. McCLINTOCK, MR. SILER, MR. BOEHNLEIN, MR. CLARK, MR. HERRMANN.
- 25w,s. APPLIED MATHEMATICS AND MECHANICS. Calculus and applied mechanics. Five credits. MR. McCLINTOCK, MR. SILER, MR. BOEHNLEIN, MR. CLARK, MR. HERRMANN.
- 26s(su). TECHNICAL MECHANICS. Five credits. MR. McCLINTOCK, MR. SILER, MR. BOEHNLEIN, MR. CLARK, MR. HERRMANN.
- 131f. TECHNICAL MECHANICS. Statics. Resolution of forces, moments, conditions of equilibrium, free-body method, catenary. Three credits. MR. DALAKER, MR. HERRICK, MR. HERRMANN, MR. PRIESTER, MR. WILCOX.
- 132w. TECHNICAL MECHANICS. Center of gravity, moment of inertia, stresses in framed structures and machines, dynamics of a particle, Newton's laws of motion, kinematics of circular, harmonic, and curvilinear motion in general. Three credits. MR. DALAKER, MR. HERRICK, MR. HERRMANN, MR. PRIESTER, MR. WILCOX.
- 133s. TECHNICAL MECHANICS. Theorems of work and energy, impulse and momentum, d'Alembert's principle. Elementary dynamics of rigid bodies. Two credits. MR. DALAKER, MR. HERRICK, MR. HERRMANN, MR. PRIESTER, MR. WILCOX.

- 134f. STRENGTH OF MATERIALS. Mechanical and elastic properties of materials of construction, beams, shafts, columns. Two credits. MR. BROOKE, MR. HOLMAN, MR. HERRICK, MR. PRIESTER, MR. WILCOX.
- 135w. STRENGTH OF MATERIALS. Continuation of 134. Combined stresses, dynamic stresses, hollow cylinders and spheres, rollers, plates, curved bars, springs, true stresses, theory of internal stress. Three credits. MR. BROOKE, MR. HOLMAN, MR. HERRICK, MR. PRIESTER, MR. WILCOX.
- 136s. HYDRAULICS. Laws of equilibrium of fluids, flow through orifices and over weirs, pressure and flow through tubes and pipes, flow in conduits and rivers, dynamic pressure of water, elementary principles of turbines and pumps. Three credits. MR. BROOKE, MR. HOLMAN, MR. HERRICK, MR. PRIESTER, MR. WILCOX.
- 141f. MATERIALS-TESTING LABORATORY. Investigation of the physical properties of various metals and engineering materials (wood, cement, ropes, etc.). Standard methods of testing. One credit. MR. BROOKE, MR. HOLMAN, MR. HERRICK, MR. PRIESTER, MR. WILCOX.
- 143s. HYDRAULICS LABORATORY. Experimental and demonstrational work. Pressure head, Piezometer tubes, gages, stability of flotation, Bernoulli's theorem. Venturi meter, flow through orifices, over weirs, and through pipes. Open channels, gaging, impact on vanes, pumps, and hydraulic machines. One credit. MR. BROOKE, MR. HOLMAN, MR. HERRICK, MR. PRIESTER, MR. WILCOX.
- 146f. MATERIALS OF ENGINEERING. Appliances for testing materials of construction. Mechanical tests, their use and significance. Definition, classification, manufacture and application of plasters, limes, cements, concrete, building stones, bricks, tile, terra cotta, rubber, and leather. Three credits. MR. PRIESTER.
- 147w. MATERIALS OF ENGINEERING. Origin, manufacture, properties, treatment, and use of iron and steel and their special alloys. Uses and limitations of special alloy steels in engineering practice—special tests of steel. Three credits. MR. PRIESTER.
- 148s. MATERIALS OF ENGINEERING. Origin, manufacture, properties, treatment, and use of copper, zinc, lead, tin, aluminum, nickel, brasses, bronzes, and bearing metals. Growth and structural characteristics of trees. Physical and mechanical properties of wood. Seasoning and preservation of timber. Three credits. MR. PRIESTER.
- 151f. DIFFERENTIAL EQUATIONS. Differential equations and their solutions. First order and first degree, first order and higher degree, singular solutions, total differential equation, linear differential equations, miscellaneous methods, system of simultaneous equations, integration in series. Partial differential equations. Three credits. MR. BROOKE, MR. DALAKER.



- 152w-153s. ADVANCED CALCULUS AND APPLICATIONS. Text, Wilson's *Advanced Calculus*. Three credits per quarter. MR. BROOKE, MR. DALAKER.
- 154f-155w-156s. MODERN ANALYSIS. Based on Whittaker & Watson's text. Three credits per quarter. MR. DALAKER.
- 161f-162w-163s. ADVANCED TECHNICAL MECHANICS. Special problems in the dynamics of machinery; vibration, balancing, whirling shafts, rapidly rotating disks, dynamical stability, gyroscope. Three credits per quarter. MR. BROOKE.
- 164f-165w-166s. ADVANCED DYNAMICS. Text, Routh's *Rigid Dynamics*. Three credits per quarter. MR. BROOKE.
- 171f-172w-173. MATHEMATICAL THEORY OF ELASTICITY. Three credits per quarter.
- 81f. TECHNICAL MECHANICS. (Course for Chemical Engineers.) Statics, resolution of forces, conditions of equilibrium, center of gravity, moment of inertia of plane sections, stresses in framed structures and machines, dynamics of a particle, Newton's laws of motion, kinematics of circular, harmonic and curvilinear motion in general. Four credits. MR. HERRICK.
- 82w. STRENGTH OF MATERIALS. (Course for Chemical Engineers.) Mechanical and elastic properties of materials of construction, beams, shafts, columns, combined stresses, dynamic stresses, hollow cylinder and spheres, rollers, plates, curved bars, springs, true stresses, theory of internal stress. Three credits. MR. HERRICK.
- 83s. HYDRAULICS WITH LABORATORY. (Short course for Chemical Engineers.) One credit. MR. HERRICK.
- 91f. CALCULUS. (Course in Architecture.) A short course. Derivatives, maxima and minima, integration of simple forms, definite integrals, areas. Four credits. MR. HOLMAN, MR. DALAKER.
- 92w. MECHANICS. (Course in Architecture.) Statics, resolution of forces, conditions of equilibrium, center of gravity, moment of inertia of plane sections, stresses in framed structures. Four credits. MR. HOLMAN, MR. DALAKER.
- 93s. STRENGTH OF MATERIALS. (Course in Architecture.) Mechanical and elastic properties of materials of construction, design of riveted joints, beam theory, columns, arches. Four credits. MR. DALAKER, MR. HOLMAN.
- 144w. MATERIAL-TESTING LABORATORY. Investigation of the physical properties of metals and engineering materials; wood, cement, ropes, etc., supplemented by lectures and materials of construction and methods of testing. (Mining and Metallurgical Engineers.) Four laboratory hours. MR. WILCOX.

## MECHANICAL ENGINEERING

Professors JOHN J. FLATHER; FRANK B. ROWLEY, S. CARL SHIPLEY;\* Associate Professors JOHN V. MARTENIS, CHARLES F. SHOOP; Assistant Professor BURTON J. ROBERTSON; Professorial Lecturer JOHN H. ROWEN; Instructors VICTOR GAUVREAU, JOHN H. MOFFETT, JOSEPH W. NILSON, EDWARD P. QUIGLEY, PAUL W. REAME, WILLIAM H. RICHARDS, GEORGE L. TUVE; Assistants HARRY MARTINSON, CARL PETERSON, FRED TEAL, JOHN A. WIDING.

## COURSES

No.	Title	Credits	Required of	Prerequisite courses
	Elementary Shop Practice.....	2	Fr. Engrs.	
111f,w,s	Wood Working .....	}	Each course is repeated every quarter	
121f,w,s	Foundry .....			
131f,w,s	Forge .....			
141f,su-				
15w,su	Machine Shop Practice.....	4	Soph. M. E.	
16s	Machine Shop .....	2	Soph. E. E.	
110f,w,s	Tool Design .....	3	Elective	
111f,w,s,su	Tool Construction .....	3	Elective	
21s	Mechanical Technology .....	1	Soph. M. E.	
181f,w,s	Industrial Education .....	3	College of Educ.	
223f	Industrial Management .....	3	Elective	15 and sr.
224w	Industrial Management Lab...	3	Elective	
225s	Industrial Management Prob-	3	Elective	
	lems .....			
226w	Safety Engineering .....	2	Elective	
31s	Elementary Machine Design...	2	Soph. M. E.	Draw. 7
32f	Mechanism .....	4	Jr. M. E.	31
33w	Mechanism and Kinematics...	3	Jr. E. E.	Draw. 7
34w	Kinematics and Machine De-	4	Jr. M. E.	32
	sign .....			
35s	Machine Design .....	3	Jr. M. E.	34
37s	Machine Design .....	3-4	Jr. E. E.	33
131f-132w-				
133s	Advanced Engineering Design..	3	Sr. M. E.	
135f,w,s	Steam-Engine Design .....	3	Sr. M. E. option	42 or equiv.
136w,s	Gas-Engine Design .....	3	Sr. M. E. option	150
237s	Gas-Tractor Design .....	3	Sr. M. E. option	236
41s	Automotives .....	2	Soph. M. E.	
42f	Steam Engines .....	3	Jr. M. E.	Soph. math.
43w	Steam Engines and Boilers....	3	Jr. M. E.	42
144f-145w-				
146s	Heat Engines .....	3	Sr. E. E.	
147w	Heat Engines .....	4	Jr. Ch. E.	
148s	Heat Engines .....	3	Jr. Ch. E.	
149w	Heat Engines .....	4	Jr. C. E.	
150w	Gas Engines and Producers...	3	Sr. M. E.	41 and 43
151f	Thermodynamics .....	3	Sr. M. E.	Jr. math.
152w	Steam Turbines .....	3	Sr. M. E. option	152
153s	Heating and Ventilation.....	4	Sr. M. E. option	

\* Absent on leave.

<sup>1</sup> These courses are open to pre-dental students in the College of Science, Literature, and the Arts.

DESCRIPTION OF COURSES

No.	Title	Credits	Required of	Prerequisite courses
154s	Heating and Ventilation (Arch.) .....	3	Sr. Arch.	
255f,w,s	Advanced Heating and Ventilation .....	3	Elective	153
256s	Comp. Air and Refrig. Mach... ..	3	Sr. M. E. option	151
257w	Mech. Equip. of Buildings.... ..	3	Elective	
61s	Measurement of Power..... ..	2	Jr. M. E.	Reg. in M. & M. 133
262f	Power Engineering .....	3		43 or equiv.
263f-264w- 265s	Power-Plant Management .....	3	Elective	43 or equiv.
266w-267s	Power-Plant Design .....	3	Elective	43 or equiv.
271f	Railway Technology .....	1	Elective	
272f-273w- 274s	Railway Design and Locomotive Construction .....	4	Elective	
278s	Locomotive Road Tests..... ..	3	Elective	
81f-82w-83s	M. E. Laboratory..... ..	2	Jr. M. E.	Reg. 42 or equiv.
84f	Elementary Lab. (Gen.)..... ..	4 hrs.	Jr. E. M. & Met. E.	
181w	Advanced Laboratory (Gen.).. ..	4 hrs.	Sr. E. M. & Met. E.	
182f	Advanced Steam Laboratory... ..	2	Sr. M. E.	151
183w	Power- and Gas-Engine Lab.... ..	2	Sr. M. E.	Reg. in 150
184s	Advanced Engineering Lab.... ..	2	Sr. M. E.	182, 183
287f-288w- 289s	Engineering Research .....	9-3	Elective	
193s	Engineering Practice .....	2	Sr. M. E.	
90f-91w-92s	Seminar .....	1	Jr. M. E. option	
190f-191w- 192s	Seminar .....	1	Sr. M. E.	
290f-291w- 292s	Seminar .....	1	Elective	
293f,w,s	Aeronautical Engineering..... ..	3	Elective	
294f,w,s	Aeroplane Design .....	3	Elective	
296f,w,s	Thesis .....		Elective	287

SHOP PRACTICE AND INDUSTRIAL ENGINEERING

Course 11f,w,s. ELEMENTARY SHOP PRACTICE. Wood working and pattern making. Two credits. MR. MARTENIS, MR. RICHARDS.

Course 12f,w,s. ELEMENTARY SHOP PRACTICE. Floor and machine molding. Iron and brass casting. Two credits. MR. MARTENIS, MR. MOFFETT.

Course 13f,w,s. ELEMENTARY SHOP PRACTICE. Forging and tempering. Two credits. MR. MARTENIS, MR. QUIGLEY.

14f,su. MACHINE SHOP PRACTICE. Machine operations. Manufacturing methods. Also heat treatment of steel, autogenous welding, welding and brazing. Shop practice, lectures, and recitations. Four credits. MR. MARTENIS, MR. NILSON, MR. QUIGLEY, MR. RHAME.

15w,s. MACHINE SHOP PRACTICE. Continuation of Course 14. Also heat treatment of steel, autogenous welding, welding and brazing. Four credits.

- 16s. MACHINE SHOP PRACTICE. Course 14 condensed for students in electrical engineering. Two credits.
- 110f,w,s. TOOL DESIGN. Design of tools for manufacturing interchangeable parts; jigs and milling fixtures. Three credits. MR. RHAME.
- 111f,w,s. TOOL CONSTRUCTION. Construction of tools, jigs, and fixtures for manufacturing interchangeable parts. Three credits. MR. NILSON, MR. RHAME.
- 21s. MECHANICAL TECHNOLOGY. Study of mechanical processes involved in various manufacturing industries and in the development and utilization of power. Lectures by various specialists. One credit.
- 18f,w,s. INDUSTRIAL EDUCATION. Special course in shop work including sloyd. For teachers in College of Education. Three credits. MR. RICHARDS.
- 223f. INDUSTRIAL MANAGEMENT. Shop and factory organization and management; cost and wage systems. Depreciation of equipment. Machine burden. Time studies. Three credits. MR. FLATHER.
- 224w. INDUSTRIAL MANAGEMENT LABORATORY. An advanced course in shop practice with especial reference to production. Time studies; stores and follow-up systems. Investigations in local factories. Lectures, assigned reading, practice, and reports. Three credits. MR. FLATHER, MR. RHAME.
- 225s. INDUSTRIAL MANAGEMENT PROBLEMS. Special investigations of practical problems and suggested methods of procedure. Lectures, assigned reading, and reports. Three credits. MR. FLATHER.
- 226w. SAFETY ENGINEERING. A study of the methods employed to promote safety in the factory; fire hazards, fire protection; automatic sprinkler apparatus; workmen's compensation laws. Two credits.

## MACHINE DESIGN

- 31s. ELEMENTARY MACHINE DESIGN. Empirical proportion and design of machine parts; tracings; working drawings from sketches; drawing-room systems and conventional methods. Taken in conjunction with the work in engineering design. Two credits. MR. RHAME.
- 32f. MECHANISM. Transmission of motion. Levers, gearing, linkwork, belts, screws, epicyclic trains, parallel motions, quick-return movements. Graphical determination of paths, speeds, accelerations of important mechanisms; centroids, analysis of mechanisms; cams; kinematic pairs, machine parts. Four credits. MR. MARTENIS, MR. GAUVREAU.
- 33w. MECHANISM AND KINEMATICS. The transmission of motion without consideration of the strength of parts. Levers, gearing linkwork, kinematic pairs; machine parts; construction of tooth profiles. Paths and

velocities of mechanisms. A short course arranged for electrical engineers. Three credits. MR. MARTENIS, MR. GAUVREAU.

- 34w. KINEMATICS AND MACHINE DESIGN. Construction of tooth profiles, roulettes; study of gearing. Calculation and design of machine parts; riveted and screwed joints; rotating pieces, bearings. Gearing; spur, bevel and spiral. Four credits. MR. MARTENIS, MR. GAUVREAU.
- 35s. MACHINE DESIGN. Calculation and design of pulleys, fly-wheels, belt- and rope-driving; study and design of valves, D-slide, piston, double ported, riding cut-off, Corliss; Stephenson link, Walschaert gear. Three credits. MR. MARTENIS, MR. GAUVREAU, MR. RHAME.
- 37s. MACHINE DESIGN. Calculation and design of such machine parts as fastenings, bearings, rotating pieces, pulleys and belting, spur gearing, bevel gears, spiral gears, and rope-driving. Recitations, lectures, drawing-room practice. Arranged for students in electrical engineering. Three or four credits. MR. MARTENIS, MR. GAUVREAU, MR. RHAME.

#### ENGINEERING DESIGN

- 131f-132w-133s. ADVANCED ENGINEERING DESIGN. Original design, including machinery for changing size and form, cranes, pumping, transmission machinery, and engineering appliances. Lectures, problems, and drawing-room practice. Three credits. MR. FLATHER, MR. ROWEN.
- 135f,w,s. STEAM-ENGINE DESIGN. Calculations and working drawings for a high-speed automatic or Corliss steam engine. Theoretical diagrams, inertia forces; determination of details. Three credits. MR. FLATHER.
- 136w,s. GAS-ENGINE DESIGN. Calculations and working drawings of a gas motor for heavy duty tractor, truck, marine, or other service. Theoretical diagrams and details of parts. Three credits. MR. ROWLEY, MR. ROBERTSON, MR. GAUVREAU.
- 237s. GAS-TRACTOR DESIGN. Selection of wheel sizes; horsepower weight and drawbar pull. Bearing pressures; ratios and strength of gearing. Details of principal parts. Three credits. MR. ROWLEY, MR. GAUVREAU.

#### HEAT ENGINEERING

- 41s. AUTOMOTIVES. A study of mechanical problems involved in automobiles, trucks, and tractors, starting and ignition devices, carburetors, lubrication, cooling, and transmissions. Two credits. MR. RHAME.
- 42f. STEAM ENGINES. The steam engine, including elementary thermodynamics. Types and details. Mechanics of the steam engine, steam distribution, reciprocating parts, indicator cards. Valve gears, Zeuner diagram; governors. Compound engines. Elementary study of steam turbines. Taken in connection with Course 81. Three credits. MR. FLATHER, MR. ROWEN, MR. SHOOP.

- 43W. STEAM ENGINES AND BOILERS. Continuation of the preceding course, together with an elementary study of condensers and air pumps, also steam boilers and stokers. Smoke prevention. To be taken in connection with 82. Three credits. MR. FLATHER, MR. ROWEN, MR. SHOOP.
- 144f. HEAT ENGINES. Elementary thermodynamics. Properties of steam; types and details of steam engines; valve gears; governors; compound engines. Condensers and air pumps. Three credits with three hours of laboratory per week. MR. FOWLEY, MR. SHOOP, MR. TUVE.
- 145W. HEAT ENGINES. Continuation of Course 144. Combustion and fuels; boilers, smoke prevention. Selection of engines and boilers. Three credits with three hours laboratory per week. MR. ROWLEY, MR. SHOOP, MR. TUVE.
- 146s. HEAT ENGINES. Elementary study of steam turbines and gas engines. Courses 144, 145, 146 are arranged for students in electrical engineering and are accompanied by three hours' work in laboratory each week. Three credits. MR. ROWLEY, MR. SHOOP, MR. TUVE.
- 147W. HEAT ENGINES. Elementary thermodynamics. Properties of steam; calorimeters; pyrometry; types and details of steam engines; valve gears; governors; compound engines. Condensers and pumps. Combustion, and fuels; evaporation; steam boilers, smoke prevention. Includes four hours work in laboratory per week. Four credits. MR. SHOOP, MR. TUVE.
- 148s. HEAT ENGINES. Elementary study of steam turbines and gas engines; gas producers. Refrigeration. Air compressors. Includes four hours' work in laboratory per week. Three credits. MR. SHOOP, MR. TUVE.
- 149W. HEAT ENGINES. A brief course for students in civil engineering accompanied by four hours' laboratory per week. Four credits. MR. SHOOP, MR. TUVE.
- 150W. GAS ENGINES AND PRODUCERS. Laws of gases; gas cycles. Otto, semi-Diesel, and Diesel engines. Mechanism of various types. Carburetion, governing, cooling, lubrication. Principles of design. Gas producers; types, suction, pressure, blast furnace. By-products recovery. Three credits. MR. ROWLEY.
- 151f. THERMODYNAMICS. The mechanical theory of heat as applied to steam oil, gas, and hot-air engines and allied power-plant machinery and accessory equipment, including compressors, injectors, reheaters, and refrigerating apparatus. Three credits. MR. SHOOP.
- 152W. STEAM TURBINES. Theory and practice applied to various types. Thermodynamics and mechanical analysis of problems involved in the design of nozzles, blades, rotors, bearings, and governors. Condition of operation; systems of transmission; lubrication; economy; field of service. Laboratory investigation. Three credits. MR. SHOOP.

- 153s. HEATING AND VENTILATING. Principles of heating and ventilation. Construction and operation of heating apparatus. Furnaces, steam, hot-water, vapor, vacuum, and fan systems of heating; ventilation. Lectures, recitations, and designs. Four credits. MR. MARTENIS.
- 154s. HEATING AND VENTILATING. Same as Course 153 with the omission of design problems. Arranged for students in architecture. Three credits. MR. MARTENIS.
- 255f,w,s. ADVANCED HEATING AND VENTILATING. An advanced course for graduates. To be taken in connection with research work in the laboratory, Course 287. Three credits. MR. ROWLEY.
- 156s. COMPRESSED AIR AND REFRIGERATOR MACHINERY. (a) Air compressors and motors; power transmission by compressed air. (b) Principles of refrigeration. Various types of refrigerating machines, refrigerants, applications to ice-making, cold storage, cooling of air, liquids, and solids. Lectures and recitations. Three credits. MR. ROWEN.
- 257w. MECHANICAL EQUIPMENT OF BUILDINGS. Appliances used; heating, ventilating, plumbing systems; piping for fire protection, compressed air, gas, and vacuum cleaning; elevators. Choice of systems. Theory and practice of designing and detailing lay-outs. Equipment designs for various types of buildings. Three credits. MR. ROWLEY, MR. MARTENIS.

## POWER ENGINEERING

- 61s. MEASUREMENT OF POWER. Methods employed in measuring power. Dynamometers, friction brakes, railway dynamometer cars, ship dynamometers, power required to drive machine tools and shafting, selection of motors, calculation of circuits. Lectures, recitations, and drawing-room work. To be taken in conjunction with 83. Two credits. MR. FLATHER.
- 162f. POWER ENGINEERING. Advanced study and application of engines, stokers, boilers; coal-handling equipment and accessories. Lay-out of manufacturing shops. Routine of work, transmission systems and selection of motors, factory lighting and heating. Lectures, recitations, drawing-room work. Three credits. MR. ROWEN.
- 163f-164w-165s. POWER-PLANT MANAGEMENT. Operation and maintenance of boilers, engines, gas producers, gas engines, steam turbines, and accessory apparatus. Smoke prevention. Flue-gas analysis. Daily logs and power costs. Three credits per quarter. MR. ROWEN.
- 266w-267s. POWER-PLANT DESIGN. Problems, designs, and estimates for power plants and central stations. Selection of motive powers, relative advantages of steam and producer-gas plants, choice of engines and boilers; pumps, shafting, piping, and accessories. Three credits per quarter. MR. ROWEN.

## RAILWAY MECHANICAL ENGINEERING

- 271f. RAILWAY TECHNOLOGY. The practical details of construction of locomotives. A systematic course of visits to the various railroad shops in the vicinity. Lectures and recitations. One credit.
- 272f-273w-274s. RAILWAY DESIGN AND LOCOMOTIVE CONSTRUCTION. Locomotive and car details; the locomotive boiler, linkages, and assembled parts. Construction of locomotives: frames, springs, equalizing arrangements, running gear, brakes, trucks, lubrication. Engine details; heat insulation, cylinder proportions. Lectures and assigned reading. Four credits.
- 278s. LOCOMOTIVE ROAD TESTS. Tests on locomotives and trains. Dynamometer car and drawbar pull. Three credits. MR. FLATHER and assistants.

## MECHANICAL ENGINEERING LABORATORY

- 81f. ELEMENTARY MECHANICAL LABORATORY. Calibration of gages, Pitot tubes, indicator springs. Study of steam calorimeters, indicator cards, valve-setting. Tests of hoists and gears; power pumps and mechanical appliances; viscosity and specific gravity of oils. Two credits. MR. SHOOP, MR. ROWEN, MR. TUVE.
- 82w. STEAM LABORATORY. Tests of steam engines, injectors, ejectors, steam separators, steam and power pumps, boilers. Two credits. MR. SHOOP, MR. ROWEN, MR. TUVE.
- 83s. ELEMENTARY POWER LABORATORY. Calibration of dynamometers, measurement of power required to drive machinery; calibration of water meters, Venturi and Pitot tubes. Two credits. MR. ROWLEY, MR. ROBERTSON.
- 84f. ELEMENTARY GENERAL LABORATORY. Calibration of thermometers, gages, weirs, nozzle orifices, and meters. Efficiency of machines, friction of belting, friction tests; burning point, chill point, viscosity and specific gravity of oils. Tests of water motor, rams, and pulsometers. Four actual hours. MR. SHOOP, MR. TUVE.
- 181w. ADVANCED GENERAL LABORATORY. Indicator practice, valve-setting, separating and throttling calorimeters, tests of steam engines, gas engines, pumps, air compressors, blowers, turbines, boilers, and power plant. Four actual hours. MR. ROWLEY, MR. SHOOP, MR. TUVE.
- 182f. ADVANCED STEAM LABORATORY. Tests of steam turbines, flow of steam through nozzles and pipes. Tests of compound and triple expansion engines, condensers, superheaters, and boilers. Two credits. MR. SHOOP, MR. TUVE.
- 183w. POWER- AND GAS-ENGINE LABORATORY. Tests of gas, gasoline, and hot-air engines, gas producers. Power and lighting plants. Two credits. MR. ROWLEY, MR. ROBERTSON, MR. RHAME.



- 184s. ADVANCED ENGINEERING LABORATORY. Opportunity will be offered for carrying on investigations in connection with tests of power plants, refrigerators, air compressors, blowers, and fans. Also automobile-testing and gas-engine investigations. Two credits. MR. ROWLEY, MR. RHAME, MR. SHOOP, MR. TUVE.
- 287f-288w-289s. ENGINEERING RESEARCH. Courses may be elected which involve investigations in connection with fuels, lubricating oils, steam and gas engines, heating and ventilating, and other problems as selected. Reports, special problems, and related tests. Three to nine credits. MR. FLATHER, MR. ROWLEY, MR. SHOOP, MR. ROWEN.

GENERAL MECHANICAL ENGINEERING COURSES

- 193s. ENGINEERING PRACTICE. Engineering relations, legal and ethical, collaboration and consultation; technical reports, investigation and estimates. Professional employment, ownership of plans; patents and rights of invention. Day labor and contract systems of construction; public and private works, arbitration. Two credits. MR. FLATHER.
- CONTRACTS AND SPECIFICATIONS. See General Engineering courses 101.
- 90f-91w-92s. SEMINAR. Reading of assigned articles in current technical press. Preparation of synopsis and presentation of principal features. Arranged for juniors. One credit. MR. MARTENIS, MR. ROWEN.
- 190f-191w-192s. SEMINAR. Same as Course 93. Arranged for seniors. One credit per quarter. MR. MARTENIS, MR. ROWEN.
- 290f-291w-292s. SEMINAR. Same as Course 93. Arranged for post-seniors. One credit per quarter. MR. FLATHER, MR. ROWLEY.
- 293f,w,s. AERONAUTICAL ENGINEERING. Design of aerial propellers, aeroplane engines. Application of theory of propellers and gasoline engines to aeroplanes. Includes calculations and drawings for high-speed multi-cylinder light-weight engine; balancing reciprocating parts; uniform torque; theoretical diagrams. Three credits. MR. GAUVREAU.
- 294f,w,s. AEROPLANE DESIGN. Calculations and drawings for a given aeroplane; stability, strength, propulsion, and motive power required. Three credits. MR. GAUVREAU.
- 296f,w,s. THESIS. A thesis will be required of all post-seniors preliminary to graduation. This thesis must be chosen in consultation with the department and may consist of problems in design or research. Three credits.

METALLURGY

Professors WILLIAM R. APPLEBY, PETER CHRISTIANSON, LEVI B. PEASE;  
Associate Professor OSCAR E. HARDER; Instructor RALPH L. DOWDELL.

COURSES

No.	Title	Lec. hrs.	Lab. hrs.	Prereq. courses
22f-23w	Metallurgy .....	3	....	Elective Chem. 8

22f. METALLURGY. A short course in metallurgy of base metals, special consideration being given to mechanical features. Three credits. MR. CHRISTIANSON, MR. PEASE,

23w. METALLURGY. A short course in metallurgy of base metals, special consideration being given to electrical features. Three credits. MR. CHRISTIANSON, MR. PEASE.

METALLURGY

Professor WILLIAM R. APPLEBY; Associate Professor OSCAR E. HARDER; Instructor RALPH L. DOWDELL.

COURSES

No.	Title	Credits	Required of	Prerequisite courses
150w	Metallography .....	3	Jr. & sr. E. E.	
151s	Adv. Metallog. ....	3	Jr. & sr. E. E.	150
156w	Metallography .....	3	Sr. M. E.	
157s	Adv. Metallog. ....	3	Sr. M. E.	156
163f-164w- 165s	Advanced Metallography .....	To be ar.	Elective	151, 157 or equiv.
201f-202w- 203s	Adv. Metallog. for Graduate Students .....	To be ar.	Elective	

150w. METALLOGRAPHY FOR ELECTRICAL ENGINEERS. Principles of metallography, including pyrometry, thermal analysis, constitution diagrams, microscopic and photomicrographic technic; study of typical alloys with special reference to electrical resistance, conductivity, magnets, etc. Laboratory work and demonstrations. Three credits. MR. HARDER, MR. DOWDELL.

151s. ADVANCED METALLOGRAPHY FOR ELECTRICAL ENGINEERS. Continuation of 150. Study of iron and steel, alloy steels, metals and alloys used in electrical engineering practice. Special problems for outside reading and for research. Laboratory work. Three credits. MR. HARDER, MR. DOWDELL.

156w. METALLOGRAPHY FOR MECHANICAL ENGINEERS. Principles of metallography, including pyrometry, thermal analysis, constitution diagrams, microscopic and photomicrographic technic; metallography and heat treatment of iron and steel. Laboratory work. Three credits. MR. HARDER, MR. DOWDELL.

157s. ADVANCED METALLOGRAPHY FOR MECHANICAL ENGINEERS. Continuation of 156. Metallography of alloy steels, tool steels, high-speed tool steels, and important non-ferrous alloys; metallography applied to engineering practice and specifications. Outside reading and special reports. Laboratory work. Three credits. MR. HARDER, MR. DOWDELL.

163f-164w-165s. ADVANCED METALLOGRAPHY. Technical and scientific research. The study of steel rails, automobile and locomotive parts, tool steels, etc. Special problems in metallography with outside reading. Seminar work on the recent advance in metallography. MR. HARDER.

201f-202w-203s. ADVANCED METALLOGRAPHY FOR GRADUATE STUDENTS. Intended primarily for research work. MR. HARDER.

### MILITARY SCIENCE

Professor GIRARD STURTEVANT, Colonel, Infantry, Chairman; Assistant Professors BEN W. FEILD, Major, Infantry; LAURENCE T. WALKER, Major, Coast Artillery Corps; LEE R. WATROUS, JR., Major, Coast Artillery Corps; EDWARD G. SHERBURNE, Major, Infantry; JAMES T. WATSON, JR., Captain, Signal Corps; EDGAR B. MOOMAU, 1st Lieutenant, Infantry; HAL M. ROSE, 1st Lieutenant, Cavalry; Instructors: ALFRED BRANDT, Master Sergeant, Infantry; HARRY E. STRIDER, Master Sergeant, Signal Corps; JOSEPH HAVLICEK, Regimental Commissary Sergeant, Retired; JOSEPH LEES, 1st Sergeant, Retired; JOHN McWILLIAMS, 1st Sergeant, Retired; WILLIAM R. FINKE, 1st Sergeant, Coast Artillery Corps; HENRY DAHL, 1st Sergeant, Retired; WILLIAM L. HOGAN, 1st Sergeant, Coast Artillery Corps; AUBREY R. DUNKUM, 1st Sergeant, Coast Artillery Corps; KENNA B. CALDWELL, Sergeant, Coast Artillery Corps; HENRY W. BROWN, Sergeant, Coast Artillery Corps; CLARENCE G. LANGE, Sergeant, Field Artillery; EDMUND T. McCANN, Sergeant, Infantry; FRED LILLIE, Sergeant, Infantry; PRESTICE B. RHODES, Sergeant, Infantry; CLARENCE C. SHELTON, Sergeant, Infantry; HERMAN SMITH, Sergeant, Infantry; CASPER M. HECKEMEYER, Sergeant, Infantry.

### COURSES

No.	Title	Credits	Required of	Prerequisite courses
1f-2w-3s	First-Year Basic Course R.O. T.C. ....	None	Fr.	None
4f-5w-6s	Second-Year Basic Course R.O.T.C. ....	None	Soph.	3
51f-52w-53s	First-Year Advanced Course R.O.T.C. ....	9‡	Jr. elective	6
54f-55w-56s	Second-Year Advanced Course R.O.T.C. ....	9	Sr. elective	53

#### 1f-2w-3s. FIRST-YEAR BASIC COURSE R.O.T.C.

INFANTRY. Practical and theoretical instruction in school of soldier, squad and company; elementary subjects of military training; infantry weapons and equipment.

COAST ARTILLERY. Duties of heavy artillery soldier; military customs and methods; military sanitation and hygiene; elementary topography; practical study of one gun and one carriage.

‡ Must be legally eligible for enrolment in Reserve Officers' Training Corps. Consult commandant.

- SIGNAL CORPS. Infantry drill and physical training; military hygiene and first aid; military courtesy; guard duty; army organization and organization of signal troops; military telegraph apparatus; military telephone apparatus; radio telegraphy.
- 4f-5W-6S. SECOND-YEAR BASIC COURSE R.O.T.C.
- INFANTRY. Practical instruction in school of platoon and company; military sketching and map-reading; infantry weapons including machine gun and automatic rifle; minor tactics.
- COAST ARTILLERY. Duties of non-commissioned officer of heavy artillery; guns, carriages, ammunition, and accessories (elementary); topography (preparation of precise maps); construction and operation of motor vehicles.
- SIGNAL CORPS. Infantry drill and physical training; military sketching and map-reading; army organization; organization of signal troops; military telegraph and telephone apparatus; radio telegraphy.
- 51f-52W-53S. FIRST-YEAR ADVANCED COURSE R.O.T.C.
- INFANTRY. Field engineering; infantry weapons, including trench mortars, 37mm. gun, grenades, and pistol; minor tactics.
- COAST ARTILLERY. Duties of a heavy artillery officer; guns, carriages, and determination of geodetic data; motor transport (advanced).
- SIGNAL CORPS. Minor tactics; field engineering; organization and tactics of all arms; staff organizations and duties; message centers; codes and ciphers; telephone construction; communication engineering (Electrical Communication, E. E. 61-63).
- 54f-55W-56S. SECOND-YEAR ADVANCED COURSE R.O.T.C.
- INFANTRY. Minor tactics; administration; military law; musketry; military history and policy of the United States; rules of land warfare.
- COAST ARTILLERY. Duties of heavy artillery officer; administrative methods; physical handling of troops; military law; military policy of the United States; tactics of infantry; field engineering; problems in employment of heavy artillery and in the use of heavy artillery against armored ships.
- SIGNAL CORPS. Minor tactics; field engineering; organization and tactics of signal troops; military history and policy of the United States; administration; military laws; signal corps duties; message centers; codes and ciphers; semi-permanent and temporary telephone construction; communication engineering (Electrical Communication, given by Electrical Engineering Department).

## PHYSICS

Professors HENRY A. ERIKSON, W. FRANCIS G. SWANN, JOHN T. TATE, ANTHONY ZELENY; Professorial Lecturer LOUALLEN F. MILLER; Instructors ARCHIE D. POWER, OSWALD ROGNLEY, JOSEPH VALASEK.

## COURSES

No.	Title	Credits	Required of	Prerequisite courses
<i>Required Courses</i>				
3f,w,s,su	Elements of Mechanics and Sound .....	3	Soph. Arch. & Engrs.	Trig. equiv. of Math. 12 3 or reg. in 3
4f	Elements of Mech. Lab.....	1	Soph. Engrs.	3
23w	Heat .....	3	Soph. Arch. & Engrs.	4, 23 or reg. in 23
24w	Heat Laboratory .....	1	Soph. Engrs.	3
43s	Magnetism and Electricity...	3	Soph. Arch. & Engrs.	4, 43 or reg. in 43
44s	Electrical Laboratory .....	1	Soph. Engrs.	3
144f	Electrical Measurements.....	3	Jr. E. E.	43 and 44
<i>Electives</i>				
122s	Pyrometry and Heat.....	3		23 and 24
241f-243w- 245s	Mathematical Theory of Electricity and Magnetism....	9	Elective P.-sr. E. E.	
247f-248w- 249s	Electron Theory .....	9	Elective P.-sr. E. E.	

- 3f,w,s,su. ELEMENTS OF MECHANICS AND SOUND. Mechanics of solids, fluids, wave motion, and sound. A study of the simpler fundamental principles. First part of a general course 3, 23, 43. Course 4 should be taken in conjunction with this course. Three lectures, one quiz hour a week. Three credits. MR. ERIKSON.
- 4f. ELEMENTS OF MECHANICS AND SOUND LABORATORY. Measurements in the mechanics of solids, fluids, wave motion, and sound; the laboratory part supplementing Course 3. One two-hour session in the laboratory a week. One credit. MR. ERIKSON.
- 23w. HEAT. A study of the principles underlying heat phenomena. Course 24 should be taken in conjunction with this course. Three lectures, one quiz hour a week. Three credits. MR. MILLER.
- 24w. HEAT LABORATORY. The laboratory part supplementing Course 23. One two-hour session in the laboratory a week. One credit. MR. MILLER.
- 43s. MAGNETISM AND ELECTRICITY. A study of the principles underlying magnetic and electric phenomena. Course 44 should be taken in conjunction with this course. Three lectures, one quiz hour a week. Three credits. MR. ZELENY.
- 44s. ELECTRICAL LABORATORY. The laboratory part supplementing Course 43. One two-hour session in the laboratory a week. One credit. MR. ZELENY.
- 144f. ELECTRICAL MEASUREMENTS. Devoted mainly to the study of potentiometer methods, capacity, inductance, magnetic flux. Two three-hour laboratory periods a week. Three credits. MR. ZELENY.

For electives in Department of Physics see the bulletin of the College of Science, Literature, and the Arts.

### POLITICAL SCIENCE

Professor CEPHAS D. ALLIN; Lecturer BEN W. PALMER.

#### COURSE

No.	Title	Credits	Required of	Prerequisite courses
27s	Business Law .....	3	Elective	None

27s. BUSINESS LAW. A course in business law arranged for engineers, including the law of contracts, suretyship, agency, partnership, corporations, negotiable instruments, conveyance patents, and riparian rights. Three credits. MR. PALMER.

### RHETORIC AND PUBLIC SPEAKING

Professor JOSEPH M. THOMAS; Associate Professor FRANK M. RARIG; Instructors CECIL C. BEAN, WILLIAM P. DUNN, HARRY W. ROBBINS.

#### COURSES

No.	Title	Credits	Required of	Prerequisite courses
4f,w-5w,s-6s,su	Rhetoric and Composition..	3	Fr. Arch. & Soph. Eng.	None
31w	Technical Writing .....	3	Elective	4-5-6
41f,w-42w,s-43s,f	Public Speaking .....	3	Elective	4-5-6

4f,w-5w,s-6s,su. RHETORIC AND COMPOSITION. Training in writing; study of the work of writers who have handled scientific subjects with clearness and power; outside reading. Three credits per quarter. MR. BEAN, MR. DUNN, MR. ROBBINS.

31w. TECHNICAL WRITING. A quarter course in business letters, reports, etc., planned to meet the professional needs of engineering students. Three credits. MR. BEAN.

41f,w-42w,s-43s,f. PUBLIC SPEAKING. A general course in public speaking. Three credits. MR. RARIG.

### SUMMER READING

All engineering students are advised to take general courses in reading of non-professional character during their summer vacations. The purpose of this general reading is to increase the acquaintance of the student with literature, history, and general science; to develop in him a taste for good reading; and to impress him with the importance of such knowledge not only as a source of individual enjoyment but as a practical aid to engineers in their social and business relations.

A circular on general reading has been prepared and may be secured at the dean's office. This contains a list of books from which the student may make his own selection. The books have been chosen for their value in providing general training, but an attempt has been made to include only readable and attractive works. Most of the books in the list are available in standard low-priced editions, and each student is urged to purchase his own copy and thus add to the value and pleasure of the reading. A statement of the books read during the summer vacation is required at the beginning of the next college year, and applications for credit must be submitted to the dean before October 15. The student will be examined on the books read. One credit will be allowed for each course satisfactorily completed, but not more than one credit will be granted in one year. The total credits for this reading shall not exceed three.

## DIRECTIONS FOR REGISTRATION AND CLASSIFICATION

PROFESSOR BROOKE IN CHARGE

Students registering in the College of Engineering and Architecture should proceed in the following manner to complete their registration:

**Payment of fees.**—Each student must pay to the University cashier his fees for the fall, winter, and spring quarters on or before September 18 (except for new students), September 28 (new students), January 3, 1922, March 28, 1922. He will receive from the cashier a receipt which must be presented to his classifier on registration day before he can be classified. By failing to pay his fees at the time mentioned he incurs a fine as stated in the engineering bulletin.

**Registration and classification.**—All students must register for the fall quarter on September 26-27, winter quarter on January 3, spring quarter on March 28. On this date each student should obtain a classification blank at the dean's office, except freshmen, who should obtain their blanks in the Auditorium, and all should then present themselves for classification in one of the following rooms in the Main Engineering Building.

Freshman	Auditorium
Sophomore	Room 1
Junior	Room 101
Senior	Room 101

Freshmen will be assigned to one of the freshmen classifiers. Sophomores, juniors, and seniors should present themselves to the classifier representing the branch of engineering in which they wish to enroll. Students in doubt as to their classifiers will report to Professor Brooke.

Before presenting himself to his classifier, each student shall fill out his registration blank in triplicate as required. (Sample of this form appears on page 147). **Do this neatly with pencil. Do not separate or fold this blank.**

In filling out this form each regular student takes all of his subjects in **one of the regular sections 1, 2, 3, 4, etc., or C.E., M.E., etc.,** as shown on pages 74 to 117. A student who can not arrange his work so that it will follow one of these groups shall consult his classifier as to the best arrangement of his work.

In filling out the registration blank the student should observe the following:



There must be no conflicts in the program.

The prerequisites for each course must be satisfied except when waived, in writing, by the head of the department concerned.

Back work must be taken whenever possible in preference to new work.

Students will not be allowed to register for less than 14 or more than 19 credit hours without the approval of the Students' Work Committee, and no regular student will be allowed to register for less than 12 credit hours in any quarter.

Before the student will be enrolled and assigned to classes he must have presented to the classifier the **cashier's receipt** for his fees and his **registration blank**. His schedule must be approved and signed by his classifier before it can be regarded as official.

**Enrolment.**—Each student should take his signed **registration blank** to Room 201, Main Engineering Building, and enroll in each class for which he is scheduled.

The student should see that each enroller signs the registration blank.

Should the section in which the student has been scheduled be already filled, he must return to his classifier for modification of his registration blank.

On completion of the enrolment the student will present the blanks to the desk in the enrolling room where he will receive his class schedule.

**Late registration and classification.**—A student registering after registration day should pay his fees at the cashier's office and then report to the dean's office where he will receive his registration blank. The student must consult his classifier before filling out his blank as to the proper section which he can enter. Students registering late are subject to the same rules as those completing their registration on registration day. After the registration blank is filled out it must be approved and signed by the classifier. The student must then present it and have it signed by all the instructors concerned and returned to the dean's office.

**Commencement of work.**—Classes in the College of Engineering and Architecture will begin at 8:00 a.m. (8:30 a.m. winter quarter) on the dates given in the University Calendar, and each student must attend classes as indicated on his registration blank.

**Change of classification.**—A student desiring to change his registration after registration day must apply at the dean's office for a special blank. This blank must be taken to the Chairman of the Students' Work Committee for his approval and signature, then signed by each instructor whose class the student leaves or enters, and returned to the dean's office within three days. A student who makes any change in classification on his own initiative, will pay a fee of \$2 for each change.

PROGRAM

FALL QUARTER, 1921-22

FRESHMAN ENGINEERS

MONDAY

	1	2	3	4
8:00	Draw. I	Draw. I	Draw. I	Draw. I
9:00	Draw. I	Draw. I	Draw. I	Draw. I
10:00	Chem. Lect. 4	Chem. Lect. 4	Chem. Lect. 4	Chem. Lect. 4
11:00	.....	Math. II	Math. II	Math. II
12:00	.....			
1:00	Drill	Drill	Drill	Drill
2:00	M.E. II	M.E. II	M.E. II	M.E. II
3:00	M.E. II	M.E. II	M.E. II	M.E. II
4:00	M.E. II	M.E. II	M.E. II	M.E. II

TUESDAY

8:00	Chem. Lab. 4	Chem. Lab. 4	Chem. Lab. 4	Chem. Lab. 4
9:00	Chem. Lab. 4	Chem. Lab. 4	Chem. Lab. 4	Chem. Lab. 4
10:00	Chem. Lab. 4	Chem. Lab. 4	Chem. Lab. 4	Chem. Lab. 4
11:00	Math. II	Math. II	Math. II	Math. II
12:00	.....			
1:00	.....	.....	.....	.....
2:00	.....	.....	.....	.....
3:00	.....	.....	.....	.....
4:00	Orientation	Orientation	Orientation	Orientation

WEDNESDAY

8:00	Draw. I	Draw. I	Draw. I	Draw. I
9:00	Draw. I	Draw. I	Draw. I	Draw. I
10:00	Chem. Lect. 4	Chem. Lect. 4	Chem. Lect. 4	Chem. Lect. 4
11:00	Math. II	.....	Math. II	Math. II
12:00	.....			
1:00	Drill	Drill	Drill	Drill
2:00	Draw. I	Draw. I	Draw. I	Draw. I
3:00	Draw. I	Draw. I	Draw. I	Draw. I
4:00	.....	.....	.....	.....

THURSDAY

8:00	M.E. II	M.E. II	M.E. II	M.E. II
9:00	M.E. II	M.E. II	M.E. II	M.E. II
10:00	M.E. II	M.E. II	M.E. II	M.E. II
11:00	Convocation	Convocation	Convocation	Convocation
12:00	.....			
1:00	Math. II	Math. II	Math. II	.....
2:00	.....	.....	.....	.....
3:00	.....	.....	.....	.....
4:00	Orientation	Orientation	Orientation	Orientation

FRIDAY

8:00	Draw. I	Draw. I	Draw. I	Draw. I
9:00	Draw. I	Draw. I	Draw. I	Draw. I
10:00	Chem. Lect. 4	Chem. Lect. 4	Chem. Lect. 4	Chem. Lect. 4
11:00	Math. II	Math. II	.....	Math. II
12:00	.....			
1:00	Drill	Drill	Drill	Drill
2:00	.....	.....	.....	.....
3:00	.....	.....	.....	.....
4:00	.....	.....	.....	.....

SATURDAY

8:00	.....	.....	.....	.....
9:00	.....	.....	.....	.....
10:00	.....	.....	.....	.....
11:00	Math. II	Math. II	Math. II	Math. II

FALL QUARTER, 1921-22

FRESHMAN ENGINEERS

MONDAY

	5	6	7	8
8:00	Solid Geom. 10	.....	.....	Draw. I
9:00	.....	Solid Geom. 10	.....	Draw. I
10:00	Chem. Lect. 4	Chem. Lect. 4	Chem. Lect. 4	Chem. Lect. 4
11:00	.....	.....	Math. 11	H. Alg. 9
12:00	.....			
1:00	Drill	Drill	Solid Geom. 10	.....
2:00	M.E. 11	M.E. 11	.....	.....
3:00	M.E. 11	M.E. 11	.....	.....
4:00	M.E. 11	M.E. 11	Drill	Drill

TUESDAY

8:00	Chem. Lab. 4	Chem. Lab. 4	Chem. Lab. 4	Chem. Lab. 4
9:00	Chem. Lab. 4	Chem. Lab. 4	Chem. Lab. 4	Chem. Lab. 4
10:00	Chem. Lab. 4	Chem. Lab. 4	Chem. Lab. 4	Chem. Lab. 4
11:00	.....	.....	Math. 11	.....
12:00	.....			
1:00	H. Alg. 9	H. Alg. 9	M.E. 11	M.E. 11
2:00	.....	.....	M.E. 11	M.E. 11
3:00	.....	.....	M.E. 11	M.E. 11
4:00	Orientation	Orientation	Orientation	Orientation

WEDNESDAY

8:00	Solid Geom. 10	.....	.....	Draw. I
9:00	.....	Solid Geom. 10	.....	Draw. I
10:00	Chem. Lect. 4	Chem. Lect. 4	Chem. Lect. 4	Chem. Lect. 4
11:00	.....	.....	Math. 11	H. Alg. 9
12:00	.....			
1:00	Drill	Drill	Solid Geom. 10	.....
2:00	.....	.....	.....	Draw. I
3:00	.....	.....	.....	Draw. I
4:00	.....	.....	Drill	Drill

THURSDAY

8:00	M.E. 11	M.E. 11	.....	.....
9:00	M.E. 11	M.E. 11	.....	.....
10:00	M.E. 11	M.E. 11	.....	.....
11:00	Convocation	Convocation	Convocation	Convocation
12:00	.....			
1:00	H. Alg. 9	H. Alg. 9	M.E. 11	M.E. 11
2:00	.....	.....	M.E. 11	M.E. 11
3:00	.....	.....	M.E. 11	M.E. 11
4:00	Orientation	Orientation	Orientation	Orientation

FRIDAY

8:00	Solid Geom. 10	.....	.....	Draw. I
9:00	.....	Solid Geom. 10	.....	Draw. I
10:00	Chem. Lect. 4	Chem. Lect. 4	Chem. Lect. 4	Chem. Lect. 4
11:00	.....	.....	Math. 11	H. Alg. 9
12:00	.....			
1:00	Drill	Drill	Solid Geom.	.....
2:00	.....	.....	.....	.....
3:00	.....	.....	.....	.....
4:00	.....	.....	Drill	Drill

SATURDAY

8:00	.....	.....	.....	.....
9:00	.....	.....	.....	.....
10:00	H. Alg. 9	H. Alg. 9	.....	.....
11:00	.....	.....	Math. 11	.....

PROGRAM

FALL QUARTER, 1921-22

FRESHMAN ENGINEERS

MONDAY

	9	10	11	12
8:00	.....	.....	.....	.....
9:00	H. Alg. 9	.....	.....	.....
10:00	Draw. I	Draw. I	Math. II	Math. II
11:00	Draw. I	Draw. I	.....	.....
12:00	.....	.....	.....	.....
1:00	.....	.....	.....	.....
2:00	.....	.....	Solid Geom. 10	Solid Geom. 10
3:00	.....	.....	.....	.....
4:00	Drill	Drill	Drill	Drill

TUESDAY

8:00	Chem. Lect. 4	Chem. Lect. 4	Chem. Lect. 4	Chem. Lect. 4
9:00	.....	H. Alg. 9	.....	.....
10:00	.....	.....	Math. II	Math. II
11:00	.....	.....	.....	.....
12:00	.....	.....	.....	.....
1:00	Draw. I	Draw. I	.....	.....
2:00	Draw. I	Draw. I	Solid Geom.	Solid Geom.
3:00	.....	.....	.....	.....
4:00	Orientation	Orientation	Orientation	Orientation

WEDNESDAY

8:00	.....	.....	.....	.....
9:00	M.E. II	M.E. II	M.E. II	M.E. II
10:00	M.E. II	M.E. II	M.E. II	M.E. II
11:00	M.E. II	M.E. II	M.E. II	M.E. II
12:00	.....	.....	.....	.....
1:00	Chem. Lab. 4	Chem. Lab. 4	Chem. Lab. 4	Chem. Lab. 4
2:00	Chem. Lab. 4	Chem. Lab. 4	Chem. Lab. 4	Chem. Lab. 4
3:00	Chem. Lab. 4	Chem. Lab. 4	Chem. Lab. 4	Chem. Lab. 4
4:00	Drill	Drill	Drill	Drill

THURSDAY

8:00	Chem. Lect. 4	Chem. Lect. 4	Chem. Lect. 4	Chem. Lect. 4
9:00	H. Alg. 9	H. Alg. 9	.....	.....
10:00	.....	.....	Math. II	Math. II
11:00	Convocation	Convocation	Convocation	Convocation
12:00	.....	.....	.....	.....
1:00	Draw. I	Draw. I	.....	.....
2:00	Draw. I	Draw. I	Solid Geom.	Solid Geom.
3:00	.....	.....	.....	.....
4:00	Orientation	Orientation	Orientation	Orientation

FRIDAY

8:00	.....	.....	.....	.....
9:00	Solid Geom. 10	.....	.....	.....
10:00	Draw. I	Draw. I	Math. II	Math. II
11:00	Draw. I	Draw. I	.....	.....
12:00	.....	.....	.....	.....
1:00	M.E. II	M.E. II	M.E. II	M.E. II
2:00	M.E. II	M.E. II	M.E. II	M.E. II
3:00	M.E. II	M.E. II	M.E. II	M.E. II
4:00	Drill	Drill	Drill	Drill

SATURDAY

8:00	Chem. Lect. 4	Chem. Lect. 4	Chem. Lect. 4	Chem. Lect. 4
9:00	.....	H. Alg. 9	.....	.....
10:00	.....	.....	Math. II	Math. II
11:00	.....	.....	.....	.....

78 COLLEGE OF ENGINEERING AND ARCHITECTURE

FALL QUARTER, 1921-22

FRESHMAN ENGINEERS

MONDAY

13  
 8:00 .....  
 9:00 Math. II  
 10:00 Draw. I  
 11:00 Draw. I  
 12:00 .....  
 1:00 .....  
 2:00 .....  
 3:00 .....  
 4:00 Drill

14  
 .....  
 Math. II  
 Draw. I  
 Draw. I  
 .....  
 .....  
 .....  
 .....  
 Drill

TUESDAY

8:00 Chem. Lect. 4  
 9:00 Math. II  
 10:00 .....  
 11:00 .....  
 12:00 .....  
 1:00 Draw. I  
 2:00 Draw. I  
 3:00 .....  
 4:00 Orientation

Chem. Lect. 4  
 Math. II  
 .....  
 .....  
 .....  
 Draw. I  
 Draw. I  
 .....  
 Orientation

WEDNESDAY

8:00 .....  
 9:00 M.E. II  
 10:00 M.E. II  
 11:00 M.E. II  
 12:00 .....  
 1:00 Chem. Lab. 4  
 2:00 Chem. Lab. 4  
 3:00 Chem. Lab. 4  
 4:00 Drill

.....  
 M.E. II  
 M.E. II  
 M.E. II  
 .....  
 Chem. Lab. 4  
 Chem. Lab. 4  
 Chem. Lab. 4  
 Drill

THURSDAY

8:00 Chem. Lect. 4  
 9:00 Math. II  
 10:00 .....  
 11:00 Convocation  
 12:00 .....  
 1:00 Draw. I  
 2:00 Draw. I  
 3:00 .....  
 4:00 Orientation

Chem. Lect. 4  
 Math. II  
 .....  
 Convocation  
 .....  
 Draw. I  
 Draw. I  
 .....  
 Orientation

FRIDAY

8:00 .....  
 9:00 Math. II  
 10:00 Draw. I  
 11:00 Draw. I  
 12:00 .....  
 1:00 M.E. II  
 2:00 M.E. II  
 3:00 M.E. II  
 4:00 Drill

.....  
 Math. II  
 Draw. I  
 Draw. I  
 .....  
 M.E. II  
 M.E. II  
 M.E. II  
 Drill

SATURDAY

8:00 Chem. Lect. 4  
 9:00 Math. II  
 10:00 .....  
 11:00 .....

Chem. Lect. 4  
 Math. II  
 .....  
 .....

PROGRAM

FALL QUARTER, 1921-22

FRESHMAN ENGINEERS

MONDAY

	15	16	17	18
8:00	.....	Math. 11	.....	Math. 11
9:00	Chem. Lab. 14	Chem. Lab. 14	Chem. Lab. 14	Chem. Lab. 14
10:00	Chem. Lab. 14	Chem. Lab. 14	Chem. Lab. 14	Chem. Lab. 14
11:00	Chem. Lab. 14	Chem. Lab. 14	Chem. Lab. 14	Chem. Lab. 14
12:00	.....			
1:00	Drill	Drill	Drill	Drill
2:00	Solid Geom.	.....	.....	.....
3:00	.....	.....	.....	.....
4:00	.....	.....	.....	.....

TUESDAY

8:00	H. Alg. 9	Math. 11	Math. 11	Math. 11
9:00	Chem. Lect. 14	Chem. Lect. 14	Chem. Lect. 14	Chem. Lect. 14
10:00	Draw. 1	Draw. 1	Draw. 1	Draw. 1
11:00	Draw. 1	Draw. 1	Draw. 1	Draw. 1
12:00	.....			
1:00	M.E. 11	M.E. 11	M.E. 11	M.E. 11
2:00	M.E. 11	M.E. 11	M.E. 11	M.E. 11
3:00	M.E. 11	M.E. 11	M.E. 11	M.E. 11
4:00	Orientation	Orientation	Orientation	Orientation

WEDNESDAY

8:00	.....	Math. 11	Math. 11	.....
9:00	.....	.....	.....	.....
10:00	Draw. 1	Draw. 1	Draw. 1	Draw. 1
11:00	Draw. 1	Draw. 1	Draw. 1	Draw. 1
12:00	.....			
1:00	Drill	Drill	Drill	Drill
2:00	Solid Geom.	.....	.....	.....
3:00	.....	.....	.....	.....
4:00	.....	.....	.....	.....

THURSDAY

8:00	H. Alg. 9	Math. 11	Math. 11	Math. 11
9:00	Chem. Lect. 14	Chem. Lect. 14	Chem. Lect. 14	Chem. Lect. 14
10:00	.....	.....	.....	.....
11:00	Convocation	Convocation	Convocation	Convocation
12:00	.....			
1:00	M.E. 11	M.E. 11	M.E. 11	M.E. 11
2:00	M.E. 11	M.E. 11	M.E. 11	M.E. 11
3:00	M.E. 11	M.E. 11	M.E. 11	M.E. 11
4:00	Orientation	Orientation	Orientation	Orientation

FRIDAY

8:00	.....	.....	Math. 11	Math. 11
9:00	Chem. Lab. 14	Chem. Lab. 14	Chem. Lab. 14	Chem. Lab. 14
10:00	Chem. Lab. 14	Chem. Lab. 14	Chem. Lab. 14	Chem. Lab. 14
11:00	Chem. Lab. 14	Chem. Lab. 14	Chem. Lab. 14	Chem. Lab. 14
12:00	.....			
1:00	Drill	Drill	Drill	Drill
2:00	Solid Geom.	.....	.....	.....
3:00	Draw. 1	Draw. 1	Draw. 1	Draw. 1
4:00	Draw. 1	Draw. 1	Draw. 1	Draw. 1

SATURDAY

8:00	H. Alg. 9	Math. 11	Math. 11	Math. 11
9:00	Chem. Lect. 14	Chem. Lect. 14	Chem. Lect. 14	Chem. Lect. 14
10:00	Draw. 1	Draw. 1	Draw. 1	Draw. 1
11:00	Draw. 1	Draw. 1	Draw. 1	Draw. 1

80 COLLEGE OF ENGINEERING AND ARCHITECTURE

FALL QUARTER, 1921-22

FRESHMAN ARCHITECTS

MONDAY

8:00	Math. 11	1	Math. 11	2
9:00	Arch. 21		Arch. 31	
10:00	Arch. 21		Arch. 31	
11:00	Rhet. 4		Arch. 31	
12:00	.....		.....	
1:00	Arch. 31		Arch. 21	
2:00	Arch. 31		Arch. 21	
3:00	Arch. 31		.....	
4:00	Drill		Drill	

TUESDAY

8:00	Math. 11	Math. 11
9:00	Draw. 31	Draw. 31
10:00	.....	Rhet. 4
11:00	Arch. 31	Arch. 31
12:00	.....	.....
1:00	.....	.....
2:00	.....	.....
3:00	.....	.....
4:00	Orientation	Orientation

WEDNESDAY

8:00	Math. 11	Math. 11
9:00	Arch. 21	Arch. 31
10:00	Arch. 21	Arch. 31
11:00	Rhet. 4	Arch. 31
12:00	.....	.....
1:00	Arch. 31	Arch. 21
2:00	Arch. 31	Arch. 21
3:00	Arch. 31	.....
4:00	Drill	Drill

THURSDAY

8:00	Math. 11	Math. 11
9:00	Draw. 31	Draw. 31
10:00	.....	Rhet. 4
11:00	Convocation	Convocation
12:00	.....	.....
1:00	.....	.....
2:00	.....	.....
3:00	.....	.....
4:00	Orientation	Orientation

FRIDAY

8:00	Math. 11	Math. 11
9:00	Arch. 21	Arch. 31
10:00	Arch. 21	Arch. 31
11:00	Rhet. 4	Arch. 31
12:00	.....	.....
1:00	Arch. 31	Arch. 21
2:00	Arch. 31	Arch. 21
3:00	Arch. 31	.....
4:00	Drill	Drill

SATURDAY

8:00	.....	.....
9:00	.....	.....
10:00	.....	Rhet. 4
11:00	Arch. 31	Arch. 31

# PROGRAM

FALL QUARTER, 1921-22

SOPHOMORE ENGINEERS

## MONDAY

	CIVIL 1	CIVIL 2	CIVIL 3	CIVIL 4
8:00	Draw. 21	Draw. 21	Drill	.....
9:00	Draw. 21	Draw. 21	Math. 24	C.E. 11
10:00	Math. 24	Phys. 3	.....	Math. 24
11:00	C.E. 11	C.E. 11	.....	.....
12:00	.....			
1:00	Phys. 3	Rhet. 4	Phys. 3	C.E. 11
2:00	.....	.....	Draw. 21	C.E. 11
3:00	Drill	Drill	Draw. 21	C.E. 11
4:00	.....	.....	.....	C.E. 11

## TUESDAY

8:00	C.E. 11	.....	Rhet. 4	.....
9:00	C.E. 11	.....	Math. 24	.....
10:00	C.E. 11	.....	Phys. Lab. 4	Math. 24
11:00	C.E. 11	Math. 24	Phys. Lab. 4	.....
12:00	.....			
1:00	.....	C.E. 11	Draw. 21	.....
2:00	Rhet. 4	C.E. 11	Draw. 21	.....
3:00	.....	C.E. 11	.....	.....
4:00	.....	C.E. 11	.....	.....

## WEDNESDAY

8:00	Draw. 21	Draw. 21	Drill	.....
9:00	Draw. 21	Draw. 21	Math. 24	.....
10:00	Math. 24	Phys. 3	.....	Math. 24
11:00	.....	Math. 24	.....	.....
12:00	.....			
1:00	Phys. 3	Rhet. 4	Phys. 3	C.E. 11
2:00	.....	.....	Draw. 21	C.E. 11
3:00	Drill	Drill	Draw. 21	C.E. 11
4:00	Phys. 3	Phys. 3	Phys. 3	.....

## THURSDAY

8:00	C.E. 11	Phys. Lab. 4	Rhet. 4	.....
9:00	C.E. 11	Phys. Lab. 4	Math. 24	.....
10:00	C.E. 11	.....	.....	Math. 24
11:00	Convocation	Convocation	Convocation	Convocation
12:00	.....			
1:00	Math. 24	Math. 24	C.E. 11	.....
2:00	Rhet. 4	.....	C.E. 11	.....
3:00	.....	.....	C.E. 11	.....
4:00	.....	.....	C.E. 11	.....

## FRIDAY

8:00	Draw. 21	Draw. 21	Drill	.....
9:00	Draw. 21	Draw. 21	C.E. 11	.....
10:00	Math. 24	Phys. 3	C.E. 11	Math. 24
11:00	.....	Math. 24	C.E. 11	.....
12:00	.....			
1:00	Phys. 3	Rhet. 4	Phys. 3	.....
2:00	.....	.....	.....	.....
3:00	Drill	Drill	C.E. 11	.....
4:00	.....	.....	.....	.....

## SATURDAY

8:00	Phys. Lab. 4	C.E. 11	Rhet. 4	.....
9:00	Phys. Lab. 4	C.E. 11	Math. 24	.....
10:00	Math. 24	C.E. 11	.....	.....
11:00	Rhet. 4	Math. 24	.....	.....



82 COLLEGE OF ENGINEERING AND ARCHITECTURE

FALL QUARTER, 1921-22

SOPHOMORE ENGINEERS

MONDAY

	ELECTRICAL 1	ELECTRICAL 2	ELECTRICAL 3	ELECTRICAL 4
8:00	Drill	Math. 24	Drill	Math. 24
9:00	Math. 24	Rhet. 4	Math. 24	Phys. 3
10:00	Draw. 26	Draw. 26	Phys. 3	.....
11:00	Draw. 26	Draw. 26	.....	.....
12:00	.....	.....	.....	.....
1:00	Phys. 3	Phys. 3	E.E. 11 (e)	Phys. Lab. 4
2:00	.....	.....	E.E. 11 (e)	Phys. Lab. 4
3:00	Phys. Lab. 4	Drill	.....	Drill
4:00	Phys. Lab. 4	.....	.....	.....

TUESDAY

8:00	Rhet. 4	Math. 24	Draw. 26	Draw. 26
9:00	Math. 24	E.E. 11 (c)	Draw. 26	Draw. 26
10:00	.....	E.E. 11 (c)	Math. 24	.....
11:00	E.E. 11	E.E. 11	Rhet. 4	.....
12:00	.....	.....	.....	.....
1:00	E.E. 11 (a)	.....	.....	.....
2:00	E.E. 11 (a)	.....	.....	Rhet. 4
3:00	.....	.....	.....	E.E. 11 (g)
4:00	.....	.....	.....	E.E. 11 (g)

WEDNESDAY

8:00	Drill	Math. 24	Drill	Math. 24
9:00	Math. 24	Rhet. 4	Math. 24	Phys. 3
10:00	E.E. 11 (b)	.....	Phys. 3	.....
11:00	E.E. 11 (b)	.....	.....	.....
12:00	.....	.....	.....	.....
1:00	Phys. 3	Phys. 3	Phys. Lab. 4	E.E. 11 (h)
2:00	.....	.....	Phys. Lab. 4	E.E. 11 (h)
3:00	.....	Drill	.....	Drill
4:00	Phys. 3	Phys. 3	Phys. 3	Phys. 3

THURSDAY

8:00	Rhet. 4	Math. 24	.....	Math. 24
9:00	E.E. 11	E.E. 11	Math. 24	.....
10:00	.....	.....	E.E. 11	E.E. 11
11:00	Convocation	Convocation	Convocation	Convocation
12:00	.....	.....	.....	.....
1:00	.....	E.E. 11 (c)	Rhet. 4	.....
2:00	.....	E.E. 11 (c)	.....	Rhet. 4
3:00	.....	.....	Draw. 26	Draw. 26
4:00	.....	.....	Draw. 26	Draw. 26

FRIDAY

8:00	Drill	Phys. Lab. 4	Drill	Math. 24
9:00	Math. 24	Phys. Lab. 4	Math. 24	Phys. 3
10:00	Draw. 26	Draw. 26	Phys. 3	.....
11:00	Draw. 26	Draw. 26	.....	.....
12:00	.....	.....	.....	.....
1:00	Phys. 3	Phys. 3	Draw. 26	Draw. 26
2:00	.....	.....	Draw. 26	Draw. 26
3:00	.....	Drill	.....	Drill
4:00	.....	.....	.....	.....

SATURDAY

8:00	Rhet. 4	Math. 24	E.E. 15 (f)	Math. 24
9:00	Math. 24	Rhet. 4	E.E. 15 (f)	.....
10:00	Draw. 26	Draw. 26	E.E. 11	E.E. 11
11:00	Draw. 26	Draw. 26	Rhet. 4	Rhet. 4

FALL QUARTER, 1921-22

SOPHOMORE ENGINEERS

	MECHANICAL	MECHANICAL	ARCHITECTS.
	I	2	
8:00	Drill	Drill	Math. 91
9:00	Phys. 3	Phys. 3	Phys. 3
10:00	Math. 24	Math. 24	Drill
11:00	.....	Rhet. 4	Arch. 14
12:00	.....	.....	.....
1:00	M.E. 14	Draw. 28	Arch. 34
2:00	M.E. 14	Draw. 28	Arch. 34
3:00	M.E. 14	.....	Arch. 34
4:00	M.E. 14	.....	.....
		<b>TUESDAY</b>	
8:00	.....	Phys. Lab. 4	Math. 91
9:00	Math. 24	Phys. Lab. 4	Arch. 24
10:00	Draw. 28	Math. 24	Arch. 24
11:00	Draw. 28	.....	Arch. 24
12:00	.....	.....	.....
1:00	Rhet. 4	Draw. 28	Arch. 34
2:00	M.E. 14	Draw. 28	Arch. 34
3:00	M.E. 14	.....	Arch. 34
4:00	M.E. 14	.....	.....
		<b>WEDNESDAY</b>	
8:00	Drill	Drill	.....
9:00	Phys. 23	Phys. 3	Phys. 3
10:00	Math. 24	Math. 24	Drill
11:00	.....	Rhet. 4	Arch. 44
12:00	.....	.....	.....
1:00	Draw. 28	.....	Arch. 44
2:00	Draw. 28	.....	Arch. 44
3:00	.....	.....	Arch. 44
4:00	Phys. 3	Phys. 3	Phys. 3
		<b>THURSDAY</b>	
8:00	.....	M.E. 14	Math. 91
9:00	Rhet. 4	M.E. 14	.....
10:00	Math. 24	M.E. 14	.....
11:00	Convocation	Convocation	Convocation
12:00	.....	.....	.....
1:00	Draw. 28	M.E. 14	Arch. 34
2:00	Draw. 28	M.E. 14	Arch. 34
3:00	.....	M.E. 14	Arch. 34
4:00	.....	M.E. 14	.....
		<b>FRIDAY</b>	
8:00	Drill	Drill	Math. 91
9:00	Phys. 3	Phys. 3	Phys. 3
10:00	Math. 24	Math. 24	Drill
11:00	Rhet. 4	Rhet. 4	Arch. 14
12:00	.....	.....	.....
1:00	Phys. Lab. 4	M.E. 14	Arch. 34
2:00	Phys. Lab. 4	M.E. 14	Arch. 34
3:00	.....	M.E. 14	Arch. 34
4:00	.....	M.E. 14	.....
		<b>SATURDAY</b>	
8:00	M.E. 14	Draw. 28	.....
9:00	M.E. 14	Draw. 28	Arch. 24
10:00	M.E. 14	Math 24	Arch. 24
11:00	M.E. 14	.....	Arch. 24

84 COLLEGE OF ENGINEERING AND ARCHITECTURE

FALL QUARTER, 1921-22

JUNIOR ENGINEERS

CIVIL 1		MONDAY CIVIL 2	CIVIL 3
8:00	Elec.	Elec.	.....
9:00	Mat. Lab. M.M. 141	.....	Mat. M.M. 134
10:00	Mat. Lab. M.M. 141	Math. 131	.....
11:00	Mat. Lab. M.M. 141	.....	Elec.
12:00	.....	.....	.....
1:00	C.E. 31	C.E. 51	C.E. 14
2:00	C.E. 31	C.E. 51	C.E. 14
3:00	C.E. 31	C.E. 51	C.E. 14
4:00	C.E. 31	C.E. 51	C.E. 14
<b>TUESDAY</b>			
8:00	.....	.....	C.E. 31
9:00	Math. 131	.....	C.E. 31
10:00	C.E. 31	Math. 134	Math. 131
11:00	C.E. 31	.....	.....
12:00	.....	.....	.....
1:00	C.E. 14	C.E. 51	Mat. Lab. M.M. 141
2:00	C.E. 14	C.E. 51	Mat. Lab. M.M. 141
3:00	C.E. 14	C.E. 51	Mat. Lab. M.M. 141
4:00	C.E. 14	C.E. 51	.....
<b>WEDNESDAY</b>			
8:00	Elec.	Elec.	.....
9:00	C.E. 31	C.E. 31	Math. 134
10:00	Math. 134	Math. 131	C.E. 31
11:00	.....	.....	Elec.
12:00	.....	.....	.....
1:00	C.E. 14	C.E. 31	C.E. 51
2:00	C.E. 14	C.E. 31	C.E. 51
3:00	C.E. 14	C.E. 31	C.E. 51
4:00	C.E. 14	C.E. 31	C.E. 51
<b>THURSDAY</b>			
8:00	.....	C.E. 31	.....
9:00	Math. 131	C.E. 31	.....
10:00	.....	Mat. 134	Math. 131
11:00	Convocation	Convocation	Convocation
12:00	.....	.....	.....
1:00	C.E. 51	Mat. Lab. 141	C.E. 14
2:00	C.E. 51	Mat. Lab. 141	C.E. 14
3:00	C.E. 51	Mat. Lab. 141	C.E. 14
4:00	C.E. 51	.....	C.E. 14
<b>FRIDAY</b>			
8:00	Elec.	Elec.	.....
9:00	C.E. 51	C.E. 51	C.E. 51
10:00	Math. 134	Math. 131	Math. 131
11:00	.....	.....	Elec.
12:00	.....	.....	.....
1:00	C.E. 51	C.E. 14	C.E. 31
2:00	C.E. 51	C.E. 14	C.E. 31
3:00	C.E. 51	C.E. 14	C.E. 31
4:00	C.E. 51	C.E. 14	C.E. 31
<b>SATURDAY</b>			
8:00	.....	C.E. 14	C.E. 51
9:00	Math. 131	C.E. 14	C.E. 51
10:00	.....	C.E. 14	C.E. 51
11:00	.....	C.E. 14	C.E. 51

FALL QUARTER, 1921-22

JUNIOR ENGINEERS

ELECTRICAL		MONDAY		ELECTRICAL	
1		2		3	
8:00	.....	.....	.....	Elec.	.....
9:00	E.E. 111	E.E. 111	E.E. 111	E.E. 111	.....
10:00	Math. 131	Math. 131	Math. 131	.....	.....
11:00	Elec.	Elec.	Elec.	Math. 131	.....
12:00	.....	.....	.....	.....	.....
1:00	E.E. 112	E.E. 61 (Lab. sec. 1)	E.E. 61 (Lab. sec. 1)	Phys. 144	.....
2:00	E.E. 112	E.E. 61 (Lab. sec. 1)	E.E. 61 (Lab. sec. 1)	Phys. 144	.....
3:00	E.E. 112	E.E. 61 (Lab. sec. 1)	E.E. 61 (Lab. sec. 1)	.....	.....
4:00	E.E. 112	.....	.....	.....	.....
<b>TUESDAY</b>					
8:00	.....	Phys. 144	Phys. 144	E.E. 112	.....
9:00	Mat. Lab. 141	Phys. 144	Phys. 144	E.E. 112	.....
10:00	Mat. Lab. 141	Math. 134	Math. 134	E.E. 112	.....
11:00	Mat. Lab. 141	.....	.....	E.E. 112	.....
12:00	.....	.....	.....	.....	.....
1:00	Phys. 144	E.E. 112	E.E. 112	.....	.....
2:00	Phys. 144	E.E. 112	E.E. 112	.....	.....
3:00	.....	E.E. 112	E.E. 112	.....	.....
4:00	.....	E.E. 112	E.E. 112	.....	.....
<b>WEDNESDAY</b>					
8:00	.....	.....	.....	Elec.	.....
9:00	E.E. 111	E.E. 111	E.E. 111	E.E. 111	.....
10:00	Math. 131	Math. 131	Math. 131	.....	.....
11:00	Elec.	Elec.	Elec.	Math. 131	.....
12:00	.....	.....	.....	.....	.....
1:00	E.E. 61 (Lect.)	E.E. 61 (Lect.)	E.E. 61 (Lect.)	.....	.....
2:00	E.E. 61 (Lab. sec. 2)	.....	.....	.....	.....
3:00	E.E. 61 (Lab. sec. 2)	.....	.....	.....	.....
4:00	E.E. 61 (Lab. sec. 2)	.....	.....	.....	.....
<b>THURSDAY</b>					
8:00	Math. 134	.....	.....	Mat. Lab. 141	.....
9:00	Phys. 144	.....	.....	Mat. Lab. 141	.....
10:00	Phys. 144	Math. 134	Math. 134	Mat. Lab. 141	.....
11:00	Convocation	Convocation	Convocation	Convocation	.....
12:00	.....	.....	.....	.....	.....
1:00	.....	Phys. 144	Phys. 144	Math. 134	.....
2:00	.....	Phys. 144	Phys. 144	.....	.....
3:00	Phys. 144	Phys. 144	Phys. 144	Phys. 144	.....
4:00	Phys. 144	Phys. 144	Phys. 144	Phys. 144	.....
<b>FRIDAY</b>					
8:00	.....	.....	.....	Elec.	.....
9:00	E.E. 111	E.E. 111	E.E. 111	E.E. 111	.....
10:00	Math. 131	Math. 131	Math. 131	.....	.....
11:00	Elec.	Elec.	Elec.	Math. 131	.....
12:00	.....	.....	.....	.....	.....
1:00	E.E. 61 (Lab. sec. 3)	.....	.....	Phys. 144	.....
2:00	E.E. 61 (Lab. sec. 3)	.....	.....	Phys. 144	.....
3:00	E.E. 61 (Lab. sec. 3)	.....	.....	.....	.....
4:00	.....	.....	.....	.....	.....
<b>SATURDAY</b>					
8:00	Math. 134	.....	.....	.....	.....
9:00	.....	Mat. Lab. 141	Mat. Lab. 141	.....	.....
10:00	.....	Mat. Lab. 141	Mat. Lab. 141	Math. 134	.....
11:00	.....	Mat. Lab. 141	Mat. Lab. 141	.....	.....

86 COLLEGE OF ENGINEERING AND ARCHITECTURE

FALL QUARTER, 1921-22

JUNIOR ENGINEERS

MECHANICAL		MONDAY	ARCHITECTS
I		MECHANICAL	
		2	
8:00	.....	Math. 131	C.E. 38
9:00	M.E. 32	M.E. 42	C.E. 38
10:00	M.E. 42	.....	Arch. 17
11:00	Elec.	Elec.	Elec.
12:00	.....	.....	.....
1:00	Mat. Lab. 141	M.E. 81	Arch. 37
2:00	Mat. Lab. 141	M.E. 81	Arch. 37
3:00	Mat. Lab. 141	M.E. 81	Arch. 37
4:00	.....	M.E. 81	.....
<b>TUESDAY</b>			
8:00	Math. 131	.....	C.E. 38
9:00	M.E. 32	Math. 134	C.E. 38
10:00	M.E. 90	M.E. 32	.....
11:00	.....	M.E. 90	.....
12:00	.....	.....	.....
1:00	.....	.....	Arch. 37
2:00	.....	.....	Arch. 37
3:00	.....	.....	Arch. 37
4:00	.....	.....	Arch. 37
<b>WEDNESDAY</b>			
8:00	.....	Math. 131	Arch. 27
9:00	Math. 134	M.E. 42	Arch. 27
10:00	M.E. 42	M.E. 32	Arch. 27
11:00	Elec.	Elec.	Elec.
12:00	.....	.....	.....
1:00	M.E. 81	.....	Arch. 37
2:00	M.E. 81	R.O.T.C.*	Arch. 37
3:00	M.E. 81	R.O.T.C.*	Arch. 37
4:00	M.E. 81	R.O.T.C.*	.....
<b>THURSDAY</b>			
8:00	Math. 131	.....	C.E. 38
9:00	M.E. 32	.....	C.E. 38
10:00	.....	M.E. 32	Arch. 17
11:00	Convocation	Convocation	Convocation
12:00	.....	.....	.....
1:00	.....	M.E. 81	Arch. 37
3:00	.....	M.E. 81	Arch. 37
3:00	.....	M.E. 81	Arch. 37
4:00	.....	M.E. 81	Arch. 37
<b>FRIDAY</b>			
8:00	.....	Math. 131	Arch. 27
9:00	Math. 134	M.E. 42	Arch. 27
10:00	M.E. 42	.....	Arch. 27
11:00	Elec.	Elec.	Elec.
12:00	.....	.....	.....
1:00	M.E. 81	Mat. Lab. 141	Arch. 37
2:00	M.E. 81	Mat. Lab. 141	Arch. 37
3:00	M.E. 81	Mat. Lab. 141	Arch. 37
4:00	M.E. 81	.....	Arch. 37
<b>SATURDAY</b>			
8:00	Math. 131	.....	Arch. 37
9:00	M.E. 32	Math. 134	Arch. 37
10:00	.....	M.E. 32	Arch. 37
11:00	M.E. 90	M.E. 90	Arch. 37

\* Elective.

PROGRAM

FALL QUARTER, 1921-22

SENIOR ENGINEERS

MONDAY

CIVIL  
1

CIVIL  
2

8:00 Elec.  
9:00 C.E. 161  
10:00 .....  
11:00 .....  
12:00 .....  
1:00 C.E. 121  
2:00 C.E. 121  
3:00 C.E. 121  
4:00 C.E. 121

Elec.  
C.E. 161  
C.E. 132\*  
M.E. 149

TUESDAY

8:00 C.E. 161  
9:00 C.E. 161  
10:00 C.E. 131  
11:00 .....  
12:00 .....  
1:00 C.E. 141  
2:00 C.E. 141  
3:00 C.E. 141  
4:00 C.E. 141

C.E. 161  
C.E. 161  
C.E. 161  
C.E. 161  
C.E. 121  
C.E. 121  
C.E. 121  
C.E. 121

WEDNESDAY

8:00 Elec.  
9:00 C.E. 121  
10:00 C.E. 121  
11:00 .....  
12:00 .....  
1:00 C.E. 161  
2:00 C.E. 161  
3:00 C.E. 161  
4:00 C.E. 161

Elec. or C.E. 132\*  
C.E. 132\*  
C.E. 132\*  
M.E. 149  
..... or M.E. 149  
..... or M.E. 149  
..... or M.E. 149  
..... or M.E. 149

THURSDAY

8:00 C.E. 141  
9:00 C.E. 141  
10:00 C.E. 141  
11:00 Convocation  
12:00 .....  
1:00 C.E. 131  
2:00 C.E. 131  
3:00 C.E. 131  
4:00 C.E. 131

C.E. 132\*  
C.E. 132\*  
C.E. 132\*  
Convocation  
C.E. 121  
C.E. 121  
C.E. 161  
C.E. 161

FRIDAY

8:00 Elec.  
9:00 C.E. 161  
10:00 C.E. 121  
11:00 .....  
12:00 .....  
1:00 C.E. 131  
2:00 C.E. 131  
3:00 C.E. 131  
4:00 C.E. 131

Elec.  
C.E. 161  
C.E. 121  
M.E. 149  
M.E. 149 or R.O.T.C.\*  
M.E. 149 or R.O.T.C.\*  
M.E. 149 or R.O.T.C.\*  
M.E. 149 or .....

SATURDAY

8:00 .....  
9:00 .....  
10:00 .....  
11:00 .....

C.E. 231\*  
C.E. 231\*  
C.E. 231\*  
C.E. 231\*

\* Elective.

FALL QUARTER, 1921-22

SENIOR ENGINEERS

	ELECTRICAL 1	MONDAY ELECTRICAL 2	ELECTRICAL 3
8:00	Elec.	Elec.	Elec.
9:00	.....	E.E. 132 (Sec. 2)	E.E. 132 (Sec. 2)
10:00	E.E. 12 (Sec. 1)	E.E. 132 (Sec. 2)	E.E. 132 (Sec. 2)
11:00	E.E. 151*	E.E. 121	E.E. 121
12:00	.....	.....	.....
1:00	E.E. 161*	.....	.....
2:00	E.E. 161*	.....	.....
3:00	E.E. 161*	.....	.....
4:00	.....	.....	.....
		<b>TUESDAY</b>	
8:00	E.E. 132 (Sec. 1)	E.E. 132 (Sec. 1 & 2)	E.E. 132 (Sec. 2)
9:00	E.E. 132 (Sec. 1)	E.E. 132 (Sec. 1)	M.E. 144
10:00	E.E. 132 (Sec. 1)	E.E. 132 (Sec. 1)	M.E. 144
11:00	.....	.....	M.E. 144
12:00	.....	.....	.....
1:00	M.E. 144	.....	E.E. 161*
2:00	M.E. 144	.....	E.E. 161*
3:00	M.E. 144	.....	E.E. 161*
4:00	.....	.....	.....
		<b>WEDNESDAY</b>	
8:00	Elec.	Elec.	Elec.
9:00	M.E. 144	M.E. 144 or .....	.....
10:00	E.E. 121	..... or M.E. 144	M.E. 144
11:00	E.E. 151*	E.E. 121	E.E. 121
12:00	.....	.....	.....
1:00	E.E. 152*	E.E. 122	C.E. 37*
2:00	E.E. 152*	E.E. 122	C.E. 37*
3:00	E.E. 152*	E.E. 122	C.E. 37*
4:00	.....	E.E. 122	.....
		<b>THURSDAY</b>	
8:00	E.E. 161*	E.E. 132 (Sec. 2)	E.E. 132 (Sec. 2)
9:00	E.E. 141*	E.E. 132 (Sec. 2)	E.E. 132 (Sec. 2)
10:00	.....	E.E. 132 (Sec. 2)	E.E. 132 (Sec. 2)
11:00	Convocation	Convocation	Convocation
12:00	.....	.....	.....
1:00	E.E. 132 (Sec. 1)	E.E. 132 (Sec. 1)	E.E. 122
2:00	E.E. 132 (Sec. 1)	E.E. 132 (Sec. 1)	E.E. 122
3:00	E.E. 132 (Sec. 1)	E.E. 132 (Sec. 1)	E.E. 122
4:00	.....	.....	E.E. 122
		<b>FRIDAY</b>	
8:00	Elec.	Elec.	Elec.
9:00	M.E. 144	M.E. 144 or .....	.....
10:00	E.E. 121	..... or M.E. 144	M.E. 144
11:00	.....	E.E. 121	E.E. 121
12:00	.....	.....	.....
1:00	E.E. 122	E.E. 161*	C.E. 37*
2:00	E.E. 122	E.E. 161*	C.E. 37*
3:00	E.E. 122	E.E. 161*	C.E. 37*
4:00	E.E. 122	.....	C.E. 37*
		<b>SATURDAY</b>	
8:00	E.E. 161*	.....	.....
9:00	E.E. 141*	M.E. 144 (Sec. 2)	.....
10:00	.....	M.E. 144 (Sec. 2)	.....
11:00	.....	M.E. 144 (Sec. 2)	.....

\* Elective.

PROGRAM

FALL QUARTER, 1921-22

SENIOR ENGINEERS

MONDAY

MECHANICAL

ARCHITECTS

8:00	.....	Arch. 131
9:00	M.E. 151	Arch. 131
10:00	.....	Arch. 17
11:00	.....	Arch. 151
12:00	.....	.....
1:00	M.E. 231	Arch. 131
2:00	M.E. 231	Arch. 131
3:00	M.E. 231	Arch. 131
4:00	M.E. 231	Arch. 131

TUESDAY

8:00	M.E. 182 (Sec. 1)	E. E. 40
9:00	M.E. 182 (Sec. 1)	.....
10:00	M.E. 182 (Sec. 1 & 2)	Arch. 141
11:00	M.E. 182 (Sec. 1 & 2)	.....
12:00	.....	.....
1:00	M.E. 182 (Sec. 1 & 2)	Arch. 131
2:00	M.E. 182 (Sec. 1 & 2)	Arch. 131
3:00	M.E. 182 (Sec. 2)	Arch. 131
4:00	M.E. 182 (Sec. 2)	Arch. 131

WEDNESDAY

8:00	.....	Arch. 131
9:00	E.E. 44	Arch. 131
10:00	E.E. 44	Arch. 151
11:00	.....	.....
12:00	.....	.....
1:00	.....	Arch. 131
2:00	.....	Arch. 131
3:00	.....	Arch. 131
4:00	.....	Arch. 131

THURSDAY

8:00	E.E. 44	E.E. 40
9:00	M.E. 151	.....
10:00	M.E. 190	Arch. 17
11:00	Convocation	Convocation
12:00	.....	.....
1:00	M.E. 231	Arch. 131
2:00	M.E. 231	Arch. 131
3:00	M.E. 231	Arch. 131
4:00	M.E. 231	Arch. 131

FRIDAY

8:00	.....	Arch. 131
9:00	E.E. 44	Arch. 131
10:00	E.E. 44	Arch. 141
11:00	.....	Arch. 161
12:00	.....	.....
1:00	R.O.T.C.*	Arch. 131
2:00	R.O.T.C.*	Arch. 131
3:00	R.O.T.C.*	Arch. 131
4:00	.....	Arch. 131

SATURDAY

8:00	E.E. 44	Arch. 131
9:00	M.E. 151	Arch. 131
10:00	.....	Arch. 131
11:00	M.E. 190	Arch. 131

\* Elective.



WINTER QUARTER, 1921-22

FRESHMAN ENGINEERS

MONDAY

	1	2	3	4
8:30	Draw. 2	Draw. 2	Draw. 2	Draw. 2
9:30	Draw. 2	Draw. 2	Draw. 2	Draw. 2
10:30	Chem. 5	Chem. 5	Chem. 5	Chem. 5
11:30	Math. 12	Math. 12	Math. 12	Math. 12
12:30	.....			
1:50	Drill	Drill	Drill	Drill
2:30	M.E. 12	M.E. 12	M.E. 12	M.E. 12
3:30	M.E. 12	M.E. 12	M.E. 12	M.E. 12
4:30	M.E. 12	M.E. 12	M.E. 12	M.E. 12

TUESDAY

8:30	Chem. Lab. 5	Chem. Lab. 5	Chem. Lab. 5	Chem. Lab. 5
9:30	Chem. Lab. 5	Chem. Lab. 5	Chem. Lab. 5	Chem. Lab. 5
10:30	Chem. Lab. 5	Chem. Lab. 5	Chem. Lab. 5	Chem. Lab. 5
11:30	Math. 12	Math. 12	Math. 12	Math. 12
12:30	.....			
1:30	.....	.....	.....	.....
2:30	.....	.....	.....	.....
3:30	.....	.....	.....	.....
4:30	.....	.....	.....	Hygiene

WEDNESDAY

8:30	Draw. 2	Draw. 2	Draw. 2	Draw. 2
9:30	Draw. 2	Draw. 2	Draw. 2	Draw. 2
10:30	Chem. 5	Chem. 5	Chem. 5	Chem. 5
11:30	Math. 12	.....	Math. 12	Math. 12
12:30	.....			
1:30	Drill	Drill	Drill	Drill
2:30	Draw. 2	Draw. 2	Draw. 2	Draw. 2
3:30	Draw. 2	Draw. 2	Draw. 2	Draw. 2
4:30	Hygiene	Hygiene	Hygiene	.....

THURSDAY

8:30	M.E. 12	M.E. 12	M.E. 12	M.E. 12
9:30	M.E. 12	M.E. 12	M.E. 12	M.E. 12
10:30	M.E. 12	M.E. 12	M.E. 12	M.E. 12
11:30	Convocation	Convocation	Convocation	Convocation
12:30	.....			
1:30	Math. 12	Math. 12	.....	.....
2:30	.....	.....	.....	.....
3:30	.....	.....	.....	.....
4:30	Orientation	Orientation	Orientation	Orientation

FRIDAY

8:30	.....	.....	.....	.....
9:30	.....	.....	Math. 12	.....
10:30	Chem. 5	Chem. 5	Chem. 5	Chem. 5
11:30	Math. 12	Math. 12	.....	Math. 12
12:30	.....			
1:30	Drill	Drill	Drill	Drill
2:30	.....	.....	.....	.....
3:30	.....	.....	.....	.....
4:30	.....	.....	.....	.....

SATURDAY

8:30	Draw. 2	Draw. 2	Draw. 2	Draw. 2
9:30	Draw. 2	Draw. 2	Draw. 2	Draw. 2
10:30	.....	.....	.....	.....
11:30	.....	Math. 12	Math. 12	Math. 12

# PROGRAM

91

WINTER QUARTER, 1921-22

FRESHMAN ENGINEERS

## MONDAY

	5	6	7	8
8:30	.....	Draw. 2	.....	.....
9:30	.....	Draw. 2	Math. 11	.....
10:30	Chem. 5	Chem. 5	Draw. 1	Math. 11
11:30	Math. 11	Math. 11	Draw. 1	.....
12:30	.....			
1:30	Drill	Drill	Draw. 1	Draw. 2
2:30	M.E. 12	M.E. 12	Draw. 1	Draw. 2
3:30	M.E. 12	M.E. 12	.....	.....
4:30	M.E. 12	M.E. 12	Drill	Drill

## TUESDAY

8:30	Chem. Lab. 5	Chem. Lab. 5	Chem. 5	Chem. 5
9:30	Chem. Lab. 5	Chem. Lab. 5	Math. 11	.....
10:30	Chem. Lab. 5	Chem. Lab. 5	.....	Math. 11
11:30	Math. 11	Math. 11	.....	.....
12:30	.....			
1:30	.....	.....	Draw. 1	Draw. 2
2:30	.....	.....	Draw. 1	Draw. 2
3:30	Draw. 1	.....	.....	.....
4:30	Draw. 1	Hygiene	Hygiene	Hygiene

## WEDNESDAY

8:30	.....	Draw. 2	.....	.....
9:30	.....	Draw. 2	M.E. 12	M.E. 12
10:30	Chem. 5	Chem. 5	M.E. 12	M.E. 12
11:30	Math. 11	Math. 11	M.E. 12	M.E. 12
12:30	.....			
1:30	Drill	Drill	Chem. Lab. 5	Chem. Lab. 5
2:30	.....	.....	Chem. Lab. 5	Chem. Lab. 5
3:30	.....	.....	Chem. Lab. 5	Chem. Lab. 5
4:30	Hygiene	.....	Drill	Drill

## THURSDAY

8:30	M.E. 12	M.E. 12	Chem. 5	Chem. 5
9:30	M.E. 12	M.E. 12	Math. 11	.....
10:30	M.E. 12	M.E. 12	.....	Math. 11
11:30	Convocation	Convocation	Convocation	Convocation
12:30	.....			
1:30	Math. 11	.....	.....	Draw. 2
2:30	.....	.....	.....	Draw. 2
3:30	.....	.....	.....	.....
4:30	Orientation	Orientation	Orientation	Orientation

## FRIDAY

8:30	Draw. 1	Draw. 2	.....	Draw. 2
9:30	Draw. 1	Draw. 2	Math. 11	Draw. 2
10:30	Chem. 5	Chem. 5	Draw. 1	Math. 11
11:30	Math. 11	Math. 11	Draw. 1	.....
12:30	.....			
1:30	Drill	Drill	M.E. 12	M.E. 12
2:30	Draw. 1	.....	M.E. 12	M.E. 12
3:30	Draw. 1	.....	M.E. 12	M.E. 12
4:30	.....	.....	Drill	Drill

## SATURDAY

8:30	Math. 11	Draw. 2	Chem. 5	Chem. 5
9:30	.....	Draw. 2	Math. 11	.....
10:30	Draw. 1	.....	.....	Math. 11
11:30	Draw. 1	Math. 11	.....	.....

92 COLLEGE OF ENGINEERING AND ARCHITECTURE

WINTER QUARTER, 1921-22

FRESHMAN ENGINEERS

	9	10	11	12
<b>MONDAY</b>				
8:30	.....	.....	.....	.....
9:30	Math. 12	Math. 12	.....	.....
10:30	.....	Draw. 1	Math. 12	Math. 11
11:30	.....	Draw. 1	.....	.....
12:30	.....			
1:30	.....	.....	Draw. 2	Draw. 2
2:30	.....	.....	Draw. 2	Draw. 2
3:30	.....	.....	.....	.....
4:30	Drill	Drill	Drill	Drill
<b>TUESDAY</b>				
8:30	Chem. 5	Chem. 5	Chem. 5	Chem. 5
9:30	Math. 12	Math. 12	.....	.....
10:30	Draw. 1	.....	Math. 12	Math. 11
11:30	Draw. 1	.....	.....	.....
12:30	.....			
1:30	Draw. 1	Draw. 1	Draw. 2	Draw. 2
2:30	Draw. 1	Draw. 1	Draw. 2	Draw. 2
3:30	.....	.....	.....	.....
4:30	Hygiene	Hygiene	Hygiene	Hygiene
<b>WEDNESDAY</b>				
8:30	.....	.....	.....	.....
9:30	M.E. 12	M.E. 12	M.E. 12	M.E. 12
10:30	M.E. 12	M.E. 12	M.E. 12	M.E. 12
11:30	M.E. 12	M.E. 12	M.E. 12	M.E. 12
12:30	.....			
1:30	Chem. Lab. 5	Chem. Lab. 5	Chem. Lab. 5	Chem. Lab. 5
2:30	Chem. Lab. 5	Chem. Lab. 5	Chem. Lab. 5	Chem. Lab. 5
3:30	Chem. Lab. 5	Chem. Lab. 5	Chem. Lab. 5	Chem. Lab. 5
4:30	Drill	Drill	Drill	Drill
<b>THURSDAY</b>				
8:30	Chem. 5	Chem. 5	Chem. 5	Chem. 5
9:30	Math. 12	Math. 12	.....	.....
10:30	.....	.....	Math. 12	Math. 11
11:30	Convocation	Convocation	Convocation	Convocation
12:30	.....			
1:30	Draw. 1	Draw. 1	Draw. 2	Draw. 2
2:30	Draw. 1	Draw. 1	Draw. 2	Draw. 2
3:30	.....	.....	.....	.....
4:30	Orientation	Orientation	Orientation	Orientation
<b>FRIDAY</b>				
8:30	.....	.....	Draw. 2	Draw. 2
9:30	Math. 12	Math. 12	Draw. 2	Draw. 2
10:30	.....	Draw. 1	Math. 12	Math. 11
11:30	.....	Draw. 1	.....	.....
12:30	.....			
1:30	M.E. 12	M.E. 12	M.E. 12	M.E. 12
2:30	M.E. 12	M.E. 12	M.E. 12	M.E. 12
3:30	M.E. 12	M.E. 12	M.E. 12	M.E. 12
4:30	Drill	Drill	Drill	Drill
<b>SATURDAY</b>				
8:30	Chem. 5	Chem. 5	Chem. 5	Chem. 5
9:30	Math. 12	Math. 12	.....	.....
10:30	Draw. 1	.....	Math. 12	Math. 11
11:30	Draw. 1	.....	.....	.....

# PROGRAM

93

WINTER QUARTER, 1921-22

FRESHMAN ENGINEERS

## MONDAY

	13	14	15	16
8:30	Math. 11	.....	Math. 12	Math. 11
9:30	Chem. Lab. 15	Chem. Lab. 15	Chem. Lab. 15	Chem. Lab. 15
10:30	Chem. Lab. 15	Chem. Lab. 15	Chem. Lab. 15	Chem. Lab. 15
11:30	Chem. Lab. 15	Chem. Lab. 15	Chem. Lab. 15	Chem. Lab. 15
12:30	.....			
1:30	Drill	Drill	Drill	Drill
2:30	.....	.....	.....	.....
3:30	.....	.....	.....	.....
4:30	.....	.....	.....	.....

## TUESDAY

8:30	Math. 11	Math. 12	Math. 12	Math. 11
9:30	Chem. 15	Chem. 15	Chem. 15	Chem. 15
10:30	Draw. 2	Draw. 2	Draw. 2	Draw. 1
11:30	Draw. 2	Draw. 2	Draw. 2	Draw. 1
12:30	.....			
1:30	.....	.....	.....	.....
2:30	M.E. 12	M.E. 12	M.E. 12	M.E. 12
3:30	M.E. 12	M.E. 12	M.E. 12	M.E. 12
4:30	M.E. 12	M.E. 12	M.E. 12	M.E. 12

## WEDNESDAY

8:30	Math. 11	Math. 12	.....	Math. 11
9:30	.....	.....	.....	.....
10:30	Draw. 2	Draw. 2	Draw. 2	.....
11:30	Draw. 2	Draw. 2	Draw. 2	.....
12:30	.....			
1:30	Drill	Drill	Drill	Drill
2:30	.....	.....	.....	Draw. 1
3:30	.....	.....	.....	Draw. 1
4:30	Hygiene	Hygiene	Hygiene	Hygiene

## THURSDAY

8:30	Math. 11	Math. 12	Math. 12	.....
9:30	Chem. 15	Chem. 15	Chem. 15	Chem. 15
10:30	.....	.....	.....	.....
11:30	Convocation	Convocation	Convocation	Convocation
12:30	.....			
1:30	M.E. 12	M.E. 12	M.E. 12	M.E. 12
2:30	M.E. 12	M.E. 12	M.E. 12	M.E. 12
3:30	M.E. 12	M.E. 12	M.E. 12	M.E. 12
4:30	Orientation	Orientation	Orientation	Orientation

## FRIDAY

8:30	.....	Math. 12	Math. 12	Math. 11
9:30	Chem. Lab. 15	Chem. Lab. 15	Chem. Lab. 15	Chem. Lab. 15
10:30	Chem. Lab. 15	Chem. Lab. 15	Chem. Lab. 15	Chem. Lab. 15
11:30	Chem. Lab. 15	Chem. Lab. 15	Chem. Lab. 15	Chem. Lab. 15
12:30	.....			
1:30	Drill	Drill	Drill	Drill
2:30	.....	.....	.....	Draw. 1
3:30	Draw. 2	Draw. 2	Draw. 2	Draw. 1
4:30	Draw. 2	Draw. 2	Draw. 2	.....

## SATURDAY

8:30	Math. 11	Math. 12	Math. 12	Math. 11
9:30	Chem. 5	Chem. 5	Chem. 5	Chem. 5
10:30	Draw. 2	Draw. 2	Draw. 2	Draw. 1
11:30	Draw. 2	Draw. 2	Draw. 2	Draw. 1

94 COLLEGE OF ENGINEERING AND ARCHITECTURE

WINTER QUARTER, 1921-22

FRESHMAN ENGINEERS

MONDAY

17

8:30	Math. 11
9:30	Drill
10:30	.....
11:30	.....
12:30	.....
1:30	Rhet. B
2:30	M.E. 11
3:30	M.E. 11
4:30	M.E. 11

TUESDAY

8:30	Math. 11
9:30	.....
10:30	Draw. 1
11:30	Draw. 1
12:30	.....
1:30	Rhet. A
2:30	M.E. 12
3:30	M.E. 12
4:30	M.E. 12

WEDNESDAY

8:30	Math. 11
9:30	Drill
10:30	Rhet. B
11:30	.....
12:30	.....
1:30	.....
2:30	Draw. 1
3:30	Draw. 1
4:30	Hygiene

THURSDAY

8:30	M.E. 11
9:30	M.E. 11
10:30	M.E. 11
11:30	Convocation
12:30	.....
1:30	Rhet. A
2:30	M.E. 12
3:30	M.E. 12
4:30	Orientation

FRIDAY

8:30	Math. 11
9:30	Drill
10:30	.....
11:30	.....
12:30	.....
1:30	Rhet. A
2:30	Draw. 1
3:30	Draw. 1
4:30	.....

SATURDAY

8:30	Math. 11
9:30	.....
10:30	Draw. 1
11:30	Draw. 1

PROGRAM

WINTER QUARTER, 1921-22

FRESHMAN ARCHITECTS

MONDAY

	1		2
8:30	Math. 12		Math. 11
9:30	Arch. 22		Arch. 31
10:30	Arch. 22		Arch. 31
11:30	Rhet. 5		Arch. 31
12:30	.....		.....
1:30	Arch. 32		Arch. 22
2:30	Arch. 32		Arch. 22
3:30	Arch. 32		.....
4:30	Drill		Drill

TUESDAY

8:30	Math. 12		Math. 11
9:30	Draw. 32		Draw. 32
10:30	.....		Rhet. 5
11:30	Arch. 32		Arch. 31
12:30	.....		.....
1:30	.....		.....
2:30	.....		.....
3:30	.....		.....
4:30	Hygiene		Hygiene

WEDNESDAY

8:30	Math. 12		Math. 11
9:30	Arch. 22		Arch. 31
10:30	Arch. 22		Arch. 31
11:30	Rhet. 5		Arch. 31
12:30	.....		.....
1:30	Arch. 32		Arch. 22
2:30	Arch. 32		Arch. 22
3:30	Arch. 32		.....
4:30	Drill		Drill

THURSDAY

8:30	Math. 12		Math. 11
9:30	Draw. 32		Draw. 32
10:30	.....		Rhet. 5
11:30	Convocation		Convocation
12:30	.....		.....
1:30	.....		.....
2:30	.....		.....
3:30	.....		.....
4:30	Orientation		Orientation

FRIDAY

8:30	Math. 12		Math. 11
9:30	Arch. 22		Arch. 31
10:30	Arch. 22		Arch. 31
11:30	Rhet. 5		Arch. 31
12:30	.....		.....
1:30	Arch. 32		Arch. 22
2:30	Arch. 32		Arch. 22
3:30	Arch. 32		.....
4:30	Drill		Drill

SATURDAY

8:30	.....		.....
9:30	.....		.....
10:30	.....		Rhet. 5
11:30	Arch. 32		Arch. 31

96 COLLEGE OF ENGINEERING AND ARCHITECTURE

WINTER QUARTER, 1921-22

SOPHOMORE ENGINEERS

MONDAY			
CIVIL	CIVIL	CIVIL	CIVIL
1	2	3	4
8:30	Draw. 22	Draw. 22	Drill
9:30	Draw. 22	Draw. 22	Math. 24
10:30	Math. 25	Phys. 23	Draw. 22
11:30	C.E. 12	C.E. 12	Draw. 22
12:30	.....		
1:30	Phys. 23	Rhet. 5	Phys. 23*
2:30	.....	.....	.....
3:30	Drill	Drill	Phys. 3*
4:30	.....	.....	.....
TUESDAY			
8:30	C.E. 12	.....	Rhet. 5
9:30	C.E. 12	.....	Math. 24
10:30	C.E. 12	.....	Phys. Lab. 24
11:30	C.E. 12	Math. 25	Phys. Lab. 24
12:30	.....		
1:30	.....	C.E. 12	Draw. 22
2:30	Rhet. 5	C.E. 12	Draw. 22
3:30	.....	C.E. 12	.....
4:30	.....	C.E. 12	.....
WEDNESDAY			
8:30	Draw. 22	Draw. 22	Drill
9:30	Draw. 22	Draw. 22	Math. 24
10:30	Math. 25	Phys. 23	Draw. 22
11:30	.....	Math. 25	Draw. 22
12:30	.....		
1:30	Phys. 23	Rhet. 5	Phys. 23*
2:30	.....	.....	.....
3:30	Drill	Drill	Phys. 3*
4:30	Phys. 23	Phys. 23	Phys. 23 or 3
THURSDAY			
8:30	C.E. 12	Phys. Lab. 24	Rhet. 5
9:30	C.E. 12	Phys. Lab. 24	Math. 24
10:30	C.E. 12	.....	.....
11:30	Convocation	Convocation	Convocation
12:30	.....		
1:30	Math. 25	Math. 25	C.E. 12
2:30	Rhet. 5	.....	C.E. 12
3:30	.....	.....	C.E. 12
4:30	.....	.....	C.E. 12
FRIDAY			
8:30	Draw. 22	Draw. 22	Drill
9:30	Draw. 22	Draw. 22	C.E. 12
10:30	Math. 25	Phys. 23	C.E. 12
11:30	.....	Math. 25	C.E. 12
12:30	.....		
1:30	Phys. 23	Rhet. 5	Phys. 23*
2:30	.....	.....	C.E. 12
3:30	Drill	Drill	Phys. 3*
4:30	.....	.....	.....
SATURDAY			
8:30	Phys. Lab. 24	C.E. 12	Rhet. 4
9:30	Phys. Lab. 24	C.E. 12	Math. 24
10:30	Math. 25	C.E. 12	.....
11:30	Rhet. 5	Math. 25	.....

\* Students will not be permitted to register for both Physics 3 and Physics 23.

WINTER QUARTER, 1921-22

SOPHOMORE ENGINEERS

MONDAY

ELECTRICAL 1		ELECTRICAL 2		ELECTRICAL 3		ELECTRICAL 4	
8:30	Drill	Math. 25		Drill		Math. 25	
9:30	Math. 25	Rhet. 5		.....		Phys. 23	
10:30	.....	.....		Phys. 23*		.....	
11:30	.....	.....		Math. 24		.....	
12:30	.....	.....		.....		.....	
1:30	Phys. 23	Phys. 23		E.E. 13 (Sec. E)		Phys. Lab. 24	
2:30	.....	.....		E.E. 13 (Sec. E)		Phys. Lab. 24	
3:30	Phys. Lab. 24	Drill		Phys. 3*		Drill	
4:30	Phys. Lab. 24	.....		.....		.....	

TUESDAY

8:30	Rhet. 5	Math. 25		Draw. 27		Draw. 27	
9:30	Math. 25	.....		Draw. 27		Draw. 27	
10:30	.....	.....		E.E. 13		E.E. 13	
11:30	E.E. 13	E.E. 13		Math. 24		.....	
12:30	.....	.....		.....		.....	
1:30	.....	E.E. 13 (Sec. C)		Rhet. 5		.....	
2:30	.....	E.E. 13 (Sec. C)		.....		Rhet. 5	
3:30	.....	.....		.....		E.E. 13 (Sec. G)	
4:30	.....	.....		.....		E.E. 13 (Sec. G)	

WEDNESDAY

8:30	Drill	Math. 25		Drill		Math. 25	
9:30	Math. 25	Rhet. 5		.....		Phys. 23	
10:30	E.E. 13 (Sec. A)	.....		Phys. 23*		Draw. 27	
11:30	E.E. 13 (Sec. A)	.....		Math. 24		Draw. 27	
12:30	.....	.....		.....		.....	
1:30	Phys. 23	Phys. 23		Phys. Lab. 24		E.E. 13 (Sec. H)	
2:30	.....	.....		Phys. Lab. 24		E.E. 13 (Sec. H)	
3:30	.....	Drill		Phys. 3*		Drill	
4:30	Phys. 23	Phys. 23		Phys. 23 or 3		Phys. 23	

THURSDAY

8:30	Rhet. 5	Math. 25		.....		Math. 25	
9:30	Draw. 27	Draw. 27		.....		.....	
10:30	Draw. 27	Draw. 27		E.E. 13		E.E. 13	
11:30	Convocation	Convocation		Convocation		Convocation	
12:30	.....	.....		.....		.....	
1:30	E.E. 13	E.E. 13		Rhet. 5		.....	
2:30	.....	E.E. 13 (Sec. D)		.....		Rhet. 5	
3:30	.....	E.E. 13 (Sec. D)		Draw. 27		.....	
4:30	.....	.....		Draw. 27		.....	

FRIDAY

8:30	Drill	Phys. Lab. 24		Drill		Math. 25	
9:30	Math. 25	Phys. Lab. 24		.....		Phys. 23	
10:30	Draw. 27	Draw. 27		Phys. 23*		.....	
11:30	Draw. 27	Draw. 27		Math. 24		.....	
12:30	.....	.....		.....		.....	
1:30	Phys. 23	Phys. 23		Draw. 27		Draw. 27	
2:30	E.E. 13 (Sec. B)	.....		Draw. 27		Draw. 27	
3:30	E.E. 13 (Sec. B)	Drill		Phys. 3*		Drill	
4:30	.....	.....		.....		.....	

SATURDAY

8:30	Rhet. 5	Math. 25		E.E. 13 (Sec. F)		Math. 25	
9:30	Math. 25	Rhet. 5		E.E. 13 (Sec. F)		.....	
10:30	Draw. 27	Draw. 27		Rhet. 5		.....	
11:30	Draw. 27	Draw. 27		Math. 24		Rhet. 5	

\* Students will not be permitted to register for both Physics 3 and Physics 23.



98 COLLEGE OF ENGINEERING AND ARCHITECTURE

WINTER QUARTER, 1921-22

SOPHOMORE ENGINEERS

MECHANICAL		MONDAY	ARCHITECTS
1		2	
8:30	Drill	Drill	Math. 92
9:30	Math. 25	Phys. 23	Phys. 23
10:30	Phys. 23	.....	Drill
11:30	Rhet. 5	Math. 25	Arch. 15
12:30	.....	.....	.....
1:30	M.E. 15	Draw. 29	Arch. 35
2:30	M.E. 15	Draw. 29	Arch. 35
3:30	M.E. 15	Phys. 3	Arch. 35
4:30	M.E. 15	.....	.....
TUESDAY			
8:30	.....	Phys. Lab. 24	Math. 92
9:30	Math. 25	Phys. Lab. 24	Arch. 25
10:30	Draw. 29	Rhet. 5	Arch. 25
11:30	Draw. 29	Math. 25	Arch. 25
12:30	.....	.....	.....
1:30	.....	.....	Arch. 35
2:30	M.E. 15	Draw. 29	Arch. 35
3:30	M.E. 15	Draw. 29	Arch. 35
4:30	M.E. 15	.....	.....
WEDNESDAY			
8:30	Drill	Drill	.....
9:30	Math. 25	Phys. 23*	Phys. 23
10:30	Phys. 23	Rhet. 5	Drill
11:30	Rhet. 5	Math. 25	Arch. 45
12:30	.....	.....	.....
1:30	Draw. 29	M.E. 15**	Arch. 45
2:30	Draw. 29	M.E. 15**	Arch. 45
3:30	.....	Phys. 3*	Arch. 45
4:30	Phys. 23	Phys. 23 or 3	.....
THURSDAY			
8:30	.....	M.E. 15	Math. 92
9:30	Math. 25	M.E. 15	Phys. 23
10:30	.....	M.E. 15	.....
11:30	Convocation	Convocation	Convocation
12:30	.....	.....	.....
1:30	Draw. 29	M.E. 15	Arch. 35
2:30	Draw. 29	M.E. 15	Arch. 35
3:30	.....	M.E. 15	Arch. 35
4:30	.....	M.E. 15	.....
FRIDAY			
8:30	Drill	Drill	Math. 92
9:30	Math. 25	Phys. 23	Phys. 23
10:30	Phys. 23	Rhet. 5	Drill
11:30	Rhet. 5	Math. 25	Arch. 15
12:30	.....	.....	.....
1:30	Phys. Lab. 24	M.E. 15	Arch. 35
2:30	Phys. Lab. 24	M.E. 15	Arch. 35
3:30	.....	M.E. 15 or Phys. 3	Arch. 35
4:30	.....	M.E. 15	.....
SATURDAY			
8:30	M.E. 15	Draw. 29	.....
9:30	M.E. 15	Draw. 29	Arch. 25
10:30	M.E. 15	.....	Arch. 25
11:30	M.E. 15	Math. 25	Arch. 25

\* Students will not be permitted to register for both Physics 3 and Physics 23.

\*\* Students taking Physics 3 will register for Mechanical Engineering 15 for these hours in place of seventh and eighth hours on Friday.

PROGRAM

WINTER QUARTER, 1921-22

JUNIOR ENGINEERS

CIVIL 1		MONDAY CIVIL 2		CIVIL 3	
8:30	Elec.	Elec.		.....	
9:30	C.E. 21	C.E. 21		Math. 135	
10:30	Math. 135	Math. 132		C.E. 32	
11:30	.....	.....		.....	
12:30	.....	.....		.....	
1:30	C.E. 21	C.E. 52		C.E. 21	
2:30	C.E. 21	C.E. 52		C.E. 21	
3:30	C.E. 21	C.E. 52		C.E. 21	
4:30	.....	.....		C.E. 21	
TUESDAY					
8:30	.....	.....		.....	
9:30	Math. 132	.....		.....	
10:30	.....	Math. 135		Math. 132	
11:30	C.E. 21	C.E. 21		.....	
12:30	.....	.....		.....	
1:30	C.E. 32	C.E. 52		.....	
2:30	C.E. 32	C.E. 52		C.E. 21	
3:30	C.E. 32	C.E. 52		C.E. 21	
4:30	C.E. 32	C.E. 52		C.E. 21	
WEDNESDAY					
8:30	Elec.	Elec.		.....	
9:30	C.E. 32	C.E. 32		Math. 135	
10:30	Math. 135	Math. 132		C.E. 32	
11:30	.....	.....		Elec.	
12:30	.....	.....		.....	
1:30	C.E. 32	C.E. 32		C.E. 52	
2:30	C.E. 21	C.E. 32		C.E. 52	
3:30	C.E. 21	C.E. 32		C.E. 52	
4:30	C.E. 21	C.E. 32		C.E. 52	
THURSDAY					
8:30	.....	.....		C.E. 32	
9:30	Math. 132	.....		C.E. 32	
10:30	.....	Math. 135		Math. 132	
11:30	Convocation	Convocation		Convocation	
12:30	.....	.....		.....	
1:30	C.E. 52	C.E. 21		Math. 135	
2:30	C.E. 52	C.E. 21		.....	
3:30	C.E. 52	C.E. 21		.....	
4:30	C.E. 52	.....		.....	
FRIDAY					
8:30	Elec.	Elec.		.....	
9:30	C.E. 52	C.E. 52		C.E. 52	
10:30	Math. 135	Math. 132		Math. 132	
11:30	.....	.....		Elec.	
12:30	.....	.....		.....	
1:30	C.E. 52	C.E. 21		C.E. 32	
2:30	C.E. 52	C.E. 21		C.E. 32	
3:30	C.E. 52	C.E. 21		C.E. 32	
4:30	.....	C.E. 21		C.E. 32	
SATURDAY					
8:30	.....	C.E. 32		C.E. 52	
9:30	Math. 132	C.E. 32		C.E. 52	
10:30	C.E. 32	Math. 135		C.E. 52	
11:30	C.E. 32	.....		C.E. 52	

100 COLLEGE OF ENGINEERING AND ARCHITECTURE

WINTER QUARTER, 1921-22

JUNIOR ENGINEERS

ELECTRICAL		MONDAY		ELECTRICAL	
1		2		3	
8:30	M.E. 33	M.E. 33		Elec.	
9:30	E.E. 113	E.E. 113		E.E. 113	
10:30	Math. 132	Math. 132		M.E. 33	
11:30	Elec.	Elec.		Math. 132	
12:30	.....				
1:30	E.E. 114	E.E. 53 (Lab.) (1)		.....	
2:30	E.E. 114	E.E. 53 (Lab.) (1)		.....	
3:30	E.E. 114	E.E. 53 (Lab.) (1)		.....	
4:30	E.E. 114	.....		.....	
TUESDAY					
8:30	.....	.....		E.E. 114	
9:30	Math. 135	.....		E.E. 114	
10:30	.....	Math. 135		E.E. 114	
11:30	.....	.....		E.E. 114	
12:30	.....				
1:30	.....	E.E. 114		Math. 135	
2:30	.....	E.E. 114		.....	
3:30	.....	E.E. 114		.....	
4:30	.....	E.E. 114		.....	
WEDNESDAY					
8:30	M.E. 33	M.E. 33		Elec.	
9:30	E.E. 113	E.E. 113		E.E. 113	
10:30	Math. 132	Math. 132		M.E. 33	
11:30	Elec.	Elec.		Math. 132	
12:30	.....				
1:30	E.E. 63 (Lect.)	E.E. 63 (Lect.)		.....	
2:30	E.E. 63 (Lab.) (2)	.....		.....	
3:30	E.E. 63 (2)	.....		.....	
4:30	E.E. 63 (2)	.....		.....	
THURSDAY					
8:30	.....	.....		.....	
9:30	Math. 135	.....		.....	
10:30	.....	Math. 135		Math. 135	
11:30	Convocation	Convocation		Convocation	
12:30	.....				
1:30	M.E. 33	M.E. 33		.....	
2:30	M.E. 33	M.E. 33		.....	
3:30	M.E. 33	M.E. 33		.....	
4:30	M.E. 33	M.E. 33		.....	
FRIDAY					
8:30	M.E. 33	M.E. 33		Elec.	
9:30	E.E. 113	E.E. 113		E.E. 113	
10:30	Math. 132	Math. 132		M.E. 33	
11:30	Elec.	Elec.		Math. 132	
12:30	.....				
1:30	E.E. 63 (Lab.) (3)	.....		M.E. 33	
2:30	E.E. 63 (Lab.) (3)	.....		M.E. 33	
3:30	E.E. 63 (Lab.) (3)	.....		M.E. 33	
4:30	.....	.....		M.E. 33	
SATURDAY					
8:30	.....	.....		.....	
9:30	Math. 135	.....		.....	
10:30	.....	Math. 135		Math. 135	
11:30	.....	.....		.....	

PROGRAM

WINTER QUARTER, 1921-22

JUNIOR ENGINEERS

MECHANICAL 1		MONDAY MECHANICAL 2		ARCHITECTS 1	
8:30	.....	Math. 132		C.E. 39	
9:30	Math. 135	M.E. 42		C.E. 39	
10:30	M.E. 42	.....		Arch. 18	
11:30	Elec.	Elec.		Elec.	
12:30	.....	.....		.....	
1:30	M.E. 34	M.E. 82		Arch. 38	
2:30	M.E. 34	M.E. 82		Arch. 38	
3:30	M.E. 34	M.E. 82		Arch. 38	
4:30	M.E. 34	M.E. 82		.....	
TUESDAY					
8:30	Math. 132	.....		C.E. 39	
9:30	M.E. 91	Math. 135		C.E. 39	
10:30	M.E. 34	M.E. 34		.....	
11:30	.....	M.E. 91		.....	
12:30	.....	.....		.....	
1:30	M.E. 34	.....		Arch. 38	
2:30	M.E. 34	.....		Arch. 38	
3:30	.....	M.E. 34		Arch. 38	
4:30	.....	M.E. 34		Arch. 38	
WEDNESDAY					
8:30	.....	Math. 132		Arch. 28	
9:30	Math. 135	M.E. 42		Arch. 28	
10:30	M.E. 42	.....		Arch. 28	
11:30	Elec.	Elec.		Elec.	
12:30	.....	.....		.....	
1:30	M.E. 82	.....		Arch. 38	
2:30	M.E. 82	R.O.T.C.*		Arch. 38	
3:30	M.E. 82	R.O.T.C.*		Arch. 38	
4:30	M.E. 82	R.O.T.C.*		.....	
THURSDAY					
8:30	Math. 132	.....		C.E. 39	
9:30	M.E. 34	Math. 135		C.E. 39	
10:30	.....	M.E. 34		Arch. 18	
11:30	Convocation	Convocation		Convocation	
12:30	.....	.....		.....	
1:30	.....	M.E. 82		Arch. 38	
2:30	.....	M.E. 82		Arch. 38	
3:30	.....	M.E. 82		Arch. 38	
4:30	.....	M.E. 82		Arch. 38	
FRIDAY					
8:30	.....	Math. 132		Arch. 28	
9:30	Math. 135	M.E. 42		Arch. 28	
10:30	M.E. 42	.....		Arch. 28	
11:30	Elec.	Elec.		Elec.	
12:30	.....	.....		.....	
1:30	M.E. 82	M.E. 34		Arch. 38	
2:30	M.E. 82	M.E. 34		Arch. 38	
3:30	M.E. 82	M.E. 34		Arch. 38	
4:30	M.E. 82	M.E. 34		Arch. 38	
SATURDAY					
8:30	Math. 132	.....		Arch. 38	
9:30	M.E. 34	Math. 135		Arch. 38	
10:30	.....	M.E. 34		Arch. 38	
11:30	M.E. 91	M.E. 91		Arch. 38	

\* Elective

102 COLLEGE OF ENGINEERING AND ARCHITECTURE

WINTER QUARTER, 1921-22

SENIOR ENGINEERS

MONDAY

CIVIL  
1

CIVIL  
2

8:30 Elec.  
9:30 C.E. 132\*  
10:30 E.E. 42 Lab.  
11:30 E.E. 42 Lab.  
12:30 .....  
1:30 C.E. 162\*  
2:30 C.E. 162\*  
3:30 C.E. 162\*  
4:30 .....

Elec.  
C.E. 122\*  
.....  
.....  
C.E. 245\*  
C.E. 245\*  
C.E. 245\*  
C.E. 245\*

TUESDAY

8:30 E.E. 42 Lect.  
9:30 C.E. 132\*  
10:30 C.E. 132\*  
11:30 C.E. 132\*  
12:30 .....  
1:30 C.E. 162\*  
2:30 C.E. 162\*  
3:30 C.E. 162\*  
4:30 .....

E.E. 42 Lect.  
C.E. 122\*  
C.E. 122\*  
C.E. 122\*  
.....  
C.E. 245\*  
C.E. 245\*  
C.E. 245\*  
C.E. 245\*

WEDNESDAY

8:30 Elec.  
9:30 C.E. 142  
10:30 C.E. 142  
11:30 C.E. 142  
12:30 .....  
1:30 C.E. 321\*  
2:30 C.E. 231\*  
3:30 C.E. 231\*  
4:30 C.E. 231\*

Elec.  
C.E. 133\*  
C.E. 133\*  
C.E. 133\*  
.....  
C.E. 163\*  
C.E. 163\*  
C.E. 163\*

THURSDAY

8:30 E.E. 42 Lect.  
9:30 C.E. 162  
10:30 .....  
11:30 Convocation  
12:30 .....  
1:30 C.E. 132\*  
2:30 C.E. 132\*  
3:30 C.E. 132\*  
4:30 .....

E.E. 42 Lect.  
E.E. 42 Lab.  
E.E. 42 Lab.  
Convocation  
.....  
C.E. 122\*  
C.E. 122\*  
C.E. 122\*

FRIDAY

8:30 Elec.  
9:30 C.E. 231\*  
10:30 C.E. 231\*  
11:30 C.E. 231\*  
12:30 .....  
1:30 C.E. 142  
2:30 C.E. 142  
3:30 C.E. 142  
4:30 C.E. 142

Elec.  
C.E. 133\*  
C.E. 133\*  
C.E. 133\*  
.....  
C.E. 163\*  
C.E. 163\*  
C.E. 163\*

SATURDAY

8:30 E.E. 42 Lect.  
9:30 .....  
10:30 .....  
11:30 C.E. 231\*

E.E. 42 Lect.  
C.E. 133\*  
C.E. 163\*

\* Elective.

PROGRAM

WINTER QUARTER, 1921-22

SENIOR ENGINEERS

ELECTRICAL		MONDAY		ELECTRICAL	
1		2		3	
8:30	Elec.	Elec.		Elec.	
9:30	.....	E.E. 134 (Sec. 2)		E.E. 134 (Sec. 2)	
10:30	E.E. 123	E.E. 134 (Sec. 2)		E.E. 134 (Sec. 2)	
11:30	E.E. 144	E.E. 123		E.E. 123	
12:30	.....	.....		.....	
1:30	E.E. 162	.....		.....	
2:30	E.E. 162	.....		.....	
3:30	E.E. 162	.....		.....	
4:30	.....	.....		.....	
TUESDAY					
8:30	E.E. 134 (1)	E.E. 134 (1, 2)		E.E. 134 (2)	
9:30	E.E. 134 (1)	E.E. 134 (1)		M.E. 145	
10:30	E.E. 134 (1)	E.E. 134 (1)		M.E. 145	
11:30	.....	.....		M.E. 145	
12:30	.....	.....		.....	
1:30	M.E. 145 (1)	.....		E.E. 162 (Lab. 3)	
2:30	M.E. 145 (1)	.....		E.E. 162 (Lab. 3)	
3:30	M.E. 145 (1)	.....		E.E. 162 (Lab. 3)	
4:30	.....	.....		.....	
WEDNESDAY					
8:30	Elec.	Elec.		Elec.	
9:30	M.E. 145	M.E. 145 or .....		.....	
10:30	E.E. 123	..... or M.E. 145		M.E. 145	
11:30	E.E. 144	E.E. 123		E.E. 123	
12:30	.....	.....		.....	
1:30	.....	E.E. 124		.....	
2:30	.....	E.E. 124		.....	
3:30	.....	E.E. 124		.....	
4:30	.....	E.E. 124		.....	
THURSDAY					
8:30	E.E. 162	E.E. 134 (2)		E.E. 134 (2)	
9:30	E.E. 142	E.E. 134 (2)		E.E. 134 (2)	
10:30	.....	E.E. 134 (2)		E.E. 134 (2)	
11:30	Convocation	Convocation		Convocation	
12:30	.....	.....		.....	
1:30	E.E. 134 (1)	E.E. 134 (1)		E.E. 124	
2:30	E.E. 134 (1)	E.E. 134 (1)		E.E. 124	
3:30	E.E. 134 (1)	E.E. 134 (1)		E.E. 124	
4:30	E.E. 134 (1)	.....		E.E. 124	
FRIDAY					
8:30	Elec.	Elec.		Elec.	
9:30	M.E. 145	M.E. 145 or .....		.....	
10:30	E.E. 123	..... or M.E. 145		M.E. 145	
11:30	.....	E.E. 123		E.E. 123	
12:30	.....	.....		.....	
1:30	E.E. 124	E.E. Lab. 162 (2)		.....	
2:30	E.E. 124	E.E. Lab. 162 (2)		.....	
3:30	E.E. 124	E.E. Lab. 162 (2)		.....	
4:30	E.E. 124	.....		.....	
SATURDAY					
8:30	E.E. 162	.....		.....	
9:30	E.E. 142	M.E. 145 (2)		.....	
10:30	.....	M.E. 145 (2)		.....	
11:30	.....	M.E. 145 (2)		.....	

104 COLLEGE OF ENGINEERING AND ARCHITECTURE

WINTER QUARTER, 1921-22

SENIOR ENGINEERS

MECHANICAL I	MONDAY	ARCHITECTS I
8:30 .....		Arch. 132
9:30 M.E. 150		Arch. 132
10:30 M.E. 152		.....
11:30 .....		.....
12:30 .....		.....
1:30 M.E. 231		Arch. 132
2:30 M.E. 231		Arch. 132
3:30 M.E. 231		Arch. 132
4:30 M.E. 231		Arch. 132
	TUESDAY	
8:30 M.E. 182 or M.E. 263		C.E. 171
9:30 M.E. 182 or M.E. 226		Arch. 142
10:30 M.E. 182		Arch. 162
11:30 M.E. 182		.....
12:30 .....		.....
1:30 M.E. 182 (Secs. 1, 2)		Arch. 132
2:30 M.E. 182 (Secs. 1, 2)		Arch. 132
3:30 M.E. 182 (Sec. 2)		Arch. 132
4:30 M.E. 182 (Sec. 2)		Arch. 132
	WEDNESDAY	
8:30 .....		Arch. 132
9:30 E.E. 44		Arch. 132
10:30 E.E. 44 or M.E. 152		Arch. 152
11:30 ..... or M.E. 263		.....
12:30 .....		.....
1:30 M.E. 152 or M.E. 263		Arch. 132
2:30 M.E. 152 or M.E. 263		Arch. 132
3:30 M.E. 152 or M.E. 263		Arch. 132
4:30 ..... or M.E. 263		Arch. 132
	THURSDAY	
8:30 E.E. 44		C.E. 171
9:30 M.E. 150		Arch. 142
10:30 M.E. 191		.....
11:30 Convocation		Convocation
12:30 .....		.....
1:30 M.E. 231		Arch. 132
2:30 M.E. 231		Arch. 132
3:30 M.E. 231		Arch. 132
4:30 M.E. 231		Arch. 132
	FRIDAY	
8:30 .....		Arch. 132
9:30 E.E. 44		Arch. 132
10:30 E.E. 44		Arch. 162
11:30 .....		.....
12:30 .....		.....
1:30 R.O.T.C.*		Arch. 132
2:30 R.O.T.C.*		Arch. 132
3:30 R.O.T.C.*		Arch. 132
4:30 .....		Arch. 132
	SATURDAY	
8:30 E.E. 44		Arch. 132
9:30 M.E. 150		Arch. 132
10:30 .....		Arch. 132
11:30 M.E. 191		Arch. 132

\* Elective.

PROGRAM

105

SPRING QUARTER, 1921-22

FRESHMAN ENGINEERS

MONDAY

	1	2	3	4
8:00	Draw. 3	Draw. 3	Draw. 3	Draw. 3
9:00	Draw. 3	Draw. 3	Draw. 3	Draw. 3
10:00	Chem. Lect. 16	Chem. Lect. 16	Chem. Lect. 16	Chem. Lect. 16
11:00	Math. 13	Math. 13	Math. 13	Math. 13
12:00	.....			
1:00	M.E. 13	M.E. 13	M.E. 13	M.E. 13
2:00	M.E. 13	M.E. 13	M.E. 13	M.E. 13
3:00	M.E. 13	M.E. 13	M.E. 13	M.E. 13
4:00	.....			

TUESDAY

8:00	Chem. Lab. 16	Chem. Lab. 16	Chem. Lab. 16	Chem. Lab. 16
9:00	Chem. Lab. 16	Chem. Lab. 16	Chem. Lab. 16	Chem. Lab. 16
10:00	Chem. Lab. 16	Chem. Lab. 16	Chem. Lab. 16	Chem. Lab. 16
11:00	Math. 13	Math. 13	Math. 13	Math. 13
12:00	.....			
1:00	Drill	Drill	Drill	Drill
2:00	Drill	Drill	Drill	Drill
3:00	Drill	Drill	Drill	Drill
4:00	Orientation	Orientation	Orientation	Orientation

WEDNESDAY

8:00	Draw. 3	Draw. 3	Draw. 3	Draw. 3
9:00	Draw. 3	Draw. 3	Draw. 3	Draw. 3
10:00	Chem. Lect. 16	Chem. Lect. 16	Chem. Lect. 16	Chem. Lect. 16
11:00	Math. 13	Math. 13	Math. 13	Math. 13
12:00	.....			
1:00	.....	.....	.....	.....
2:00	.....	.....	.....	.....
3:00	.....	.....	.....	.....
4:00	.....	.....	.....	.....

THURSDAY

8:00	M.E. 13	M.E. 13	M.E. 13	M.E. 13
9:00	M.E. 13	M.E. 13	M.E. 13	M.E. 13
10:00	M.E. 13	M.E. 13	M.E. 13	M.E. 13
11:00	Convocation	Convocation	Convocation	Convocation
12:00	.....			
1:00	Draw. 3	Draw. 3	Draw. 3	Draw. 3
2:00	Draw. 3	Draw. 3	Draw. 3	Draw. 3
3:00	.....	.....	.....	.....
4:00	.....	.....	.....	.....

FRIDAY

8:00	Draw. 3	Draw. 3	Draw. 3	Draw. 3
9:00	Draw. 3	Draw. 3	Draw. 3	Draw. 3
10:00	Chem. Lect. 16	Chem. Lect. 16	Chem. Lect. 16	Chem. Lect. 16
11:00	Math. 13	Math. 13	Math. 13	Math. 13
12:00	.....			
1:00	.....	.....	.....	.....
2:00	.....	.....	.....	.....
3:00	.....	.....	.....	.....
4:00	Orientation	Orientation	Orientation	Orientation

SATURDAY

8:00	Chem. Lab. 16	Chem. Lab. 16	Chem. Lab. 16	Chem. Lab. 16
9:00	Chem. Lab. 16	Chem. Lab. 16	Chem. Lab. 16	Chem. Lab. 16
10:00	Chem. Lab. 16	Chem. Lab. 16	Chem. Lab. 16	Chem. Lab. 16
11:00	Math. 13	Math. 13	Math. 13	Math. 13



106 COLLEGE OF ENGINEERING AND ARCHITECTURE

SPRING QUARTER, 1921-22

FRESHMAN ENGINEERS

MONDAY

	5	6	7	8
8:00	.....	.....	.....	Math. 12
9:00	Math. 12	Chem. Lab. 16	Chem. Lab. 16	Chem. Lab. 16
10:00	Draw. 2	Chem. Lab. 16	Chem. Lab. 16	Chem. Lab. 16
11:00	Draw. 2	Chem. Lab. 16	Chem. Lab. 16	Chem. Lab. 16
12:00	.....	.....	.....	.....
1:00	Chem. Lab. 16	Math. 12	Math. 12	Draw. 2
2:00	Chem. Lab. 16	.....	.....	Draw. 2
3:00	Chem. Lab. 16	.....	.....	.....
4:00	.....	.....	.....	.....

TUESDAY

8:00	Chem. Lect. 16	.....	.....	Math. 12
9:00	Math. 12	Chem. Lect. 16	Chem. Lect. 16	Chem. Lect. 16
10:00	Draw. 2	Math. 12	Math. 12	Draw. 2
11:00	Draw. 2	.....	.....	Draw. 2
12:00	.....	.....	.....	.....
1:00	Drill	Drill	Drill	Drill
2:00	Drill	Drill	Drill	Drill
3:00	Drill	Drill	Drill	Drill
4:00	Orientation	Orientation	Orientation	Orientation

WEDNESDAY

8:00	.....	M.E. 13	M.E. 13	M.E. 13
9:00	Math. 12	M.E. 13	M.E. 13	M.E. 13
10:00	Draw. 2	M.E. 13	M.E. 13	M.E. 13
11:00	Draw. 2	.....	.....	.....
12:00	.....	.....	.....	.....
1:00	Chem. Lab. 16	.....	.....	.....
2:00	Chem. Lab. 16	.....	.....	.....
3:00	Chem. Lab. 16	.....	.....	.....
4:00	.....	.....	.....	.....

THURSDAY

8:00	Chem. Lect. 16	.....	.....	Math. 12
9:00	Math. 12	Chem. Lect. 16	Chem. Lect. 16	Chem. Lect. 16
10:00	.....	Math. 12	Math. 12	.....
11:00	Convocation	Convocation	Convocation	Convocation
12:00	.....	.....	.....	.....
1:00	.....	M.E. 13	M.E. 13	M.E. 13
2:00	.....	M.E. 13	M.E. 13	M.E. 13
3:00	.....	M.E. 13	M.E. 13	M.E. 13
4:00	.....	.....	.....	.....

FRIDAY

8:00	.....	.....	.....	Math. 12
9:00	Math. 12	Chem. Lab. 16	Chem. Lab. 16	Chem. Lab. 16
10:00	Draw. 2	Chem. Lab. 16	Chem. Lab. 16	Chem. Lab. 16
11:00	Draw. 2	Chem. Lab. 16	Chem. Lab. 16	Chem. Lab. 16
12:00	.....	.....	.....	.....
1:00	M.E. 13	Math. 12	Math. 12	Draw. 2
2:00	M.E. 13	.....	.....	Draw. 2
3:00	M.E. 13	.....	.....	.....
4:00	Orientation	Orientation	Orientation	Orientation

SATURDAY

8:00	Chem. Lect. 16	.....	.....	Math. 12
9:00	M.E. 13	Chem. Lect. 16	Chem. Lect. 16	Chem. Lect. 16
10:00	M.E. 13	Math. 12	Math. 12	Draw. 2
11:00	M.E. 13	.....	.....	Draw. 2

PROGRAM

SPRING QUARTER, 1921-22

FRESHMAN ENGINEERS

MONDAY

	9	10	11	12
8:00	Math. 13	.....	Draw. 2	.....
9:00	Chem. Lab. 16	.....	Draw. 2	Math. 13
10:00	Chem. Lab. 16	Math. 12	Math. 12	.....
11:00	Chem. Lab. 16	.....	.....	.....
12:00	.....			
1:00	Draw. 2	Chem. Lab. 16	Chem. Lab. 16	Chem. Lab. 16
2:00	Draw. 2	Chem. Lab. 16	Chem. Lab. 16	Chem. Lab. 16
3:00	.....	Chem. Lab. 16	Chem. Lab. 16	Chem. Lab. 16
4:00	.....	.....	.....	.....

TUESDAY

8:00	Math. 13	Chem. Lect. 16	Chem. Lect. 16	Chem. Lect. 16
9:00	Chem. Lect. 16	.....	.....	Math. 13
10:00	Draw. 2	Math. 12	Math. 12	Draw. 3
11:00	Draw. 2	.....	.....	Draw. 3
12:00	.....			
1:00	Drill	Drill	Drill	Drill
2:00	Drill	Drill	Drill	Drill
3:00	Drill	Drill	Drill	Drill
4:00	Orientation	Orientation	Orientation	Orientation

WEDNESDAY

8:00	M.E. 13	M.E. 13	.....	.....
9:00	M.E. 13	M.E. 13	Math. 12	Math. 13
10:00	M.E. 13	M.E. 13	Draw. 2	Draw. 3
11:00	.....	.....	Draw. 2	Draw. 3
12:00	.....			
1:00	.....	Chem. Lab. 16	Chem. Lab. 16	Chem. Lab. 16
2:00	.....	Chem. Lab. 16	Chem. Lab. 16	Chem. Lab. 16
3:00	.....	Chem. Lab. 16	Chem. Lab. 16	Chem. Lab. 16
4:00	.....	.....	.....	.....

THURSDAY

8:00	Math. 13	Chem. Lect. 16	Chem. Lect. 16	Chem. Lect. 16
9:00	Chem. Lect. 16	.....	.....	Draw. 3
10:00	.....	Math. 12	Math. 12	Draw. 3
11:00	Convocation	Convocation	Convocation	Convocation
12:00	.....			
1:00	M.E. 13	M.E. 13	Draw. 2	Math. 13
2:00	M.E. 13	M.E. 13	Draw. 2	.....
3:00	M.E. 13	M.E. 13	.....	.....
4:00	.....	.....	.....	.....

FRIDAY

8:00	Math. 13	.....	Draw. 2	.....
9:00	Chem. Lab. 16	.....	Draw. 2	Math. 13
10:00	Chem. Lab. 16	Math. 12	Math. 12	Draw. 3
11:00	Chem. Lab. 16	.....	.....	Draw. 3
12:00	.....			
1:00	Draw. 2	.....	M.E. 13	M.E. 13
2:00	Draw. 2	.....	M.E. 13	M.E. 13
3:00	.....	.....	M.E. 13	M.E. 13
4:00	Orientation	Orientation	Orientation	Orientation

SATURDAY

8:00	Math. 13	Chem. Lect. 16	Chem. Lect. 16	Chem. Lect. 16
9:00	Chem. Lect. 16	.....	M.E. 13	M.E. 13
10:00	Draw. 2	Math. 12	M.E. 13	M.E. 13
11:00	Draw. 2	.....	M.E. 13	M.E. 13

108 COLLEGE OF ENGINEERING AND ARCHITECTURE

SPRING QUARTER, 1921-22

FRESHMAN ENGINEERS

MONDAY

13  
 8:00 .....  
 9:00 Math. 13  
 10:00 .....  
 11:00 .....  
 12:00 .....  
 1:00 Chem. Lab. 16  
 2:00 Chem. Lab. 16  
 3:00 Chem. Lab. 16  
 4:00 .....

14  
 Math. 12  
 .....  
 Draw. 2  
 Draw. 2  
 .....  
 Chem. Lab. 16  
 Chem. Lab. 16  
 Chem. Lab. 16  
 .....

15  
 Math. 12  
 Rhet. A  
 Draw. 2  
 Draw. 2  
 .....  
 M.E. 13  
 M.E. 13  
 M.E. 13  
 .....

TUESDAY

8:00 Chem. Lect. 16  
 9:00 Math. 13  
 10:00 Draw. 3  
 11:00 Draw. 3  
 12:00 .....  
 1:00 Drill  
 2:00 Drill  
 3:00 Drill  
 4:00 Orientation

Chem. Lect. 16  
 .....  
 .....  
 Math. 12  
 .....  
 Drill  
 Drill  
 Drill  
 Orientation

.....  
 Rhet. A  
 .....  
 Math. 12  
 .....  
 .....  
 .....  
 .....  
 Orientation

WEDNESDAY

8:00 .....  
 9:00 Math. 13  
 10:00 Draw. 3  
 11:00 Draw. 3  
 12:00 .....  
 1:00 Chem. Lab. 16  
 2:00 Chem. Lab. 16  
 3:00 Chem. Lab. 16  
 4:00 .....

Draw. 2  
 Draw. 2  
 .....  
 Math. 12  
 .....  
 Chem. Lab. 16  
 Chem. Lab. 16  
 Chem. Lab. 16  
 .....

Draw. 2  
 Draw. 2  
 Rhet. A  
 Math. 12  
 .....  
 Drill  
 Drill  
 Drill

THURSDAY

8:00 Chem. Lect. 16  
 9:00 Draw. 3  
 10:00 Draw. 3  
 11:00 Convocation  
 12:00 .....  
 1:00 .....  
 2:00 Math. 13  
 3:00 .....  
 4:00 .....

Chem. Lect. 16  
 .....  
 .....  
 Convocation  
 .....  
 Math. 12  
 .....  
 Draw. 2  
 Draw. 2  
 .....

M.E. 13  
 M.E. 13  
 M.E. 13  
 Convocation  
 .....  
 Math. 12  
 .....  
 Draw. 2  
 Draw. 2

FRIDAY

8:00 .....  
 9:00 Math. 13  
 10:00 Draw. 3  
 11:00 Draw. 3  
 12:00 .....  
 1:00 M.E. 13  
 2:00 M.E. 13  
 3:00 M.E. 13  
 4:00 Orientation

Math. 12  
 .....  
 Draw. 2  
 Draw. 2  
 .....  
 M.E. 13  
 M.E. 13  
 M.E. 13  
 Orientation

Math. 12  
 Rhet. A  
 Draw. 2  
 Draw. 2  
 .....  
 .....  
 .....  
 Orientation

SATURDAY

8:00 Chem. Lect. 16  
 9:00 M.E. 13  
 10:00 M.E. 13  
 11:00 M.E. 13

Chem. Lab. 16  
 M.E. 13  
 M.E. 13  
 M.E. 13

.....  
 Rhet. A  
 .....  
 .....

PROGRAM

109

SPRING QUARTER, 1921-22

FRESHMAN ARCHITECTS

MONDAY

8:00 Math. 13  
 9:00 Arch. 23  
 10:00 Arch. 23  
 11:00 Rhet. 6  
 12:00 .....  
 1:00 Arch. 33  
 2:00 Arch. 33  
 3:00 Arch. 33  
 4:00 .....

Math. 12  
 Arch. 32  
 Arch. 32  
 Arch. 32

Arch. 23  
 Arch. 23

TUESDAY

8:00 Math. 13  
 9:00 Draw. 33  
 10:00 .....  
 11:00 Arch. 33  
 12:00 .....  
 1:00 Drill  
 2:00 Drill  
 3:00 Drill  
 4:00 Orientation

Math. 12  
 Draw. 33  
 Rhet. 6  
 Arch. 32

Drill  
 Drill  
 Drill  
 Orientation

WEDNESDAY

8:00 Math. 13  
 9:00 Arch. 23  
 10:00 Arch. 23  
 11:00 Rhet. 6  
 12:00 .....  
 1:00 Arch. 33  
 2:00 Arch. 33  
 3:00 Arch. 33  
 4:00 .....

Math. 12  
 Arch. 32  
 Arch. 32  
 Arch. 32

Arch. 23  
 Arch. 23

THURSDAY

8:00 Math. 13  
 9:00 Draw. 33  
 10:00 .....  
 11:00 Convocation  
 12:00 .....  
 1:00 .....  
 2:00 .....  
 3:00 .....  
 4:00 .....

Math. 12  
 Draw. 33  
 Rhet. 6  
 Convocation

FRIDAY

8:00 Math. 13  
 9:00 Arch. 23  
 10:00 Arch. 23  
 11:00 Rhet. 6  
 12:00 .....  
 1:00 Arch. 33  
 2:00 Arch. 33  
 3:00 Arch. 33  
 4:00 Orientation

Math. 12  
 Arch. 32  
 Arch. 32  
 Arch. 32

Arch. 23  
 Arch. 23  
 .....  
 Orientation

SATURDAY

8:00 .....  
 9:00 .....  
 10:00 .....  
 11:00 Arch. 33

.....  
 .....  
 Rhet. 6  
 Arch. 32

110 COLLEGE OF ENGINEERING AND ARCHITECTURE

MONDAY

SPRING QUARTER, 1921-22

SOPHOMORE ENGINEERS

	CIVIL 1	CIVIL 2	CIVIL 3	CIVIL 4
8:00	Draw. 23	Draw. 23	.....	.....
9:00	Draw. 23	Draw. 23	Math. 25	.....
10:00	Math. 26	Phys. 43	Draw. 23	Math. 25
11:00	C.E. 13	C.E. 13	Draw. 23	.....
12:00	.....			
1:00	Phys. 23	C.E. 13	Phys. 43	.....
2:00	Rhet. 6	C.E. 13	Draw. 23	.....
3:00	.....	C.E. 13	Draw. 23	.....
4:00	.....	C.E. 13	.....	.....

TUESDAY

8:00	C.E. 13	.....	Rhet. 6	.....
9:00	C.E. 13	.....	Math. 25	.....
10:00	C.E. 13	Rhet. 5	Phys. Lab. 44	Math. 25
11:00	C.E. 13	Math. 26	Phys. Lab. 44	.....
12:00	.....			
1:00	Drill	Drill	Drill	.....
2:00	Drill	Drill	Drill	.....
3:00	Drill	Drill	Drill	.....
4:00	.....	.....	.....	.....

WEDNESDAY

8:00	Draw. 23	Draw. 23	.....	.....
9:00	Draw. 23	Draw. 23	Math. 25	.....
10:00	Math. 26	Phys. 43	Draw. 23	Math. 25
11:00	.....	Math. 26	Draw. 23	.....
12:00	.....			
1:00	Phys. 43	.....	Phys. 43	.....
2:00	Rhet. 6	.....	.....	.....
3:00	.....	.....	.....	.....
4:00	Phys. 43	Phys. 43	Phys. 43	.....

THURSDAY

8:00	C.E. 13	Phys. Lab. 44	Rhet. 6	.....
9:00	C.E. 13*	Phys. Lab. 44	Math. 25	.....
10:00	C.E. 13	Rhet. 6	.....	Math. 25
11:00	Convocation	Convocation	Convocation	Convocation
12:00	.....			
1:00	Math. 26	Math. 26	C.E. 13	.....
2:00	.....	.....	C.E. 13	.....
3:00	.....	.....	C.E. 13	.....
4:00	.....	.....	.....	.....

FRIDAY

8:00	Draw. 23	Draw. 23	C.E. 13	.....
9:00	Draw. 23	Draw. 23	C.E. 13	.....
10:00	Math. 26	Phys. 43	C.E. 13	Math. 25
11:00	.....	Math. 26	C.E. 13	.....
12:00	.....			
1:00	Phys. 43	Rhet. 6	Phys. 43	.....
2:00	Rhet. 6	.....	C.E. 13	.....
3:00	.....	.....	.....	.....
4:00	.....	.....	.....	.....

SATURDAY

8:00	Phys. Lab. 44	C.E. 13	Rhet. 6	.....
9:00	Phys. Lab. 44	C.E. 13	Math. 25	.....
10:00	Math. 26	C.E. 13	.....	.....
11:00	.....	Math. 26	.....	.....

PROGRAM

SPRING QUARTER, 1921-22

SOPHOMORE ENGINEERS

MONDAY

	ELECTRICAL 1	ELECTRICAL 2	ELECTRICAL 3	ELECTRICAL 4
8:00	.....	Math. 26	.....	Math. 26
9:00	M.E. 16	M.E. 16 or ....	Rhet. 6	Phys. 43
10:00	M.E. 16	M.E. 16 or ....	Phys. 43	E.E. 15 (Sec. H)
11:00	M.E. 16	M.E. 16 or ....	Math. 25	E.E. 15 (Sec. H)
12:00	.....	.....	.....	.....
1:00	Phys. 43	Phys. 43	E.E. 15 (Sec. E)	Phys. Lab. 44
2:00	.....	.... or M.E. 16	M.E. 16 or E.E. 15	Phys. Lab. 44
3:00	.....	.... or M.E. 16	M.E. 16 or ....	.....
4:00	.....	.... or M.E. 16	M.E. 16 or ....	.....

TUESDAY

8:00	Rhet. 6	Math. 26	Phys. Lab. 44	Math. 26
9:00	Math. 26	Rhet. 6	Phys. Lab. 44	.....
10:00	.....	.....	E.E. 15	E.E. 15
11:00	E.E. 15	E.E. 15	Math. 25	Rhet. 6
12:00	.....	.....	.....	.....
1:00	M.E. 16	M.E. 16 or E.E. 15	.....	.....
2:00	M.E. 16	M.E. 16 or E.E. 15	.....	.....
3:00	M.E. 16	M.E. 16 or	.....	E.E. 15 (Sec. G)
4:00	.....	.....	.....	E.E. 15 (Sec. G)

WEDNESDAY

8:00	.....	Math. 26	.....	Math. 26
9:00	Math. 26	.....	Rhet. 6	Phys. 43
10:00	E.E. 15 (Sec. A)	.....	Phys. 43	.....
11:00	E.E. 15 (Sec. A)	.....	Math. 25	.....
12:00	.....	.....	.....	.....
1:00	Phys. 43	Phys. 43	.... or M.E. 16	M.E. 16
2:00	.....	.....	.... or M.E. 16	M.E. 16
3:00	.....	.....	.... or M.E. 16	M.E. 16
4:00	Phys. 43	Phys. 43	Phys. 43	Phys. 43

THURSDAY

8:00	Rhet. 6	Math. 26	.....	Math. 26
9:00	Math. 26	Rhet. 6	.....	.....
10:00	.....	.....	E.E. 15	E.E. 15
11:00	Convocation	Convocation	Convocation	Convocation
12:00	.....	.....	.....	.....
1:00	E.E. 15	E.E. 15	.....	Rhet. 6
2:00	Drill	Drill	Drill	Drill
3:00	Drill	Drill	Drill	Drill
4:00	Drill	Drill	Drill	Drill

FRIDAY

8:00	.....	Phys. Lab. 44	.....	Math. 26
9:00	Math. 26	Phys. Lab. 44	Rhet. 6	Phys. 43
10:00	.....	E.E. 15 (Sec. D)	Phys. 43	.....
11:00	.....	E.E. 15 (Sec. D)	Math. 25	.....
12:00	.....	.....	.....	.....
1:00	Phys. 43	Phys. 43	.....	.....
2:00	E.E. 15 (Sec. B)	.... or M.E. 16	M.E. 16 or ....	.....
3:00	E.E. 15 (Sec. B)	.... or M.E. 16	M.E. 16 or ....	.....
4:00	.....	.... or M.E. 16	M.E. 16 or ....	.....

SATURDAY

8:00	Rhet. 6	Math. 26	E.E. 15 or M.E. 16	M.E. 16
9:00	Math. 26	Rhet. 6	E.E. 15 or M.E. 16	M.E. 16
10:00	Phys. Lab. 44	.....	.... or M.E. 16	M.E. 16
11:00	Phys. Lab. 44	.....	Math. 25	Rhet. 6

112 COLLEGE OF ENGINEERING AND ARCHITECTURE

SPRING QUARTER, 1921-22

SOPHOMORE ENGINEERS

	MECHANICAL 1	MONDAY MECHANICAL 2	ARCHITECTS 1
8:00	Rhet. 6	.....	Math. 93
9:00	Math. 26	Phys. 43	Phys. 43
10:00	Phys. 43	Rhet. 6	.....
11:00	.....	Math. 26	Arch. 16
12:00	.....		
1:00	M.E. 31	.....	Arch. 36
2:00	M.E. 31	.....	Arch. 36
3:00	M.E. 31	Phys. Lab. 44	Arch. 36
4:00	.....	Phys. Lab. 44	.....
		<b>TUESDAY</b>	
8:00	.....	.....	.....
9:00	Math. 26	.....	Arch. 26
10:00	M.E. 21	M.E. 21	Arch. 26
11:00	.....	Math. 26	Arch. 26
12:00	.....		
1:00	Drill	Drill	Drill
2:00	Drill	Drill	Drill
3:00	Drill	Drill	Drill
4:00	.....	.....	.....
		<b>WEDNESDAY</b>	
8:00	Rhet. 6	M.E. 41	Math. 93
9:00	Math. 26	Phys. 43	Phys. 43
10:00	Phys. 43	Rhet. 6	Arch. 46
11:00	.....	Math. 26	Arch. 46
12:00	.....		
1:00	.....	M.E. 31	Arch. 36
2:00	.....	M.E. 31	Arch. 36
3:00	.....	M.E. 31	Arch. 36
4:00	Phys. 43	Phys. 43	.....
		<b>THURSDAY</b>	
8:00	M.E. 41	.....	Math. 93
9:00	Math. 26	.....	Phys. 43
10:00	M.E. 21	M.E. 21	.....
11:00	Convocation	Convocation	Convocation
12:00	.....		
1:00	M.E. 31	.....	Arch. 36
2:00	M.E. 31	.....	Arch. 36
3:00	M.E. 31	.....	Arch. 36
4:00	.....	.....	.....
		<b>FRIDAY</b>	
8:00	Rhet. 6	M.E. 41	Math. 93
9:00	Math. 26	Phys. 43	Phys. 43
10:00	Phys. 43	Rhet. 6	Arch. 46
11:00	.....	Math. 26	Arch. 46
12:00	.....		
1:00	Phys. Lab. 44	M.E. 31	Arch. 36
2:00	Phys. Lab. 44	M.E. 31	Arch. 36
3:00	.....	M.E. 31	Arch. 36
4:00	.....	.....	.....
		<b>SATURDAY</b>	
8:00	M.E. 41	.....	Arch. 16
9:00	.....	.....	Arch. 26
10:00	.....	.....	Arch. 26
11:00	.....	Math. 26	Arch. 26

PROGRAM

SPRING QUARTER, 1921-22

JUNIOR ENGINEERS

	CIVIL 1	MONDAY CIVIL 2	CIVIL 3
8:00	Elec.	Elec.	Math. 136
9:00	C.E. 53	C.E. 53	C.E. 53
10:00	Math. 136	Math. 133	C.E. 33
11:00	C.E. 33	C.E. 33	Elec.
12:00	.....	.....	.....
1:00	C.E. 22	C.E. 33	.....
2:00	C.E. 22	C.E. 33	.....
3:00	C.E. 22	C.E. 33	.....
4:00	.....	C.E. 33	.....
TUESDAY			
8:00	Math. 143	C.E. 33	.....
9:00	Math. 143	C.E. 33	.....
10:00	Math. 143	.....	Math. 133
11:00	C.E. 22	C.E. 32	.....
12:00	.....	.....	.....
1:00	C.E. 33	Math. 136	C.E. 22
2:00	C.E. 33	.....	C.E. 22
3:00	C.E. 33	.....	C.E. 22
4:00	C.E. 33	.....	C.E. 22
WEDNESDAY			
8:00	Elec.	Elec.	Math. 136
9:00	C.E. 53	C.E. 53	C.E. 53
10:00	Math. 133	Math. 133	C.E. 22
11:00	.....	.....	Elec.
12:00	.....	.....	.....
1:00	C.E. 22	.....	C.E. 22
2:00	C.E. 22	.....	C.E. 22
3:00	C.E. 22	.....	<b>C.E. 22</b>
4:00	C.E. 22	.....	.....
THURSDAY			
8:00	.....	.....	C.E. 33
9:00	Math. 136	.....	C.E. 33
10:00	.....	Math. 136	Math. 133
11:00	Convocation	Convocation	Convocation
12:00	.....	.....	.....
1:00	.....	C.E. 22	.....
2:00	.....	<b>C.E. 22</b>	.....
3:00	.....	C.E. 22	.....
4:00	.....	<b>C.E. 22</b>	.....
FRIDAY			
8:00	Elec.	Elec.	Math. 136
9:00	Math. 133	Math. 143	.....
10:00	C.E. 33	Math. 136	C.E. 22
11:00	C.E. 33	Math. 143	Elec.
12:00	.....	.....	.....
1:00	.....	C.E. 22	C.E. 33
2:00	.....	C.E. 22	C.E. 33
3:00	.....	<b>C.E. 22</b>	C.E. 33
4:00	.....	.....	C.E. 33
SATURDAY			
8:00	C.E. 53	C.E. 53	C.E. 53
9:00	Math. 136	.....	Math. 143
10:00	.....	Math. 133	Math. 143
11:00	C.E. 22	C.E. 22	Math. 143



114 COLLEGE OF ENGINEERING AND ARCHITECTURE

SPRING QUARTER, 1921-22

JUNIOR ENGINEERS

	ELECTRICAL I	MONDAY ELECTRICAL 2	ELECTRICAL 3
8:00	.....	.....	Elec.
9:00	E.E. 115	E.E. 115	E.E. 115
10:00	Math. 133	Math. 133	.....
11:00	Elec.	Elec.	.....
12:00	.....	.....	.....
1:00	E.E. 116	E.E. 65 Lab. (1)	Math. 143
2:00	E.E. 116	E.E. 65 Lab. (1)	Math. 143
3:00	E.E. 116	E.E. 65 Lab. (1)	Math. 143
4:00	E.E. 116	.....	.....
		<b>TUESDAY</b>	
8:00	.....	.....	E.E. 116
9:00	.....	.....	E.E. 116
10:00	Math. 136	Math. 136	E.E. 116
11:00	.....	.....	E.E. 116
12:00	.....	.....	.....
1:00	.....	E.E. 116	Math. 136
2:00	.....	E.E. 116	.....
3:00	.....	E.E. 116	.....
4:00	.....	E.E. 116	.....
		<b>WEDNESDAY</b>	
8:00	.....	.....	Elec.
9:00	E.E. 115	E.E. 115	E.E. 115
10:00	Math. 133	Math. 133	.....
11:00	Elec.	Elec.	Math. 133
12:00	.....	.....	.....
1:00	E.E. 65 (Lect.)	E.E. 65 (Lect.)	.....
2:00	E.E. 65 (Lab.) (2)	.....	M.E. 33
3:00	E.E. 65 (Lab.) (2)	.....	M.E. 33
4:00	E.E. 65 (Lab.) (2)	.....	M.E. 33
		<b>THURSDAY</b>	
8:00	Math. 143	.....	.....
9:00	Math. 143	.....	.....
10:00	Math. 143	Math. 136	Math. 136
11:00	Convocation	Convocation	Convocation
12:00	.....	.....	.....
1:00	M. E. 37	M. E. 37	.....
2:00	M. E. 37	M. E. 37	.....
2:00	M. E. 37	M. E. 37	.....
4:00	.....	.....	.....
		<b>FRIDAY</b>	
8:00	M.E. 37	M. E. 37	Elec.
9:00	E.E. 115	E.E. 115	E.E. 115
10:00	Math. 136	Math. 136	M.E. 33
11:00	Elec.	Elec.	Math. 132
12:00	.....	.....	.....
1:00	E.E. 65 Lab. (2)	Math. 143	M.E. 33
2:00	E.E. 65 Lab. (2)	Math. 143	M.E. 33
3:00	E.E. 65 Lab. (2)	Math. 143	M.E. 33
4:00	.....	.....	.....
		<b>SATURDAY</b>	
8:00	M.E. 37	M. E. 37	.....
9:00	M.E. 37	M. E. 37	.....
10:00	M.E. 37	M. E. 37	Math. 136
11:00	Math. 136	.....	.....

PROGRAM

SPRING QUARTER, 1921-22

JUNIOR ENGINEERS

MECHANICAL		MONDAY MECHANICAL	ARCHITECTS
	1	2	1
8:00	Math. 133	.....	C.E. 41
9:00	M.E. 61	Math. 136	C.E. 41
10:00	M.E. 33	M.E. 61	Arch. 19
11:00	Elec.	Elec.	P.S. 27
12:00	.....	.....	.....
1:00	M.E. 35 Lab.	M.E. 83 Lab.	Arch. 39
2:00	M.E. 35 Lab.	M.E. 83 Lab.	Arch. 39
3:00	M.E. 35 Lab.	M.E. 83 Lab.	Arch. 39
4:00	.....	M.E. 83 Lab.	Arch. 39
TUESDAY			
8:00	.....	Math. 133	C.E. 41
9:00	Math. 136	.....	C.E. 41
10:00	M.E. 61 or M.E. 83	M.E. 33	.....
11:00	M.E. 61 or M.E. 83	M.E. 92	.....
12:00	.....	.....	.....
1:00	M.E. 35 Lab.	.....	Arch. 39
2:00	M.E. 35 Lab.	Math. 143	Arch. 39
3:00	M.E. 35 Lab.	Math. 143	Arch. 39
4:00	.....	Math. 143	Arch. 39
WEDNESDAY			
8:00	.....	.....	Arch 28
9:00	Math. 136	E.E. 43	Arch 28
10:00	M.E. 92	E.E. 43	Arch 28
11:00	Elec.	Elec.	P.S. 27
12:00	.....	.....	.....
1:00	M.E. 83 Lab.	..... or M.E. 35	Arch. 39
2:00	M.E. 83 Lab.	R.O.T.C.* or M.E. 35	Arch. 39
3:00	M.E. 83 Lab.	R.O.T.C.* or M.E. 35	Arch. 39
4:00	M.E. 83 Lab.	R.O.T.C.* or .....	Arch. 39
THURSDAY			
8:00	.....	Math. 136	C.E. 41
9:00	E.E. 43	E.E. 43	C.E. 41
10:00	M.E. 61	M.E. 61	Arch. 19
11:00	Convocation	Convocation	Convocation
12:00	.....	.....	.....
1:00	Math. 143	M.E. 83 Lab.	Arch. 39
2:00	Math. 143	M.E. 83 Lab.	Arch. 39
3:00	Math. 143	M.E. 83 Lab.	Arch. 39
4:00	.....	M.E. 83 Lab.	Arch. 39
FRIDAY			
8:00	Math. 133	Math. 133	Arch. 29
9:00	E.E. 43	M.E. 61	Arch. 29
10:00	E.E. 43	M.E. 61	Arch. 29
11:00	Elec.	Elec.	P.S. 27
12:00	.....	.....	.....
1:00	M.E. 83 Lab.	M.E. 35 Lab.	Arch. 39
2:00	M.E. 83 Lab.	M.E. 35 Lab.	Arch. 39
3:00	M.E. 83 Lab.	M.E. 35 Lab.	Arch. 39
4:00	M.E. 83 Lab.	.....	Arch. 39
SATURDAY			
8:00	E.E. 43	E.E. 43	Arch. 39
9:00	Math. 136	Math. 136	Arch. 39
10:00	M.E. 35	M.E. 35	Arch. 39
11:00	M.E. 92	M.E. 92	Arch. 39

\* Elective.

116 COLLEGE OF ENGINEERING AND ARCHITECTURE

SPRING QUARTER, 1921-22

SENIOR ENGINEERS

MONDAY

CIVIL

8:00	Elec.*
9:00	.....
10:00	C.E. 163*
11:00	M.E. 149
12:00	.....
1:00	C.E. 133*
2:00	C.E. 133*
3:00	C.E. 133*
4:00	.....

TUESDAY

8:00	C.E. 163*
9:00	C.E. 163*
10:00	C.E. 163*
11:00	C.E. 163*
12:00	.....
1:00	C.E. 123*
2:00	C.E. 123*
3:00	C.E. 123*
4:00	C.E. 123*

WEDNESDAY

8:00	Elec.*
9:00	C.E. 133*
10:00	C.E. 123*
11:00	M.E. 149
12:00	.....
1:00	M.E. 149
2:00	M.E. 149
3:00	M.E. 149
4:00	M.E. 149

THURSDAY

8:00	C.E. 133
9:00	C.E. 133
10:00	C.E. 133
11:00	Convocation
12:00	.....
1:00	C.E. 163*
2:00	C.E. 163*
3:00	C.E. 163*
4:00	C.E. 163*

FRIDAY

8:00	Elec.*
9:00	C.E. 123*
10:00	C.E. 123*
11:00	M.E. 149
12:00	.....
1:00	C.E. 143*
2:00	C.E. 143*
3:00	C.E. 143*
4:00	C.E. 143*

SATURDAY

8:00	.....
9:00	C.E. 143*
10:00	C.E. 143*
11:00	C.E. 143*

\* Elective.

# PROGRAM

117

SPRING QUARTER, 1921-22

SENIOR ENGINEERS

	MONDAY	
ELECTRICAL	ELECTRICAL	ELECTRICAL
1	2	3
8:00 Elec.	Elec.	Elec.
9:00 .....	E.E. 136 (2)	E.E. 136 (2)
10:00 E.E. 125	E.E. 136 (2)	E.E. 136 (2)
11:00 E.E. 145*	E.E. 125	E.E. 125
12:00 .....	.....	.....
1:00 E.E. 163*	.....	C.E. 16*
2:00 E.E. 163*	.....	C.E. 16*
3:00 E.E. 163*	.....	C.E. 16*
4:00 .....	.....	C.E. 16*
<b>TUESDAY</b>		
8:00 E.E. 136 (1)	E.E. 136 (1)	E.E. 136 (2)
9:00 E.E. 136 (1)	E.E. 136 (1)	M.E. 146
10:00 E.E. 136 (1)	E.E. 136 (1)	M.E. 146
11:00 .....	.....	M.E. 146
12:00 .....	.....	.....
1:00 M.E. 146	.....	..... or E.E. 163
2:00 M.E. 146	.....	..... or E.E. 163
3:00 M.E. 146	.....	..... or E.E. 163
4:00 .....	.....	.....
<b>WEDNESDAY</b>		
8:00 Elec.	Elec.	Elec.
9:00 M.E. 146	M.E. 146	.....
10:00 E.E. 125	..... or M.E. 146	M.E. 146
11:00 E.E. 145*	E.E. 125	E.E. 125
12:00 .....	.....	.....
1:00 .....	E.E. 126	.....
2:00 .....	E.E. 126	.....
3:00 .....	E.E. 126	.....
4:00 .....	E.E. 126	.....
<b>THURSDAY</b>		
8:00 E.E. 163*	E.E. 136 (2)	E.E. 136 (2)
9:00 .....	E.E. 136 (2)	E.E. 136 (2)
10:00 .....	E.E. 136 (2)	E.E. 136 (2)
11:00 Convocation	Convocation	Convocation
12:00 .....	.....	.....
1:00 E.E. 136 (1)	E.E. 136 (1)	E.E. 126
2:00 E.E. 136 (1)	E.E. 136 (1)	E.E. 126
3:00 E.E. 136 (1)	E.E. 136 (1)	E.E. 126
4:00 .....	.....	E.E. 126
<b>FRIDAY</b>		
8:00 Elec.	Elec.	Elec.
9:00 M.E. 146	M.E. 146 or .....	.....
10:00 E.E. 125	..... or M.E. 146	M.E. 146
11:00 .....	E.E. 125	E.E. 125
12:00 .....	.....	.....
1:00 E.E. 126	E.E. 163*	C.E. 16*
2:00 E.E. 126	E.E. 163*	C.E. 16*
3:00 E.E. 126	E.E. 163*	C.E. 16*
4:00 E.E. 126	.....	C.E. 16*
<b>SATURDAY</b>		
8:00 E.E. 163*	M.E. 146 Lab. (2)	C.E. 35*
9:00 .....	M.E. 146 Lab. (2)	C.E. 35*
10:00 .....	M.E. 146 Lab. (2)	C.E. 35*
11:00 .....	.....	C.E. 35*

\* Elective

118 COLLEGE OF ENGINEERING AND ARCHITECTURE

SPRING QUARTER, 1921-22

SENIOR ENGINEERS

MECHANICAL		MONDAY	ARCHITECTS	
I			I	
8:00	.....		Arch. 133	
9:00	M.E. 153		Arch. 133	
10:00	C.E. 144* or .....		Arch. 143	
11:00	C.E. 144* or .....		.....	
12:00	.....		.....	
1:00	M.E. 265 Lab.		Arch. 133	
2:00	M.E. 265 Lab.		Arch. 133	
3:00	M.E. 265 Lab.		Arch. 133	
4:00	M.E. 265 Lab.		Arch. 133	
<b>TUESDAY</b>				
8:00	M.E. 184 or M.E. 256		Arch. 133	
9:00	M.E. 184		Arch. 133	
10:00	M.E. 184		Arch. 133	
11:00	M.E. 184		Arch. 153	
12:00	.....		.....	
1:00	M.E. 184		Arch. 133	
2:00	M.E. 184		Arch. 133	
3:00	M.E. 184		Arch. 133	
4:00	M.E. 184		Arch. 133	
<b>WEDNESDAY</b>				
8:00	.....		Arch. 133	
9:00	M.E. 153		Arch. 133	
10:00	M.E. 193		Arch. 153	
11:00	M.E. 265		M.E. 154	
12:00	.....		.....	
1:00	C.E. 35* or M.E. 233		Arch. 133	
2:00	C.E. 35* or M.E. 233		Arch. 133	
3:00	C.E. 35* or M.E. 233		Arch. 133	
4:00	C.E. 35* or M.E. 233		Arch. 133	
<b>THURSDAY</b>				
8:00	M.E. 256		.....	
9:00	M.E. 265		.....	
10:00	M.E. 265		Arch. 143	
11:00	Convocation		Convocation	
12:00	.....		.....	
1:00	C.E. 144* or R.O.T.C.*		Arch. 133	
2:00	C.E. 144* or R.O.T.C.*		Arch. 133	
3:00	C.E. 144* or R.O.T.C.*		Arch. 133	
4:00	C.E. 144* or .....		Arch. 133	
<b>FRIDAY</b>				
8:00	.....		C.E. 17	
9:00	M.E. 192		C.E. 17	
10:00	M.E. 193		C.E. 17	
11:00	C.E. 144* or .....		M.E. 154	
12:00	.....		.....	
1:00	C.E. 35* or M.E. 233		Arch. 133	
2:00	C.E. 35* or M.E. 233		Arch. 133	
3:00	C.E. 35* or M.E. 233		Arch. 133	
4:00	C.E. 35* or M.E. 233		Arch. 133	
<b>SATURDAY</b>				
8:00	M.E. 256		Arch. 133	
9:00	M.E. 153		Arch. 133	
10:00	.....		Arch. 133	
11:00	M.E. 192		Arch. 133	

\* Elective.

# PROGRAM OF STUDIES

## ASTRONOMY

No.	Credits	Title	Hour	Day	Building	Instructor
30S	3	Field Astronomy.....	11:00	MWF	124F	Mr. Leavenworth

## ARCHITECTURE

No.	Credits	Title	Hour	Day	Building	Instructor
14f	2	Architectural History....	11:00	MF	320ME	Mr. Forsythe
15w	2	Architectural History....	11:30	MF	320ME	Mr. Forsythe
16S	2	Architectural History....	11:00	M		
			8:00	S	320ME	Mr. Forsythe
17f-19S	2	Architectural History....	10:00	MTh	320ME	Mr. Mann
18w	2	Architectural History....	10:30	MTh	320ME	Mr. Mann
21f-s,22f-s, 23f-s	2	Freehand Drawing, Grade I.....				
		Sec. 1	1:00- 2:50	MWF	401ME	Mr. Johnson
		2	9:00-10:50	MWF	401ME	Mr. Johnson
21w,22w,23w	2	Freehand Drawing, Grade I.....				
		Sec. 1	1:30- 3:20	MWF	401ME	Mr. Johnson
		2	9:30-11:20	MWF	401ME	Mr. Johnson
24f-s,25f-s, 26f-s	2	Freehand Drawing, Grade II.....	9:00-11:50	TS	401ME	Mr. Burton
24w,25w,26w	2	Freehand Drawing, Grade II.....	9:30-12:20	TS	401ME	Mr. Burton
27f-s,28f-s, 29f-s	2	Freehand Drawing, Grade III.....	8:00-10:50	WF	401ME	Mr. Burton
27w,28w,29w	2	Freehand Drawing, Grade III.....	8:30-11:20	WF	401ME	Mr. Burton
31f	4	Elements of Architecture Lect.	11:00	TS	320ME	Mr. Forsythe
		Sec. 1 Lab.	1:00- 3:50	MWF	309ME	Mr. R. T. Jones
		2 Lab.	9:00-11:50	MWF	309ME	Mr. Hammett
		3 Lab.*	2:00- 3:50	MWF	309ME	
			8:00-10:50	S	309ME	
31w	4	Elements of Architecture Lect.	11:30	TS	320ME	Mr. Forsythe, Mr. R. T. Jones
		Lab.	9:30-12:20	MWF	309ME	Mr. Hammett
32w	4	Elements of Architecture Lect.	11:30	TS	135ME	Mr. Forsythe, Mr. R. T. Jones, Mr. Hammett
		Sec. 1 Lab.	2:30- 4:20	MWF		
			8:30-11:20	S	309ME	
		2 Lab.	1:30- 4:20	MWF	309ME	
32S	4	Elements of Architecture Lect.	11:00	TS	320ME	Mr. Forsythe
		Lab.	9:00-11:50	MWF	309ME	Mr. R. T. Jones, Mr. Hammett

\* Open only to students entering without high-school chemistry.

No.	Credits	Title	Hour	Day	Building	Instructor
33s	4	Elements of Architecture Lect.	11:00	TS	135ME	Mr. Forsythe, Mr. R. T. Jones
		Sec. 1 Lab.	2:00- 3:50	MWF		
			8:00-10:50	S	309ME	Mr. Hammett
		2 Lab.	1:00- 3:50	MWF	309ME	
34f,35f,36f	4	Architectural Design, Grade I.....	1:00- 3:50	MTThF	402ME	Mr. R. C. Jones
34w,35w,36w	4	Architectural Design, Grade I.....	1:30- 4:20	MTThF	402ME	Mr. R. C. Jones
34s,35s,36s	4	Architectural Design, Grade I.....	1:00- 3:50	MWThF	402ME	Mr. R. C. Jones
37f-s,38f-s, 39f-s	7	Architectural Design, Grade II.....	1:00- 4:50	MTWThF		
			8:00-11:50	S	317ME	Mr. Arnal
37w,38w,39w	7	Architectural Design, Grade II.....	1:30- 5:20	MTWThF		
			8:30-12:20	S	317ME	Mr. Arnal
44f	2	Elements of Construction Lect.	11:00	W	320ME	
		Lab.	1:00- 3:50	W	402ME	Mr. R. T. Jones
45w	2	Elements of Construction Lect.	11:30	W	320ME	
		Lab.	1:30- 4:20	W	402ME	Mr. R. T. Jones
46s	2	Elements of Construction	10:00-11:50	WF	402ME	Mr. R. T. Jones
131f,132f, 133f	10	Architectural Design, Grade III.....	8:00- 9:50	MWF		
			1:00- 4:50	MTWThF		
			8:00-11:50	S	317ME	Mr. Arnal
131w,132w, 133w	10	Architectural Design, Grade III.....	8:30-10:20	MWF		
			1:30- 5:20	MTWThF		
			8:30-12:20	S	317ME	Mr. Arnal
131s,132s, 133s	10	Architectural Design, Grade III.....	8:00- 9:50	MTW		
			1:00- 4:50	MTWThF		
			8:00-11:50	S	317ME	Mr. Arnal
141f	2	Materials of Construction	10:00	TF	320ME	Mr. R. T. Jones
142w	2	Materials of Construction	9:30	TTh	320ME	Mr. R. T. Jones
143s	2	Materials of Construction	10:00	MTh	21ME	Mr. R. T. Jones
151f	1	Architectural Seminar...	10:00	W	320ME	Mr. Mann
152w	1	Architectural Seminar...	10:30	W	320ME	Mr. Gauger
153s	2	Business Relations....	10:00	WF	320ME	Mr. Mann
161f	2	History of Painting and Sculpture .....	9:00	TTh	320ME	Mr. Burton
162w	2	Landscape Design.....	10:30	TF	320ME	Mr. Nichols
163s	2	Allied Arts.....	8:00	T	320ME	Mr. Mann
			9:00	Th		

PROGRAM

121

CHEMISTRY

No.	Credits	Title	Hour	Day	Building	Instructor
4f	4	General Inorganic Chemistry .....				
		Lect. Sec. 1, 2, 3, 4, 5, 6, 7, 8	10:00	MWF	100C	Mr. Kirk
		Sec. 9, 10, 11, 12, 13, 14	8:00	TThS	100C	Mr. Kirk
		Lab. Sec. 1, 2, 3, 4, 5, 6, 7, 8	8:00-11:00	T	110C	Mr. Kirk
5W	4	General Inorganic Chemistry .....				
		Lect. Sec. 1, 2, 3, 4, 5, 6	10:30	MWF	100C	Mr. Kirk
		Sec. 7, 8, 9, 10, 11, 12	8:30	TThS	100C	Mr. Kirk
		Lab. Sec. 1, 2, 3, 4, 5, 6	8:30-11:20	T	110C	Mr. Kirk
14f	5	General Inorganic Chemistry .....				
		Lect. Sec. 15, 16, 17, 18	9:00	TThS	100C	Mr. Pervier
		Lab. Sec. 15, 16, 17, 18	9:00-11:50	MF	110C	Mr. Pervier
		Sec. 1, 2, 3, 4, 5, 6	1:30-4:20	W	110C	Mr. Kirk
15W	5	General Inorganic Chemistry .....				
		Lect. Sec. 13, 14, 15, 16	9:30	TThS	100C	Mr. Pervier
		Lab. Sec. 13, 14, 15, 16	9:30-12:20	MF	110C	Mr. Pervier
		Qualitative Analysis.....				
16s	5	Lect. Sec. 1, 2, 3, 4	10:00	MWF	100C	Mr. Kirk
		Sec. 5, 10, 11, 12, 13, 14	8:00	TThS	100C	Mr. Pervier
		Sec. 6, 7, 8, 9	9:00	TThS	100C	
		Lab. Sec. 1, 2, 3, 4	8:00-10:50	TS	110C	
28f	3	Sec. 5, 10, 11, 12, 13, 14	1:00-3:50	MW	110C	
		Sec. 6, 7, 8, 9	9:00-11:50	MF	110C	
		Quantitative Analysis....	1:00-5:00	TTh	310C	Mr. Sidener, Mr. Geiger
		Lab. Sec. 1, 2, 3, 4	8:00-10:50	TS	110C	
28W	3	Quantitative Analysis...	1:30-5:00	TTh	310C	Mr. Sidener, Mr. Geiger
		Power-Plant Chemistry..				
		Lect.	8:00	M	215C	Mr. Harding
		Lab. Sec. A	1:00-3:50	M		
60s	3	Sec. B	2:00-4:50	W	224C	Mr. Harding
		Lab. Sec. B	8:00-10:00	T		
		Sec. B	8:00-10:50	S	224C	Mr. Harding
		Lab. Sec. B	8:00-10:50	S	224C	Mr. Harding



## CIVIL ENGINEERING

No.	Credits	Title	Hour	Day	Building	Instructor			
11f	3	Surveying ..... Sec. 1	11:00	M	203ME				
			8:00-11:50	T					
			8:00-10:50	Th	1ME	Mr. Boon			
			11:00	M	203ME				
			1:00- 4:50	T					
			8:00-10:50	S	1ME	Mr. Boon			
			1:00- 4:50	Th					
			9:00-11:50	F	1ME				
			2:00	F	203ME	Mr. Boon			
			9:00	M	136ME				
			1:00- 4:50	M					
			1:00- 3:50	W	1ME	Mr. Boon			
			12w	3	Surveying ..... Sec. 1	11:30	M	203ME	Mr. Boon
8:30-12:20	T					Mr. Zelner			
8:30-11:20	Th	1ME				Mr. Boon			
11:30	M	203ME				Mr. Boon			
1:30- 5:20	T					Mr. Zelner			
8:30-11:20	S	1ME				Mr. Boon			
1:30- 5:20	Th					Mr. Zelner			
9:30-12:20	F	1ME				Mr. Boon			
2:30	F	229ME				Mr. Boon			
13s	3	Surveying ..... Sec. 1				11:00	M	203ME	
						8:00-11:50	T		
						8:00-10:50	Th	1ME	Mr. Boon
						11:00	M	203ME	
			1:00- 4:50	M					
			8:00-10:50	S	1ME	Mr. Boon			
			1:00- 3:50	Th					
			8:00-11:50	F	1ME				
			2:00	F	203ME	Mr. Boon			
			14f	3	Surveying ..... Sec. 1	1:00- 4:50	TW	225(A)ME	Mr. Zelner
						1:00- 4:50	F		
						8:00-11:50	S	225(B)ME	Mr. Zelner
						1:00- 4:50	M	225(B)ME	
	Th	225(A)ME				Mr. Zelner			
	MF	21ME				Mr. Zelner			
16s	3	Surveying .....	1:00- 4:50	MF	21ME	Mr. Zelner			
17s	1	Surveying .....	8:00-10:50	F	206ME	Mr. Zelner			
21w	3	Railway Engineering.... Sec. 1	9:30	M	215ME				
			1:30- 4:20	M	225(B)ME				
			11:30	T	215ME	Mr. Boon			
			1:30- 5:20	W	225(B)ME	Mr. Zelner			
			9:30	M	215ME				
			11:30	T	215ME				
			1:30- 4:20	Th	225(B)ME	Mr. Boon			
			1:30- 5:20	F	225(B)ME	Mr. Zelner			
			1:30- 5:20	M	225(A)ME	Mr. Zelner			
			2:30- 5:20	T	225(A)ME				
			10:30	W	135ME				
			11:30	S	136ME	Mr. Boon			

PROGRAM

No.	Credits	Title	Hour	Day	Building	Instructor			
22S	3	Railway Engineering.... Sec. 1	1:00- 3:50	M	225(B)ME				
			11:00	T					
			11:00	S		106ME	Mr. Boon		
			1:00- 4:50	W		225(B)ME	Mr. Zelner		
			11:00	T		107ME			
			11:00	W		106ME	Mr. Boon		
			1:00- 4:50	Th		225(A)ME	Mr. Zelner		
			1:00- 3:50	F		225(B)ME	Mr. Boon		
			1:00- 4:50	T		225(A)ME	Mr. Zelner		
			10:00	WF		106ME			
31f	3	Stresses .....	1:00- 3:50	W	225(A)ME	Mr. Boon			
			1:00- 4:50	M					
			10:00- 11:50	T	225(A)ME				
			9:00	W	135ME	Ar			
			9:00	W	135ME				
			1:00- 4:50	W					
			8:00- 9:50	Th	225(B)ME	Ar			
			8:00- 9:50	T	225(A)ME				
			10:00	W	229ME				
			1:00- 4:50	F	225(A)ME	Ar			
32W	3	Stresses .....	1:30- 5:20	T	225(B)ME				
			9:30	W	203ME				
			10:30-11:50	S	225(B)ME	Ar			
			9:30	W	203ME				
			1:30- 5:20	W	225(A)ME				
			8:30-10:20	S	225(A)ME	Ar			
			10:30	M	203ME				
			8:30-10:20	Th	225(A)ME				
			1:30- 5:20	F	225(A)ME	Ar			
			33S	3	Structural Design..... Sec. 1	1:00- 4:50	T	225(B)ME	
11:00	M	217ME							
10:00-11:50	F	225(B)ME				Ar			
11:00	M	217ME							
1:00- 4:50	M	225(A)ME							
8:00- 9:50	T	225(A)ME				Ar			
10:00	M	217ME							
8:00- 9:50	Th	225(A)ME							
1:00- 4:50	F	225(A)ME				Ar			
37S	3	Structural Engineering.. Sec. 1				1:00- 4:50	T		
			8:00-11:50	S	206ME	Mr. Lagaard			
			1:00- 4:50	WF	206ME	Mr. Lagaard			
			8:00- 9:50	MTTh	401ME	Mr. Lagaard			
			8:30-10:20	MTTh	Ar	Mr. Lagaard			
			8:00- 9:50	MTTh	Ar	Mr. Maney			
			1:00- 4:50	F					
			1:00- 4:50	ThF	201ExE	Mr. Lang			
			9:00	F		Mr. Worrell			
			1:00- 4:50	MT	201ExE	Mr. Worrell			
38f	3	Stresses .....	9:00	F		Mr. Lang			
			1:00- 4:50	ThF	201ExE	Mr. Worrell			
			9:00	F		Mr. Lang			
			1:00- 4:50	MT	201ExE	Mr. Worrell			
			9:00	F		Mr. Lang			
			1:00- 4:50	W		Mr. Lang			
			8:00-11:50	S	201ExE	Mr. Worrell			
			39W	3	Structural Design.....	9:00	F		Mr. Lang
						1:00- 4:50	ThF	201ExE	Mr. Worrell
						9:00	F		Mr. Lang
1:00- 4:50	MT	201ExE				Mr. Worrell			
9:00	F					Mr. Lang			
1:00- 4:50	W					Mr. Lang			
8:00-11:50	S	201ExE				Mr. Worrell			
41S	3	Reinforced Concrete....				9:00	F		Mr. Lang
						1:00- 4:50	ThF	201ExE	Mr. Worrell
						9:00	F		Mr. Lang
			1:00- 4:50	MT	201ExE	Mr. Worrell			
			9:00	F		Mr. Lang			
			1:00- 4:50	W		Mr. Lang			
			8:00-11:50	S	201ExE	Mr. Worrell			
			51f	3	Highways and Pavements Sec. 1	9:00	F		Mr. Lang
						1:00- 4:50	ThF	201ExE	Mr. Worrell
						9:00	F		Mr. Lang
1:00- 4:50	MT	201ExE				Mr. Worrell			
9:00	F					Mr. Lang			
1:00- 4:50	W					Mr. Lang			
8:00-11:50	S	201ExE				Mr. Worrell			

No.	Credits	Title	Hour	Day	Building	Instructor
52w	3	Highways and Pavements Sec. 1	1:30- 5:20	Th		
			9:30	F		Mr. Lang
			1:30- 4:20	F	201 ExE	Mr. Worrell
	2		1:30- 4:20	M		
			1:30- 5:20	T		Mr. Lang
			9:30	F	201 ExE	Mr. Worrell
	3		1:30- 5:20	W		
			9:30	F		Mr. Lang
			8:30-11:20	S	201 ExE	Mr. Worrell
	53s	3	Municipal Engineering..	9:00	MW	
			8:00	S	135ME	Mr. Bass
121f	3	Railway Engineering.... Sec. 1	1:00- 4:50	M		
			9:00-10:50	W	206ME	
			10:00	F	135ME	Mr. Cutler
	2		1:00- 4:50	T		
			1:00- 2:50	Th	227ME	
			10:00	F	135ME	Mr. Cutler
	3	Railway Engineering....	9:30	M	217ME	
			9:30-12:20	T		
	3	Railway Engineering....	1:30- 4:20	Th	227ME	Mr. Cutler
			1:00	W	104ME	
3	Railway Engineering....	1:00- 4:50	T			
		9:00-10:50	F	227ME	Mr. Cutler	
125w	3	Transportation .....	10:30	MThS	217ME	Mr. Cutler
125s	3	Transportation .....	9:00	TThS	104ME	Mr. Cutler
131f	4	Bridge Analysis.....	10:00	T	107ME	
			1:00- 4:50	ThF	206ME	Ar
132f	3	Bridge Design.....	10:00	M	205ME	
			8:00-10:50	WTh	227ME	Ar
132w	3	Bridge Design.....	9:30	M	203ME	
			9:30-12:20	T		
3	Bridge Design.....	1:30- 4:20	Th	206ME	Ar	
		9:30-12:20	WF	227ME		
133w	3	Bridge Design.....	9:30	S	215ME	Ar
			9:30			
133s	3	Bridge Design.....	1:00- 3:50	M		
			8:00-10:50	Th	227ME	
141f	3	Reinforced Concrete....	9:00	W	229ME	Ar
			1:00- 4:50	T		
142w	3	Reinforced Concrete....	8:00-10:50	Th	206ME	Mr. Maney
			9:30-12:20	W		
3	Foundations .....	1:30- 5:20	F	206ME	Mr. Maney	
		1:00- 4:50	F			
143s	3	Foundations .....	9:00-11:50	S	227ME	Mr. Maney
			9:00			
144s	3	Reinforced Concrete....	10:00-11:50	M		
			1:00- 4:50	Th	206ME	
161f	4	Hydrology .....	11:00	F	217ME	Mr. Lagaard
			8:00- 9:50	T	135ME	
3	Sec. 1	1:00- 4:50	W			
		9:00	MF	206ME	Mr. Bass	
2		9:00	MF	135ME		
		1:00- 4:50	M			
		3:00- 4:50	Th	227ME	Mr. Bass	

PROGRAM

No.	Credits	Title	Hour	Day	Building	Instructor
162f	3	Water Supply.....	10:00	M	229ME	
			8:00-10:50	W	225(A)ME	
162w	3	Water Supply.....	1:00- 3:50	F	227ME	Mr. Bass
			1:30- 4:20	MT	206ME	
163w	3	Sanitary Engineering....	9:30	Th	106ME	Mr. Bass
			1:30- 4:20	WF	227ME	
163s	3	Sanitary Engineering....	10:30	S	205ME	Mr. Bass
			10:00	M	106ME	
164w	3	Water Power.....	8:00-11:50	T		
			1:00- 4:50	Th	227ME	Mr. Bass
165s	3	Water Power.....	9:30	M	136ME	
			9:30-12:20	M	225(A)ME	
171w	2	Building Sanitation.....	9:30-12:20	T	225(A)ME	Mr. Bass
			1:00- 4:50	M	206ME	
231f	3	Indeterminate Structures	8:00-11:50	TS	227ME	Mr. Maney
231w	4	Indeterminate Structures	1:30- 5:20	W		
			9:30-12:20	F		
243f-244w	3	Concrete Laboratory....	11:30	S	206ME	Mr. Maney
			Ar	Ar	ExE	Mr. Lagaard
245w	4	Reinforced Concrete Analysis .....	1:30- 5:20	MT	227ME	Mr. Maney

DRAWING AND DESCRIPTIVE GEOMETRY

No.	Credits	Title	Hour	Day	Building	Instructor
M&M 1 of	3	Solid Geometry.....	8:00	MWF	136ME	Ar
			9:00	MWF	215ME	Ar
			1:00	MWF	215ME	Ar
			2:00	MTTh	205ME	Ar
			2:00	MTTh	215ME	Ar
			2:00	MWF	104ME	Ar
if	3	Engineering Drawing....	8:00- 9:50	MWF		
			2:00- 3:50	W	401C	Ar
			8:00- 9:50	MWF		
			2:00- 3:50	W	411C	Ar
			8:00- 9:50	MWF		
			2:00- 3:50	W	412C	Ar
			8:00- 9:50	MWF		
			2:00- 3:50	W	422C	Ar
			8:00- 9:50	MWF		
			2:00- 3:50	W	409C	Ar
			10:00- 11:50	MF		
			1:00- 2:50	TTh	401C	Ar
			10:00-11:50	MF		
			1:00- 2:50	TTh	411C	Ar
			10:00-11:50	MF		
			1:00- 2:50	TTh	412C	Ar
			10:00-11:50	TWS		
			3:00- 4:50	F	401C	Ar
10:00-11:50	TWS					
3:00- 4:50	F	411C	Ar			
10:00-11:50	TWS					
3:00- 4:50	F	412C	Ar			
10:00-11:50	TWS					
3:00- 4:50	F	422C	Ar			

No.	Credits	Title	Hour	Day	Building	Instructor	
1w	3	Engineering Drawing... Sec. 5	3:30- 5:20	T			
			8:30-10:20	F			
			2:30- 4:20	F			
			10:30-12:20	S	401C	Ar	
			7	10:30-12:20	MF		
			1:30- 3:20	MT	401C	Ar	
			9	10:30-12:20	TS		
			1:30- 3:20	TTh	403C	Ar	
			10	10:30-12:20	MF		
			1:30- 3:20	TTh	411C	Ar	
			16, 17	10:30-12:20	TS		
2:30- 4:20	WF	409C	Ar				
2w	3	Engineering Drawing... Sec. 1	8:30-10:20	MWS			
			2:30- 4:20	W	401C	Ar	
			2	8:30-10:20	MWS		
			2:30- 4:20	W	409C	Ar	
			3	8:30-10:20	MWS		
			2:30- 4:20	W	412C	Ar	
			4	8:30-10:20	MWS		
2:30- 4:20	W	422C	Ar				
6	8:30-10:20	MWFS	411C	Ar			
2w	3	Engineering Drawing... Sec. 8	1:30- 3:20	MTTh			
			8:30-10:20	F	409C	Ar	
			11	1:30- 3:20	MTTh		
			8:30-10:20	F	412C	Ar	
			12	1:30- 3:20	MTTh		
			8:30-10:20	F	422C	Ar	
			13	10:30-12:20	TWS		
			3:30- 5:20	F	412C	Ar	
			14	10:30-12:20	TWS		
			3:30- 5:20	F	422C	Ar	
			10:30-12:20	TWS			
3:30- 5:20	F	422C	Ar				
2s	3	Engineering Drawing.... Sec. 5	10:00-11:50	MTWF	412C	Ar	
			8	1:00- 2:50	MWF		
			10:00-11:50	T	411C	Ar	
			9	1:00- 2:50	MWF		
			10:00-11:50	T	403C	Ar	
			11	8:00- 9:50	MF		
			10:00-11:50	W			
			1:00- 2:50	Th	411C	Ar	
			14, 15	10:00-11:50	MF		
			8:00- 9:50	W			
			3:00- 4:50	Th	411C	Ar	
3f	3	Descriptive Geometr..... Sec. Eng.	10:00	MWF	203ME	Mr. Myers	

PROGRAM

No.	Credits	Title	Hour	Day	Building	instructor
3s	3	Descriptive Geometry....				
		Sec. 1	8:00- 9:50	MWF		
			1:00- 2:50	Th	401C	Ar
		2	8:00- 9:50	MWF		
			1:00- 2:50	Th	409C	Ar
		3	8:00- 9:50	MWF		
			1:00- 2:50	Th	412C	Ar
		4	8:00- 9:50	MWF		
			1:00- 2:50	Th	422C	Ar
		12	10:00-11:50	TWF		
			9:00-10:50	Th	401C	Ar
		13	10:00-11:50	TWF		
			9:00-10:50	Th	409C	Ar
4f	2	Engineering Drawing....				
		Fr. Chem.	1:00- 2:50	MThF	409C	Ar
5w	2	Engineering Drawing...				
		Fr. Chem.	1:30- 3:20	MThF	Ar	Ar
6s	2	Engineering Drawing....				
		Fr. Chem.	1:00- 2:50	MF		
			2:00- 3:50	Th	101ME	Ar
7w	3	Engineering Drawing...				
		Fr. Chem.	Ar	Ar	Ar	Ar
8s	3	Engineering Drawing...				
		Fr. Chem.	Ar	Ar	Ar	Ar
9f	2	Drafting .....				
		Soph. Chem. (Elec.)	Ar	Ar	Ar	Ar
11f	4	Engineering Drawing....				
		Fr. Mines	10:00-11:50	MTWFS	409C	Mr. Archibald
12w	4	Engineering Drawing...				
		Fr. Mines	Ar	Ar	Ar	Ar
13s	4	Engineering Drawing....				
		Fr. Mines	10:00-11:50	MTWTF	101ME	Ar
14f	3	Descriptive Geometry....				
		Soph. Mines	10:00	MWF	201ExE	Ar
15w	2	Drafting .....				
		Soph. Mines	Ar	Ar	Ar	Ar
21f	2	Drafting .....				
		Sec. C.E. 1	8:00- 9:50	MWF	201ME	Ar
		C.E. 2	8:00- 9:50	MWF	101ME	Ar
		C.E. 3	2:00- 3:50	MW		
			1:00- 2:50	T	101ME	Ar
21w	2	Drafting .....				
		Sec. C.E. 1	8:30-10:20	MWF	201ME	Ar
		C.E. 2	8:30-10:20	MWF	101ME	Ar
		C.E. 3	10:30-12:20	MW		
			1:30- 3:20	T	201ME	Ar
22s	2	Drafting .....				
		Sec. C.E. 1	8:00- 9:50	MWF	201ME	Ar
		C.E. 2	8:00- 9:50	MWF	101ME	Ar
		C.E. 3	10:00-11:50	MW		
			2:00- 3:50	M	201ME	Ar

No.	Credits	Title	Hour	Day	Building	Instructor
26f	2	Drafting .....				
		Sec. E.E. 1	10:00-11:50	MFS	201ME	Ar
		E.E. 2	10:00-11:50	MFS	101ME	Ar
		E.E. 3	8:00- 9:50	T		
			3:00- 4:50	Th		
			1:00- 2:50	F	201ME	Ar
		E.E. 4	8:00- 9:50	T		
		3:00- 4:50	Th			
		1:00- 2:50	F	101ME	Ar	
26w	2	Drafting .....	Ar	Ar	Ar	Ar
27w	2	Drafting .....				
		Sec. E.E. 1	9:30-11:20	Th		
			10:30-12:20	FS	201ME	Ar
		E.E. 2	9:30-11:20	Th		
			10:30-12:20	FS	101ME	Ar
		E.E. 3	8:30-10:20	T		
			3:30- 5:20	Th		
			1:30- 3:20	F	201ME	Ar
		E.E. 4	8:30-10:20	T		
			10:30-12:20	W		
		1:30- 3:20	F	101ME	Ar	
27s	2	Drafting .....	Ar	Ar	Ar	Ar
28f	2	Drafting .....				
		Sec. M.E. 1	10:00-11:50	T		
			1:00- 2:50	WTh	201ME	Ar
		M.E. 2	1:00- 2:50	MT		
			8:00- 9:50	S	201ME	Ar
28w	2	Drafting .....	Ar	Ar	Ar	Ar
29w	2	Drafting .....				
		Sec. M.E. 1	10:30-12:20	T		
			1:30- 3:20	WTh	201ME	Ar
		M.E. 2	1:30- 3:20	M		
			2:30- 4:20	T		
			8:30-10:20	S	101ME	Ar
29s	2	Drafting .....	Ar	Ar	Ar	Ar
31f	2	Graphics (Fr. Arch)....	9:00	TTh	215ME	Mr. Kirchner
32w	2	Graphics (Fr. Arch)....	9:30	TTh	215ME	Mr. Kirchner
33s	2	Graphics (Fr. Arch)....	9:00	TTh	215ME	Mr. Kirchner
39f	2	Lettering for Engineers.				
		(Jr., sr., elective)	10:00	MS	135ME	Mr. Kirchner
39w-s	2	Lettering for Engineers.				
		(Jr., sr., elective)	Ar	Ar	Ar	Mr. Kirchner
41f	2	Technical Drawing.....				
		(S.L.A. and Dents.)				
		Sec. 1	8:00- 9:50	MWF	403C	Ar
		2	10:00-11:50	MWF	403C	Mr. Cederberg
		3	2:00- 3:50	MWF	403C	Mr. Cederberg
42w	2	Technical Drawing.....				
		(S.L.A. and Dents.)				
		Sec. 1	8:30-10:20	MWF	403C	Ar
		2	10:30-12:20	MWF	403C	Ar
		3	2:30- 4:20	MWF	403C	Ar
43s	2	Technical Drawing.....				
		(S.L.A. and Dents.)				
		Sec. 1	8:00- 9:50	MWF	403C	A1
		2	10:00-11:50	MWF	403C	Ar
		3	2:00- 3:50	MWF	401C	Ar

PROGRAM

No.	Credits	Title	Hour	Day	Building	Instructor
44f-w-s	1	Lettering .....	9:00	Th	217ME	Ar
45f	2	*Alphabets .....				
		(S.L.A., elective)	9:00	TTh	208ME	Ar
45w	2	Alphabets .....				
		(Jr., sr., elective)	9:30	TTh	Ar	Ar
45s	2	Alphabets .....				
		(S.L.A., elective)	9:00	TTh	208ME	Ar
47f	3	Drawing, Engraving, and Decoration .....				
		(S.L.A., elective)	11:00	MWF	208ME	Mr. Kirchner
48w	3	Drawing, Engraving, and Decoration .....				
		(S.L.A., elective)	11:30	MWF	208ME	Mr. Kirchner
49s	3	Drawing, Engraving, and Decoration .....				
		(S.L.A., elective)	11:00	MWF	208ME	Mr. Kirchner
71f-w-s	3	Graphical Representation (Jr., sr., elective)	Ar	Ar	Ar	Mr. Egger

ECONOMICS

No.	Credits	Title	Hour	Day	Building	Instructor
8f	3	General Economics.....				
		Sec. 1	8:00	MWF	135ME	Ar
		2	11:00	MWF	135ME	Ar
		3	11:00	MWF	136ME	Ar
9w	3	General Economics.....				
		Sec. 1	8:30	MWF	135ME	Ar
		2	11:30	MWF	135ME	Ar
		3	11:30	MWF	136ME	Ar
29s	4	Principles of Accounting	8:00	MW	203ME	
				F	229ME	
			1:00-2:50	Th	Ar	Mr. Ostlund
57w	3	Business Finance.....	8:30	MWF	209ExE	Mr. Stehman
91f	3	Principles of Organiza- tion and Management.	11:00	MWF	107ME	Mr. Pelz

ELECTRICAL ENGINEERING

No.	Credits	Title	Hour	Day	Building	Instructor
11f	3	Elements of Elec. Eng..				
		Sec. 1	11:00	T		
			9:00	Th	201EE	Mr. Shepardson
		2	11:00	T		
			9:00	Th	204EE	Mr. Todd
		3	10:00	ThS	201EE	Mr. Swenson
		4	10:00	ThS	204EE	Mr. Todd
		Elements of Elec. Eng Lab. ....				
		Sec. A	1:00-2:50	T	100EE	Mr. Todd
		B	10:00-11:50	W	100EE	Mr. Swenson
		C	9:00-10:50	T	100EE	Mr. Todd
		D	1:00-2:50	Th	100EE	Mr. Swenson
		E	1:00-2:50	M	100EE	Mr. Todd
		F	8:00-9:50	S	100EE	Mr. Todd
		G	3:00-4:50	T	100EE	Mr. Kuhlman
		H	1:00-2:50	W	100EE	Mr. Kuhlman



No.	Credits	Title	Hour	Day	Building	Instructor	
13W	3	Elements of Elec. Eng..					
		Sec. 1	11:30	T			
			1:30	Th	201EE	Mr. Shepardson	
		2	11:30	T			
			1:30	Th	204EE	Mr. Todd	
			10:30	TTh	201EE	Mr. Swenson	
			10:30	TTh	204EE	Mr. Todd	
			Elements of Elec. Eng.				
			Lab. ....				
			Sec. A	10:30-12:20	W	100EE	Ar
			B	2:30-4:20	F	100EE	Ar
			C	1:30-3:20	T	100EE	Ar
			D	2:30-4:20	Th	100EE	Ar
		E	1:30-3:20	M	100EE	Ar	
		F	8:30-10:20	S	100EE	Ar	
		G	3:30-5:20	T	100EE	Ar	
		H	1:30-3:20	W	100EE	Ar	
15S	3	Elements of Elec. Eng..					
		Sec. 1	11:00	T			
			1:00	Th	201EE	Mr. Shepardson	
		2	11:00	T			
			1:00	Th	204EE	Mr. Todd	
			10:00	TTh	201EE	Mr. Swenson	
			10:00	TTh	204EE	Mr. Todd	
			Elements of Elec. Eng.				
			Lab. ....				
			Sec. A	10:00-11:50	W	100EE	Ar
			B	2:00-3:50	F	100EE	Ar
			C	1:00-2:50	T	100EE	Ar
			D	10:00-11:50	F	100EE	Ar
		E	1:00-2:50	M	100EE	Ar	
		F	8:00-9:50	S	100EE	Ar	
		G	3:00-4:50	T	100EE	Ar	
		H	10:00-11:50	M	100EE	Ar	
40f	2	Electric Wiring and Equip. ....	8:00	TTh	201EE	Mr. Todd	
41f	3	Electric Power (Miners) Lab.	10:00 Ar	TTh	Ar 100EE	Mr. Ryan Mr. Swenson	
42W		Electric Power (C.E.)... Sec. 1 Lab.	8:30 10:30-12:20	TThS M	201EE 100EE	Mr. Ryan Mr. Swenson	
43S-44f		2 Lab.	9:30-11:20	W	100EE	Mr. Swenson	
		Electric Power.....					
		Sec. Mech.	8:00	ThS	104MechE	Mr. Martin	
		Lab. Sec. 1	9:00-10:50	W	100EE	Mr. Martin	
		2	9:00-10:50	F	100EE	Mr. Martin	
45W		Sec. Chem.	9:00	TTh	115C	Mr. Martin	
		Lab.	8:00-10:50	S	100EE	Mr. Martin	
		Electric Power.....					
		Sec. Mech.	8:30	ThS	104MechE	Mr. Martin	
		Lab. Sec. 1	9:30-11:20	W	100EE	Mr. Martin	
61f-65S		2	9:30-11:20	F	100EE	Mr. Martin	
		Sec. Chem.	9:30	TTh	115C	Mr. Martin	
		Lab.	8:30-11:20	S	100EE	Mr. Martin	
		Electric Communication.	1:00	W	201EE	Mr. Shepardson	
		Sec. 1 Lab.	1:00-3:50	M	207EE	Mr. Swenson	
		2 Lab.	2:00-4:50	W	207EE	Mr. Swenson	
		3 Lab.	1:00-3:50	F	207EE	Mr. Swenson	

PROGRAM

131

No.	Credits	Title	Hour	Day	Building	Instructor
63w	2	Electric Communication.	1:30	W	201EE	Mr. Shepardson
		Sec. 1 Lab.	1:30-4:20	M	207EE	Mr. Swenson
		2 Lab.	2:30-5:20	W	207EE	Mr. Swenson
		3 Lab.	1:30-4:20	F	207EE	Mr. Swenson
111f-115s-113w		D. C. Machinery.....	9:00	MWF	201EE	Mr. Springer
			9:30	MWF	201EE	Mr. Springer
112f-116s	2	D. C. Machinery Lab...				
		Sec. 1	1:00-4:50	M	100EE	Mr. Martin
		2	8:00-11:50	T	100EE	Mr. Swenson
		3	1:00-4:50	T	100EE	Mr. Martin
114w	2	D. C. Machinery Lab...				
		Sec. 1	1:30-5:20	M	100EE	Mr. Martin
		2	8:30-12:20	T	100EE	Mr. Swenson
		3	1:30-5:20	T	100EE	Mr. Martin
121f-125s	3	A. C. Machinery				
		Sec. 1	10:00	MWF	201EE	Mr. Ryan
		2	11:00	MWF	201EE	Mr. Ryan
123w	3	A. C. Machinery.....				
		Sec. 1	10:30	MWF	201EE	Mr. Ryan
		2	11:30	MWF	201EE	Mr. Ryan
122f-126s	2	A. C. Machinery.....				
		Sec. 1	1:00-4:50	W	100EE	Mr. Springer
		2	1:00-4:50	Th	100EE	Mr. Springer
		3	1:00-4:50	F	100EE	Mr. Springer
124w	2	A. C. Machinery Lab...				
		Sec. 1	1:30-5:20	W	100EE	Mr. Springer
		2	1:30-5:20	Th	100EE	Mr. Springer
		3	1:30-5:20	F	100EE	Mr. Springer
132f-136s	2	Electric Design.....				
		Lect.	8:00	T	136ME	Mr. Kuhlman
		Sec. 1 Lab.	9:00-11:00	T		
			1:00-3:50	Th	225(B)ME	Mr. Kuhlman
		2 Lab.	9:00-11:00	M		
			8:00-11:00	Th	225(A)ME	Mr. Kuhlman
134w	2	Electric Design.....				
		Lect.	8:30	T	136ME	Mr. Kuhlman
		Sec. 1 Lab.	9:30-11:20	T		
			1:30-4:20	Th	225(B)ME	Mr. Kuhlman
		2 Lab.	9:30-11:20	M		
			8:30-11:20	Th	225(A)ME	Mr. Kuhlman
141f	2	Central Station.....	9:00	ThS	229ME	Mr. Ryan
142w	2	Electrical Transmission..	9:30	ThS	204EE	Mr. Ryan
143f-w-s	1	Power Plant Oper.....	(Any 3 consecutive hours)		Power Plant	Mr. Ryan, Mr. Dixon
144w	2	Railway Electrical Eng.	11:30	MW	204EE	Mr. Martin
145s	2	Railroad Electrification..	11:00	MW	204EE	Mr. Martin
151f	2	Elec. Lighting.....	11:00	MW	204EE	Mr. Martin
152f	1	Photometric Lab.....	1:00-3:50	W	209EE	Mr. Martin
161f-163s	3	Radio Communication...				
		Lect.	8:00	ThS	204EE	Mr. Jansky
		Sec. 1 Lab.	1:00-3:50	M	207EE	Mr. Jansky
		2 Lab.	1:00-3:50	F	207EE	Mr. Jansky
		3 Lab.	1:00-3:50	T	207EE	Mr. Jansky
162w	3	Radio Communication...				
		Lect.	8:30	ThS	204EE	Mr. Jansky
		Sec. 1 Lab.	1:30-4:20	M	207EE	Mr. Jansky
		2 Lab.	1:30-4:20	F	207EE	Mr. Jansky
		3 Lab.	1:30-4:20	T	207EE	Mr. Jansky

No.	Credits	Title	Hour	Day	Building	Instructor
167f-168w-169s	1	Radio-Station Operation.		Ar	207EE	Mr. Jansky
183f-184w-185s	2	Advanced Elec. Lab.....		Ar	100EE	Mr. Springer
191f-193s	1	Seminar .....	2:00- 3:50	T	201EE	Mr. Shepardson
192w	1	Seminar .....	2:30- 4:20	T	201EE	Mr. Shepardson
221s-223f-225w	2	Transients .....		Ar	Ar	Mr. Jansky

## GENERAL ENGINEERING COURSE

No.	Credits	Title	Hour	Day	Building	Instructor
11f	1	Orientation .....	4:00- 4:50	TTh	100C	Ar
12w	1	Orientation .....	4:30- 5:20	Th	100C	Ar
13s	1	Orientation .....	4:00- 4:50	TF	100C	Ar
81f,w,s	3	Cost Estimating..... Jr., sr., elective	11:00	MWF	7ME(F) 215ME(W) Ar(S)	
101w	3	Lab. Engineering Contracts and Specifications.....	Ar	Ar	Ar	Mr. French
111s	1	Valuation of Public Utilities .....	Ar	Ar	Ar	Mr. Pillsbury
124w	1	Engineering Relations...	Ar	Ar	Ar	Mr. Shepardson

## GEOLOGY

No.	Credits	Title	Hour	Day	Building	Instructor
2f	3	Geology .....	8:00	MWF	210P	Mr. Schwartz
6w	3	Geology .....	8:30	MWF	210P	Mr. Schwartz

## HYGIENE AND FIRST AID

No.	Credits	Title	Hour	Day	Building	Instructor
1w	0	Hygiene and First Aid to Sick and Injured..... Sec. 1, 2, 3, 5, 13, 14, 15, 16, 17	4:30	W	305ME	Mr. Sundwall
		Sec. 4, 6, 7, 8, 9, 10, 11, 12	4:30	T	305ME	Mr. Sundwall

## MATHEMATICS AND MECHANICS

No.	Credits	Title	Hour	Day	Building	Instructor
9f	0	High-School Higher Algebra .....				
		Sec. 5	10:00	S		
			1:00	TTh	229ME	Ar
		6	10:00	S		
			1:00	TTh	215ME	Ar
		8	11:00	MWF	215ME	Ar
		9	9:00	MThF	7ME	Ar
		10	9:00	TThS	203ME	Ar
		15	8:00	TThS	215ME	Ar

PROGRAM

No.	Credits	Title	Hour	Day	Building	Instructor
Prof	0	Solid Geometry.....	See under	Drawing and	Descriptive Geometry	Dept.
11f	5	Applied Mathematics & Mechanics, College Algebra .....				
		Sec. 1	11:00	TWFS		
			1:00	Th	21ME	Ar
		2	11:00	MTFS		
			1:00	Th	22ME	Ar
		3	11:00	MTWS		
			1:00	Th	104ME	Ar
		4	11:00	MTWFS	106ME	Ar
		7	11:00	MTWFS	209ExE	Ar
		11	10:00	MThFS	21ME	Ar
		12	10:00	MThFS	22ME	Ar
		13	9:00	MThFS	21ME	Ar
		14	9:00	MThFS	22ME	Ar
		16	8:00	MTWThS	21ME	Ar
		17	8:00	TWThFS	217ME	Ar
		18	8:00	MThFS	104ME	Ar
		Arch.	8:00	MTWThF	106ME	Ar
		Chem.	11:00	MTWFS	215C	Ar
11W	5	Applied Mathematics and Mechanics, College Algebra .....				
		Sec. 5	11:30	MTWF	201ExE	
			1:30	Th	110ExE	Ar
		6	11:30	MTWFS	110ExE	Ar
		7	9:30	MThFS	107ME	Ar
		8	10:30	MThFS	104ME	Ar
		12	10:30	MThFS	22ME	Ar
		13	8:30	MTWThS	217ME	Ar
		16	8:30	MTWFS	21ME	Ar
		17	8:30	MTWFS	21ME	Ar
		Arch. 2	8:30	MTWThF	104ME	Ar
12W	5	Applied Mathematics and Mechanics, Trigonometry .....				
		Sec. 1	11:30	MTWF		
			1:30	Th	21ME	Ar
		2	11:30	MTFS		
			1:30	Th	22ME	Ar
		3	11:30	MTWFS	104ME	Ar
		4	11:30	MTWFS	106ME	Ar
		9	9:30	MThFS	22ME	Ar
		10	9:30	MThFS	21ME	Ar
		11	10:30	MThFS	21ME	Ar
		14	8:30	TWThFS	7ME	Ar
		15	8:30	MThFS	229ME	Ar
		Arch. 1	8:30	MTWThF	106ME	Ar
		Chem.	11:30	MTWFS	215C	Ar

No.	Credits	Title	Hour	Day	Building	Instructor
125	5	Applied Mathematics and Mechanics, Trigonometry .....				
		Sec. 5	9:00	MTWThF	21ME	Ar
		6	1:00	MF		
			10:00	TThS	203ME	Ar
		7	1:00	MF		
			10:00	TThS	22ME	Ar
		8	8:00	MTThFS	21ME	Ar
		10	10:00	MTThFS	7ME	Ar
		11	10:00	MTThF		
			9:00	W	104ME	Ar
		14, 15	8:00	WF		
			11:00	TW		
			10:00	Th	217ME	Ar
		Arch. 2	8:00	MTWThF	104ME	Ar
138		Applied Mathematics and Mechanics Analytical Geometry .....				
		Sec. 1	11:00	MTWFS	21ME	Ar
		2	11:00	MTWFS	22ME	Ar
		3	11:00	MTWFS	104ME	Ar
		4	11:00	MTWFS	106ME	Ar
		9	8:00	MTThFS	107ME	Ar
		12	9:00	MTWF		
			1:00	Th	22ME	Ar
		13	9:00	MTWF		
			2:00	Th	106ME	Ar
		Arch. 1	8:00	MTWThF	106ME	Ar
		Chem.	11:00	MTWFS	215C	Ar
24f	5	Calculus .....				
		Sec. C.E. 1	10:00	MWFS		
			1:00	Th	106ME	Ar
		C.E. 2	11:00	TWFS		
			1:00	Th	203ME	Ar
		C.E. 3	9:00	MTWThS	104ME	Ar
		C.E. 4	10:00	MTWThF	104ME	Ar
		E.E. 1	9:00	MTWFS	106ME	Ar
		E.E. 2	8:00	MTWThS	107ME	Ar
		E.E. 3	9:00	MWThF		
			10:00	T	205ME	Ar
		E.E. 4	8:00	MWThFS	229ME	Ar
		M.E. 1	9:00	T		
			10:00	MWThF	7ME	Ar
		M.E. 2	10:00	MTWFS	217ME	Ar
		Chem.	11:00	MTWFS	315C	Ar
24W	5	Calculus .....				
		Sec. C.E. 3	9:30	MTWThS	104ME	Ar
		E.E. 3	11:30	MTWFS	205ME	Ar
25W	5	Calculus .....				
		Sec. C.E. 1	10:30	MWFS		
			1:30	Th	106ME	Ar
		C.E. 2	11:30	TWFS		
			1:30	Th	203ME	Ar
		C.E. 4	10:30	MTWThF	209ExE	Ar
		E.E. 1	9:30	MTWFS	106ME	Ar
		E.E. 2	8:30	MTWThS	107ME	Ar
		E.E. 4	8:30	MWThFS	136ME	Ar
		M.E. 1	9:30	MTWThF	7ME	Ar
		M.E. 2	11:30	MTWFS	217ME	Ar
		Chem.	11:30	MTWFS	315C	Ar

PROGRAM

No.	Credits	Title	Hour	Day	Building	Instructor
25S	5	Calculus .....				
		Sec. C.E. 3	9:00	MTWThS	107ME	Ar
		C.E. 4	10:00	MTWThF	205ME	Ar
		E.E. 3	11:00	MTWFS	215ME	Ar
26S	5	Mechanics .....				
		Sec. C.E. 1	10:00	MWFS		
			1:00	Th	107ME	Ar
		C.E. 2	11:00	TWFS		
			1:00	Th	203ME	Ar
		E.E. 1	9:00	TWThFS	203ME	Ar
		E.E. 2	8:00	MTWThS	229ME	Ar
		E.E. 4	8:00	MTWThF	205ME	Ar
		M.E. 1	9:00	MTWThF	205ME	Ar
		M.E. 2	11:00	MTWFS	205ME	Ar
		Chem.	11:00	MTWFS	315C	Ar
81f	4	Mechanics (Chemists)...	8:00	MWThF	203ME	Mr. Herrick
82w	3	Materials (Chemists)....	8:30	MF	203ME	Mr. Herrick
		Lab.	1:30- 4:20	W	ExE	
83S	2	Hydraulics (Chemists)..	11:00	T	136ME	Mr. Herrick
		Lab.	1:00- 3:50	W	ExE	Mr. Herrick
91f	4	Calculus (Architects)...	8:00	MTThS	209ExE	Mr. Holman
92w	4	Mechanics (Architects)..	8:30	MTTh	201ExE	Mr. Holman
				S	110ExE	
93S	4	Materials (Architects)...	8:00	MWFS	201ExE	Mr. Holman
131f	3	Technical Mechanics....				
		Sec. C.E. 1	9:00	TThS	136ME	Ar
		C.E. 2	10:00	MWF	107ME	Ar
		C.E. 3	10:00	TThF	229ME	Ar
		E.E. 1	10:00	MWF	136ME	Ar
		E.E. 2	10:00	MWF	215ME	Ar
		E.E. 3	11:00	MWF	205ME	Ar
		M.E. 1	8:00	TThS	205ME	Ar
		M.E. 2	8:00	MWF	205ME	Ar
132w	3	Technical Mechanics....				
		Sec. C.E. 1	9:30	TThS	136ME	Ar
		C.E. 2	10:30	MWF	107ME	Ar
		C.E. 3	10:30	TThF	229ME	Ar
		E.E. 1	10:30	MWF	136ME	Ar
		E.E. 2	10:30	MWF	215ME	Ar
		E.E. 3	11:30	MWF	229ME	Ar
		M.E. 1	8:30	TThS	205ME	Ar
		M.E. 2	8:30	MWF	205ME	Ar
133S	2	Technical Mechanics....				
		Sec. C.E. 1	10:00	W		
			9:00	F	217ME	Ar
		C.E. 2	10:00	MW	136ME	Ar
		C.E. 3	10:00	TTh	106ME	Ar
		E.E. 1	10:00	MW	229ME	Ar
		E.E. 2	10:00	MW	215ME	Ar
		E.E. 3	11:00	WF	229ME	Ar
		M.E. 1	8:00	MF	110ExE	Ar
		M.E. 2	8:00	TF	203ME	Ar

No.	Credits	Title	Hour	Day	Building	Instructor
134f	2	Strength of Materials...				
		Sec. C.E. 1	10:00	WF	205ME	Ar
		C.E. 2	10:00	TTh	136ME	Ar
		C.E. 3	9:00	MW	203ME	Ar
		E.E. 1	8:00	ThS	136ME	Ar
		E.E. 2	10:00	TTh	215ME	Ar
		E.E. 3	10:00	S		
			1:00	Th	136ME	Ar
		M.E. 1	9:00	WF	136ME	Ar
		M.E. 2	9:00	TS	205ME	Ar
135W	3	Strength of Materials..				
		Sec. C.E. 1	10:30	MWF	205ME	Ar
		C.E. 2	10:30	TThS	136ME	Ar
		C.E. 3	9:30	MW		
			1:30	Th	229ME	Ar
		E.E. 1	9:30	TThS	203ME	Ar
		E.E. 2	10:30	TThS	215ME	Ar
		E.E. 3	10:30	ThS		
			1:30	T	107ME	Ar
		M.E. 1	9:30	MWF	205ME	Ar
		M.E. 2	9:30	TThS	205ME	Ar
		136s	3	Hydraulics .....		
Sec. C.E. 1	10:00			M		
	9:00			ThS	201ExE	Ar
C.E. 2	1:00			T		
	10:00			ThS	201ExE	Ar
C.E. 3	8:00			MWF	136ME	Ar
E.E. 1	10:00			TF		
	11:00			S	217ME	Ar
E.E. 2	10:00			TThF	215ME	Ar
E.E. 3	1:00			T		
	10:00			ThS	136ME	Ar
M.E. 1	9:00			TWS	136ME	Ar
M.E. 2	9:00			MS		
	8:00	Th	7ME	Ar		
141f	1	Materials-Testing Lab ..				
		Sec. C.E. 1	9:00-11:50	M	ExE	Ar
		C.E. 2	1:00- 3:50	Th	ExE	Ar
		C.E. 3	1:00- 3:50	T	ExE	Ar
		E.E. 1	9:00-11:50	T	ExE	Ar
		E.E. 2	9:00-11:50	S	ExE	Ar
		E.E. 3	8:00-10:50	Th	ExE	Ar
		M.E. 1	1:00- 3:50	M	ExE	Ar
		M.E. 2	1:00- 3:50	F	ExE	Ar
		143s	1	Hydraulics Laboratory...		
Sec. C.E. 1	8:00-10:50			T	ExE	Ar
C.E. 2	9:00-11:50			F	ExE	Ar
C.E. 3	9:00-11:50			S	ExE	Ar
E.E. 1	8:00-10:50			Th	ExE	Ar
E.E. 2	1:00- 3:50			F	ExE	Ar
E.E. 3	1:00- 3:50			M	ExE	Ar
M.E. 1	1:00- 3:50			Th	ExE	Ar
M.E. 2	1:00- 3:50			T	ExE	Ar
144W	1½			Materials-Testing Laboratory (Miners)..	Ar	Ar

PROGRAM

137

No.	Credits	Title	Hour	Day	Building	Instructor
146f-147w-						
148s	3	Materials of Engineering	8:00	MWF	22ME	Mr. Priester
151f	3	Differential Equations...	8:00	MWF	215ME	Mr. Dalaker
152w-153s	3	Advanced Calculus.....	8:30	MWF	215ME	Mr. Dalaker
154f-155w-						
156s	3	Modern Analysis.....	11:00	TThS	229ME	Mr. Dalaker

MECHANICAL ENGINEERING

No.	Credits	Title	Hour	Day	Building	Instructor
11f,12f,13f	2	Elementary Shop*.....			MechE	Mr. Martenis, Mr. Rhame, Mr. Richards, Mr. Quigley, Mr. Moffett
		Sec. A (1, 2, 3, 4, 5, 6)	2:00- 4:00 8:00-10:50	M Th		
		B (9, 10, 11, 12, 13, 14)	9:00-11:50 1:00- 3:50	W F		
		C (7, 8, 15, 16, 17, 18)	9:00-11:50 1:00- 3:50	T Th		
11w,12w,13w	2	Elementary Shop*.....			MechE	Mr. Martenis, Mr. Rhame, Mr. Richards, Mr. Quigley, Mr. Moffett
		Sec. A (1, 2, 3, 4, 5, 6, 17)	2:30- 5:20 8:30-11:20	M Th		
		B (7, 8, 9, 10, 11, 12)	9:30-11:20 1:30- 4:20	W F		
		C (13, 14, 15, 16, 17)	2:30- 5:20 1:30- 4:20	T Th		
11s,12s,13s	2	Elementary Shop*.....			MechE	Mr. Martenis, Mr. Rhame, Mr. Richards, Mr. Quigley, Mr. Moffett
		Sec. A (1, 2, 3, 4)	1:00- 3:50 8:00-10:50	M Th		
		B (6, 7, 8, 9, 10)	8:00-10:50 1:00- 3:50	W Th		
		C (5, 11, 12, 13, 14, 15)	1:00- 3:50 9:00-11:50	F S		
11f,12f	2	Elementary Shop*.....			MechE	Mr. Martenis, Mr. Rhame, Mr. Richards, Mr. Moffett
		Sec. D (Pre-dents)	8:00-10:50 1:00 3:50	T W		



No.	Credits	Title	Hour	Day	Building	Instructor
12w,13w	2	Elementary Shop*.....			MechE	Mr. Martenis, Mr. Rhame, Mr. Moffett, Mr. Quigley
		Sec. D (Pre-dents)	8:30-11:20 1:30- 4:20	T W		
11s,13s	2	Elementary Shop*.....			MechE	Mr. Martenis, Mr. Rhame, Mr. Richards, Mr. Quigley
		Sec. D (Pre-dents)	8:00-10:50 1:00- 3:50	T W		
13f	2	Elementary Shop*.....			MechE	Mr. Martenis, Mr. Rhame, Mr. Quigley, Mr. Nilson
		Sec. E (Chemists)	8:00-10:50 1:00- 3:50	T W		
12w,13w	2	Elementary Shop*.....			MechE	Mr. Martenis, Mr. Rhame, Mr. Moffett, Mr. Quigley
		Sec. E (Chemists)	8:30-11:20 1:30- 4:20	T W		
12s	2	Elementary Shop*.....			MechE	Mr. Martenis, Mr. Rhame, Mr. Moffett, Mr. Nilson
		Sec. E (Chemists)	8:00-10:50 1:00- 3:50	T W		
14f	4	Machine Shop*.....			MechE	Mr. Martenis, Mr. Rhame, and Mr. Nilson
		Sec. 1	1:00- 4:50 2:00- 4:50 8:00-11:50	M T S		
		2	8:00-10:50 1:00- 4:50 1:00- 4:50	Th Th F		
15w	4	Advanced Machine Shop *.....			MechE	Mr. Martenis, Mr. Rhame, and Mr. Nilson
		Sec. 1	1:30- 5:20 2:30- 5:20 8:30- 12:20	M T S		
15w	4	Advanced Machine Shop			MechE	Mr. Martenis, Mr. Rhame, Mr. Nilson
		Sec. 2	8:30-11:20 1:30- 5:20 1:30- 5:20	Th Th F		
		3 (only for students back in physics)	10:30-12:20 8:30-11:20 1:30- 3:20 1:30- 5:20	W Th Th F		

\* Students can not register in broken sections.

PROGRAM

No.	Credits	Title	Hour	Day	Building	Instructor
16s	2	Machine Shop (Elect.)*			MechE	Mr. Martenis, Mr. Rhame, Mr. Nilson
		Sec. 1, 2A	9:00-11:50	M		
			1:00- 3:50	T		
		2B, 3A	2:00- 4:50	MF		
		3B, 4	1:00- 3:50	W		
			8:00-10:50	S		
17f-s	2	Machine Shop.....				
		Sec. E (Chemists)	8:00-10:50	T	MechE	Mr. Martenis, Mr. Rhame, Mr. Nilson
			1:00- 3:50	W		
21s	1	Mechanical Technology..				
		Sec. 1, 2	10:00	TTh	102MechE	Mr. Shoop
31s	2	Elementary Machine De- sign .....				
		Sec. 1	1:00- 3:50	MTh	204MechE	Mr. Rhame
		2	1:00- 3:50	WF	204MechE	Mr. Rhame
32f	4	Mechanism .....				
		Sec. 1	9:00	MTThS	102MechE	Mr. Martenis
		2	10:00	TWThS	102MechE	Mr. Martenis
33w	3	Mechanism and Kine- matics (Elect.).....				
		Sec. 1, 2	8:30	MWF	102MechE	Mr. Martenis
			1:30- 4:20	Th	204MechE	
		3	10:30	MWF	102MechE	Mr. Martenis
			1:30- 4:20	F	204MechE	
34w	4	Kinematics and Machine Design .....				
		Sec. 1	10:30	T		Mr. Martenis
			9:30	ThS	102MechE	
			1:30- 5:20	M	205MechE	
			1:30- 3:20	T		
		2	10:30	TThS	102MechE	Mr. Martenis
			1:30- 5:20	F		
			3:30- 5:20	T	205MechE	
35s	3	Machine Design (Mech.)				
		Sec. 1	10:00	MS	102MechE	Mr. Martenis
			1:00- 3:50	MT	202MechE	
		2	10:00	TS	104MechE	Mr. Martenis
			1:00- 3:50	WF	202MechE	
37s	3	Machine Design (Elect.)				
		Sec. 1, 2	8:00	F	102MechE	Mr. Martenis
			1:00- 3:50	Th		
			8:00-10:50	S	202MechE	
		3	10:00	F	102MechE	Mr. Martenis
			1:00- 3:50	F	ExE	
			2:00- 4:50	Th	ExE	
38f	3	Machine Design (Chemists) .....				
			1:00- 4:50	MF		
			11:00	T	205MechE	Mr. Rowen
41s	2	Automotives .....				
		Sec. 1	8:00	ThS	102MechE	Mr. Rhame
		2	8:00	WF	104MechE	Mr. Rhame

No.	Credits	Title	Hour	Day	Building	Instructor
42f	3	Steam Engines.....				
		Sec. 1	10:00	MWF	104MechE	Mr. Rowen
		2	9:00	MWF	104MechE	Mr. Rowen
43w	2	Steam Engines and Boilers .....				
		Sec. 1	10:30	MWF	104MechE	Mr. Rowen
		2	9:30	MWF	104MechE	Mr. Rowen
61s	2	Measurement of Power..				
		Sec. 1	9:00	M		
			10:00	Th	104MechE	
			10:00-11:50	T	202MechE	Mr. Flather
81f	2	Elementary M.E. Lab...				
		Sec. 1A	1:00- 4:50	W		Mr. Shoop
			1:00- 2:50	F	ExE	
		1B	1:00- 2:50	W		Mr. Shoop
			1:00- 4:50	F	ExE	
		2A	1:00- 4:50	M		Mr. Shoop
			1:00- 2:50	Th	ExE	
		2B	1:00- 2:50	M		Mr. Shoop
			1:00- 4:50	Th	ExE	
82w	2	Elementary Steam Lab.....				
		Sec. 1A	1:30- 5:20	W		Mr. Shoop
			1:30- 3:20	F	ExE	
		1B	1:30- 3:20	W		Mr. Shoop
			1:30- 5:20	F	ExE	
		2A	1:30- 5:20	M		Mr. Shoop
			1:30- 3:20	Th	ExE	
		2B	1:30- 3:20	M		Mr. Shoop
			1:30- 5:20	Th	ExE	
83s	2	Elementary Power Laboratory .....				
		Sec. 1A	1:00- 4:50	W		Mr. Shoop
			1:00- 2:50	F		
			or 10:00-11:50	T	ExE	
		1B	1:00- 2:50	W		Mr. Shoop
			1:00- 4:50	F		
		2A	1:00- 4:50	M	ExE	
			1:00- 2:50	Th		Mr. Shoop
		2B	1:00- 2:50	M	ExE	
			1:00- 4:50	Th		Mr. Shoop
84f	2	Elementary Laboratory (Miners) .....				
		Sec. 1	1:00- 4:50	M	ExE	
		2	1:00- 4:50	Th	ExE	Mr. Shoop
85w	2	Elementary Laboratory (Miners) .....				
		Sec. 1	1:30- 5:20	M	ExE	Mr. Shoop
			1:30- 5:20	Th	ExE	Mr. Shoop
90f	1	Seminar .....				
		Sec. 1	11:00	TS	ExE	Mr. Shoop
		2	11:00	TS	104MechE	Mr. Martenis
91w	1	Seminar .....				
		Sec. 1	9:30	T	102MechE	Mr. Rowen
			11:30	S	104MechE	Mr. Martenis
		2	11:30	TS	102MechE	Mr. Rowen

PROGRAM

No.	Credits	Title	Hour	Day	Building	Instructor
92s	1	Seminar .....				
		Sec. 1	11:00	TS	104MechE	Mr. Rowen
		2	10:00	W		
			11:00	S	102MechE	Mr. Martenis
144f	3	Heat Engines (Elect.)...				
		Rec. Sec. 1, 2A	9:00	WF	110ExE	Mr. Rowley
		2B, 3	10:00	WF	110ExE	Mr. Rowley
		Lab. Sec. 1	1:00-3:50	T	ExE	Mr. Rhame
		2	9:00-11:50	S	ExE	Mr. Rhame
		3	9:00-11:50	T	ExE	Mr. Rhame
145w	3	Heat Engines (Elect.)..				
		Rec. Sec. 1, 2A	9:30	WF	110ExE	Mr. Rowley
		2B, 3	10:30	WF	110ExE	Mr. Rowley
		Lab. Sec. 1	1:30-4:20	T	ExE	Mr. Rhame
		2	9:30-12:20	S	ExE	Mr. Rhame
		3	9:30-12:20	T	ExE	Mr. Rhame
146s	3	Heat Engines (Elect.)..				
		Rec. Sec. 1, 2A	9:00	WF	110ExE	Mr. Rowley
		2B, 3	10:00	WF	110ExE	Mr. Rowley
		Lab. Sec. 1	1:00-3:50	T	ExE	Mr. Rhame
		2	9:00-11:50	S	ExE	Mr. Rhame
		3	9:00-11:50	T	ExE	Mr. Rhame
147w	4	Heat Engines (Chemists)				
		Rec.	11:30	MTWF	104MechE	Mr. Shoop
		Lab.	1:30-5:20	F	ExE	
148s	3	Heat Engines (Chemists)				
		Rec.	11:00	MW	110ExE	Mr. Shoop
		Lab.	1:00-4:50	E	ExE	
149f	4	Heat Engines (Civil)...				
		Rec. Sec. 1, 2	11:00	MWF	110ExE	Mr. Shoop
		Lab. Sec. 1	1:00-4:50	W	ExE	
		2	1:00-4:50	F	ExE	
149s	4	Heat Engines (Civil)...				
		Rec.	11:00	MWF	201ExE	Mr. Shoop
		Lab.	1:00-4:50	W	ExE	
150w	3	Gas Engines and Producers .....	9:30	MThS	110ExE	Mr. Rowley
151f	3	Thermodynamics .....	9:00	MThS	110ExE	Mr. Shoop
152w	3	Steam Turbines .....				
		Rec.	10:30	MW	201ExE	
		Lab.	1:30-4:20	W	ExE	Mr. Shoop
153s	4	Heating and Ventilating.	9:00	MWF	102MechE	Mr. Martenis
154s	2	Heating and Ventilating (Arch.) .....	11:00	WF	205MechE	Mr. Martenis
182f	2	Advanced Steam Laboratory .....				
		Sec. 1	8:00-11:50	T		
			1:00-2:50	T	ExE	Mr. Shoop
		2	10:00-11:50	T		
			1:00-4:50	T	ExE	Mr. Shoop
183w	2	Power and Gas Eng. Lab.				
		Sec. 1	8:30-12:20	T		
			1:30-3:20	T	ExE	Mr. Rowley
		2	10:30-12:20	T		
			1:30-5:20	T	ExE	Mr. Rowley

No.	Credits	Title	Hour	Day	Building	Instructor
184s	2	Advanced Engineering.. Lab. ....				
		Sec. 1	8:00-11:50	T		Mr. Rowley
			1:00- 2:50	T	ExE	Mr. Shoop
		2	10:00-11:50	T		Mr. Rowley
			1:00- 4:50	T	ExE	Mr. Shoop
190f	1	Seminar .....				
		Sec. 1	11:00	S	104MechE	Mr. Flather
		2	10:00	Th	110ExE	Mr. Rowley
191w	1	Seminar .....				
		Sec. 1	10:30	Th	104MechE	Mr. Flather
		2	11:30	S	201ExE	Mr. Rowley
192s	1	Seminar .....				
		Sec. 1	9:00	F	104MechE	Mr. Flather
		2	11:00	S	110ExE	Mr. Rowley
193s	2	Engineering Practice....	10:00	WF	104MechE	Mr. Flather
210f,w	3	Tool Design.....	Ar	Ar	Ar	Mr. Rhame
223f,224w, 225s	3	Industrial Management..	Ar	Ar	Ar	Mr. Flather
231f	3	Engr. Design as approved	1:00- 4:50	MTh	MechE	Mr. Martenis
232w	3	Engr. Design as approved	1:30- 5:20	MTh	MechE	Mr. Rowen
233s	3	Engr. Design as approved	1:00- 4:50	WF	MechE	Mr. Flather, Mr. Parcel, Mr. Rowen, Mr. Rowley
255f	3	Advanced Heating and Ventilating .....	8:00	TThS	110ExE	Mr. Rowley
255s	3	Advanced Heating and Ventilating .....	Ar	Ar	Ar	Mr. Rowley
256s	3	Compressed Air and Refrigeration .....	8:00	TThS	110ExE	Mr. Rowen
262f	3	Power Engineering.....	11:00	MWF	104MechE	Mr. Rowen
263w	3	Power-Plant Manage- ment .....	8:30-10:20	T		
			11:30	W		
			1:30- 5:20	W	205MechE	Mr. Rowen
265s	3	Power-Plant Management	11:00	W	104MechE	
			1:00- 4:50	W		
			9:00-10:50	Th	MechE	Mr. Rowen
288w,289s	3-9	Engineer. Lab. and Thesis .....	Ar	Ar	ExE	Mr. Flather, Mr. Rowley, Mr. Shoop

## METALLURGY

No.	Credits	Title	Hour	Day	Building	Instructor
22f	3	Metallurgy .....	11:00	MWF	111	Mr. Christianson
150w	3	Metallography (Elec.)... Rec. Lab.	8:30 Ar	MW Ar	305	Mr. Harder
151s	3	Metallography (Elec.)... Rec. Lab.	8:00 Ar	MW Ar	305	Mr. Harder

PROGRAM

No.	Title	Hour	Day	Room	Instructor
156W	3 Metallography (Mech.).. Rec.	8:30	TTh	305	Mr. Harder
	Lab. Sec. 1	1:30- 4:20	W		
	2	1:30- 4:20	F		
157S	3 Metallography (Mech.).. Rec.	8:00	TTh	305	Mr. Harder
	Lab. Sec. 1	1:30- 4:20	W		
	2	1:30- 4:20	F		

MILITARY SCIENCE AND TACTICS

No.	Credits	Title	Hour	Day	Building	Instructor
1f	0	First-Year Basic Course R.O.T.C. Artillery, Signal Corps, and In- fantry Units..... Sec. 1, 2, 3, 4, 5, 6, 15, 16, 17, 18	1:00	MWF	A	Mr. Sturtevant, Mr. Walker, Mr. Ingles
		Sec. 7, 8, 9, 10, 11, 12, 13, 14, Arch. 1, 2	4:00	MWF	A	Mr. Sturtevant, Mr. Walker, Mr. Ingles
2S	0	First-Year Basic Course R.O.T.C. Artillery, Signal Corps, and In- fantry Unit only Sec. 1, 2, 3, 4, 5, 6, 13, 14, 15, 16	1:30	MWF	A	Mr. Sturtevant, Mr. Walker, Mr. Ingles
		Sec. 7, 8, 9, 10, 11, 12, Arch. 1, 2	4:30	MWF	A	Mr. Sturtevant, Mr. Walker, Mr. Ingles
		Infantry Unit only Sec. 17	9:30	MWF	A	Mr. Sturtevant
3S	0	First-Year Basic Course R.O.T.C. Artillery, Signal Corps..... All sections except Sec. 15	1:00- 3:50	T	A	Mr. Walker, Mr. Ingles
		Infantry Unit Sec. 1, 2, 6, 7, 8, 9, 15	2:00- 4:50	W	A	Mr. Sturtevant
4f	0	Second-Year Basic Course R.O.T.C. Artillery Unit..... Sec. C.E. 1, C.E. 2 C.E. 3, M.E. 1, M.E. 2	3:00	MWF	A	Mr. Walker
		Signal Corps Sec. F.E. 1, E.E. 3	8:00	MWF	A	Mr. Walker
		E.E. 2, E.E. 4	8:00	MWF	A	Mr. Ingles
		Infantry Sec. Arch.	3:00	MWF	A	Mr. Ingles
			10:00	MWF	A	Mr. Sturtevant

No.	Title	Hour	Day	Room	Instructor
5w	0 Second-Year Basic Course R.O.T.C. Artillery Unit.....				
	Sec. C.E. 1, C.E. 2	3:30	MWF	A	Mr. Walker
	C.E. 3, M.E. 1, M.E. 2	8:30	MWF	A	Mr. Walker
	Signal Corps Sec. E.E. 1, E.E. 3	8:30	MWF	A	Mr. Ingles
	E.E. 2, E.E. 4	3:30	MWF	A	Mr. Ingles
	Infantry Sec. Arch.	10:30	MWF	A	Mr. Sturtevant
6s	0 Second-Year Basic Course R.O.T.C. Artillery Unit.....				
	Sec. C.E. 1, C.E. 2, C.E. 3, M.E. 1, M.E. 2	1:00- 3:50	T	A	Mr. Walker
	Signal Corps Unit Sec. E.E. 1, E.E. 2, E.E. 3, E.E. 4	1:00- 3:50	Th	A	Mr. Ingles
	Infantry Unit Sec. Arch.	2:00- 4:50	T	A	Mr. Sturtevant
51f-52w-53s	First-Year Advanced Course R.O.T.C. ....	2:00- 4:50	W	A	Mr. Walker, Mr. Ingles
54f-55w-56s	Second-Year Advanced Course R.O.T.C.....	2:00- 4:50	F	A	Mr. Walker, Mr. Ingles

## PHYSICS

No.	Credits	Title	Hour	Day	Building	Instructor
3f	3	Elements of Mechanics and Sound.....				
		Rec. Sec. E.E. 4, M.E. 1, M.E. 2, Arch.	9:00	MWF	30Ph	Mr. Erikson
		C.E. 2, C.E. 3, E.E. 3	10:00	MWF	30Ph	
		C.E. 1, E.E. 1, E.E. 2	1:00	MWF	30Ph	
		Quiz—All sections	4:00	W	305ME	
3w	3	Elements of Mechanics and Sound.....				
		Rec.	3:30	MWF	30Ph	Mr. Erikson
		Quiz.	4:30	W	100C	Mr. Erikson
4f	1	Elements of Mech. Lab..				
		Sec. C.E. 1	8:00- 9:50	S	16Ph	Mr. Erikson
		C.E. 2	8:00- 9:50	Th	16Ph	
		C.E. 3	10:00-11:50	T	16Ph	
		E.E. 1	3:00- 4:50	M	16Ph	
		E.E. 2	8:00- 9:50	F	16Ph	
		E.E. 3	1:00- 2:50	W	16Ph	
		E.E. 4	1:00- 2:50	M	16Ph	
		M.E. 1	1:00- 2:50	F	16Ph	
		M.E. 2	8:00- 9:50	T	16Ph	

PROGRAM

No.	Credits	Title	Hour	Day	Building	Instructor
4W	1	Elem. of Mech. Lab....	3:30- 5:20	Th	16Ph	Mr. Erikson
23W	3	Heat .....				
		Rec. Sec. C.E. 1,				
		C.E. 3, E.E. 1,				
		E.E. 2	1:30	MWF	30Ph	Mr. Miller
		Sec. C.E. 2, E.E. 3,				
		M.E. 1	10:30	MWF	30Ph	Mr. Miller
		Sec. E.E. 4, M.E. 2,				
		Arch.	9:30	MWF	30Ph	Mr. Miller
		Quiz--All sections				
		except Arch.	4:30	W	135-136ME	Mr. Miller
		Sec. Arch.	9:30	Th	305ME	
24W	1	Heat Laboratory.....				
		Sec. C.E. 1	8:30-10:20	S	Ph	Mr. Miller
		C.E. 2	8:30-10:20	Th	Ph	
		C.E. 3	10:30-12:20	T	Ph	
		E.E. 1	3:30- 5:20	M	Ph	
		E.E. 2	8:30-10:20	F	Ph	
		E.E. 3	1:30- 3:20	W	Ph	
		E.E. 4	1:30- 3:20	M	Ph	
		M.E. 1	1:30- 3:20	F	Ph	
		M.E. 2	8:30-10:20	T	Ph	
43S	3	Magnetism and Elec- tricity .....				
		Rec. Sec. C.E. 1,				
		C.E. 3, E.E. 1,				
		E.E. 2	1:00	MWF	30Ph	Mr. Zeleny
		C.E. 2, E.E. 3,				
		M.E. 1	10:00	MWF	30Ph	Mr. Zeleny
		E.E. 4, M.E. 2,				
		Arch.	9:00	MWF	30Ph	Mr. Zeleny
		Quiz--All sections				
		except Arch.	4:00	W	305ME	Mr. Zeleny
		Sec. Arch.	9:00	Th	305ME	Mr. Zeleny
		Sec. C.E. 1	8:00- 9:50	S	Ph	Mr. Zeleny
		C.E. 2	8:00- 9:50	Th	Ph	
		C.E. 3	10:00-11:50	T	Ph	
		E.E. 1	10:00-11:50	S	Ph	
		E.E. 2	8:00- 9:50	F	Ph	
		E.E. 3	8:00- 9:50	T	Ph	
		E.E. 4	1:00- 2:50	M	Ph	
		M.E. 1	1:00- 2:50	F	Ph	
		M.E. 2	3:00- 4:50	M	Ph	
144f	3	Electric Measurements..				
		Sec. E.E. 1	9:00-10:50	Th		
			1:00- 2:50	T		
			3:00- 4:50	Th	Ph	Mr. Zeleny
		E.E. 2	8:00- 9:50	T		
			1:00- 2:50	Th		
			3:00- 4:50	Th	Ph	Mr. Zeleny
		E.E. 3	1:00- 2:50	M		
			3:00- 4:50	Th		
			1:00- 2:50	F	Ph	Mr. Zeleny



## POLITICAL SCIENCE

No.	Credits	Title	Hour	Day	Building	Instructor
27s	3	Business Law.....				
		Sec. 1	8:00	MWF	135ME	Ar
		2	11:00	MWF	135ME	Ar
		3	11:00	MWF	136ME	Ar

## RHETORIC AND PUBLIC SPEAKING

No.	Credits	Title	Hour	Day	Building	Instructor
4f	3	Rhetoric and Composition				
		Sec. C.E. 1	2:00	TTh		
		C.E. 2	11:00	S	135ME	Ar
			1:00	MWF	203ME	Ar
		C.E. 3	8:00	TThS	7ME	Ar
		E.E. 1	8:00	TThS	135ME	Ar
		E.E. 2	9:00	MWS	217ME	Ar
		E.E. 3	11:00	TS		
			1:00	Th	205ME	Ar
		E.E. 4	2:00	TTh		
			11:00	S	217ME	Ar
		M.E. 1	1:00	T		
			9:00	Th	107ME	
			11:00	F	104ME	Ar
		M.E. 2	11:00	MWF	217ME	Ar
		Arch. 1	11:00	MWF	229ME	Ar
		Arch. 2	10:00	TThS	203ME	Ar
5w	3	Rhetoric and Composition .....				
		Sec. C.E. 1	2:30	TTh		
			11:30	S	215ME	Ar
		C.E. 2	1:30	MWF	104ME	Ar
		C.E. 3	8:30	TThS	22ME	Ar
		E.E. 1	8:30	TThS	203ME	Ar
		E.E. 2	9:30	MWS	135ME	Ar
		E.E. 3	1:30	TTh		
			10:30	S	135ME	Ar
		E.E. 4	2:30	TTh		
			11:30	S	21ME	Ar
		M.E. 1	11:30	MWF	7ME	Ar
		M.E. 2	10:30	TWF	7ME	Ar
		Arch. 1	11:30	MWF	107ME	Ar
		Arch. 2	10:30	TThS	203ME	Ar
6s	3	Rhetoric and Composition				
		Sec. C.E. 1	2:00	MWF	104ME	Ar
		C.E. 2	10:00	TTh		
			1:00	F	107ME	Ar
		C.E. 3	8:00	TThS	215ME	Ar
		E.E. 1	8:00	TThS	217ME	Ar
		E.E. 2	9:00	TThS	135ME	Ar
		E.E. 3	9:00	MWF	215ME	Ar
		E.E. 4	11:00	TS		
			1:00	Th	135ME	Ar
		M.E. 1	8:00	MWF	7ME	Ar
		M.E. 2	10:00	MWF	135ME	Ar
		Arch. 1	11:00	MWF	107ME	Ar
		Arch. 2	10:00	TThS	135ME	Ar

PROGRAM

147

No.	Title	Hour	Day	Room	Instructor
Aw	5 Freshman English.....				
	Lect.	10:30	W	Ar	Ar
	Rec.	1:30	MTThF	Ar	Ar
Bs	5 Freshman English.....				
	Lect.	10:30	W	Ar	Ar
	Rec.	9:00	MThS	Ar	Ar
31W	3 Technical Writing.....	8:30	MWF	110ExE	Mr. Bean
31S	3 Technical Writing.....	11:00	MWF	7ME	Mr. Bean

# *The Bulletin* *of the University of* **Minnesota**

*General Extension Division*  
*Evening Business Courses*  
**1921-1922**



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## CALENDAR

1921-1922

1921

September	19-24	Week	Registration week
September	26	Monday	Regular class work begins
November	24	Thursday	Thanksgiving Day; a holiday
December	24	Saturday	Christmas recess begins

1922

January	2	Monday	Class work resumed
January	23-27	Week	Examination week, first semester
January	27	Friday	First semester ends
January	30	Monday	Second semester begins
May	22-26	Week	Examination week, second semester
May	26	Friday	Second semester ends
May	29	Monday	Annual dinner and closing exercises

## EVENING BUSINESS COURSES

### FACULTY

- LOTUS DELTA COFFMAN, Ph.D., President  
WILLIAM WATTS FOLWELL, LL.D., President Emeritus  
CYRUS NORTHROP, LL.D., President Emeritus  
\*RICHARD REES PRICE, M.A., Director of University Extension  
J. J. PETTIJOHN, B.A., Acting Director of University Extension  
ADOLPH A. BLANDIN, Instructor in Accounting  
GEORGE G. CHAPIN, B.A., LL.B., Instructor in Business Law  
SHERMAN CHILD, B.A., LL.B., Instructor in Business Law  
JOSEPH E. CUMMINGS, M.A., Instructor in Economics  
JOHN F. DULEBOHN, B.A., LL.B., Instructor in Business Law  
J. FRANKLIN EBERSOLE, M.A., Professorial Lecturer in Economics  
JOHN S. GARNs, B.A., Instructor in Public Speaking, General Extension  
Division  
GEORGE G. GLICK, B.A., LL.B., Instructor in Business Law  
HARRY D. HARPER, M.A., Instructor in Accounting  
ERNEST A. HEILMAN, Ph.D., Assistant Professor of Accounting  
LYLE W. HINES, Instructor in Accounting  
STANLEY B. HOUCK, LL.M., Instructor in Business Law  
G. SIDNEY HOUSTON, JR., Instructor in Accounting  
EDWARD J. KENNY, B.A., LL.B., Instructor in Business Law  
MAC MARTIN, Professorial Lecturer in Advertising, General Extension  
Division  
WALTER R. MYERS, Ph.D., Instructor in Economics  
WILLIAM NIEMACKL, Instructor in Accounting  
HOWARD S. NOBLE, B.A., M.B.A., Assistant Professor of Accounting  
BENJAMIN W. PALMER, M.A. LL.B., Instructor in Business Law  
OLIVER S. POWELL, B.A., Instructor in Banking  
CHARLES H. PRESTON, B.A., C.P.A., Associate Professor of Business Ad-  
ministration, General Extension Division  
FRED E. RINGHAM, B.A., Instructor in Accounting  
CLARE L. ROTZEL, B.C.S., C.P.A., Associate Professor of Accounting  
WILFRED RUMBLE, LL.B., Instructor in Business Law  
T. J. SHANNON, Instructor in Accounting  
WILLIAM C. SMILEY, LL.M., Assistant Professor of Business Law, General  
Extension Division  
ARTHUR V. SMITH, Instructor in Accounting  
J. WARREN STEHMAN, M.A., Assistant Professor of Economics  
R. H. TUTTLE, Instructor in Accounting  
ARCHIE F. WAGNER, B.A., C.P.A., Instructor in Accounting  
BRUCE W. WHITE, Instructor in Accounting

\* Absent on leave, 1921-1922.

## EXTENSION SERVICE

The Extension Service of the University of Minnesota is organized to include:

- A. Evening classes, in Minneapolis, St. Paul, Duluth, and other cities.
  - 1. Courses leading to credit in the College of Science, Literature, and the Arts, in the College of Education, and in the School of Business.
  - 2. Courses in business administration, accountancy, and finance.
  - 3. Practical courses in engineering and in industrial subjects.
- B. Correspondence courses.
- C. Extension lectures, singly or in groups, and lyceum lectures, concerts, and entertainments.
- D. The Municipal Reference Bureau, which compiles and furnishes to city officials information pertaining to municipal government and administration.
- E. The Bureau of Visual Instruction, through which loan collections of lantern slides and films are furnished to schools and clubs.
- F. Drama Service, through which dramatic clubs and school societies are given advice about the production of amateur theatricals, and copies of plays are lent for reading and selection.
- G. Community Service, through which the elements making up a community and its trading fringe are given advice and assistance for bringing together all the social forces into an organization whose purpose shall be to make the people healthy and wealthy and wise.
- H. Agricultural Extension, including lectures, demonstrations, institutes, and short courses under the direction of the College of Agriculture, Forestry, and Home Economics.

# EVENING EXTENSION COURSES

## GENERAL INFORMATION

### ADMISSION TO COURSES

It is not intended that any regulation should debar from the privileges of these courses any person who can pursue them profitably. Those persons desiring credit toward a university degree must of course comply with the regulations laid down by the college in which credit is desired. Those not desiring such credit may be admitted, provided they are sufficiently mature (more than eighteen years of age) and can satisfy the departments in which they wish to study that they are able to carry the work profitably to themselves and without hindrance to the classes.

### CREDIT FOR EXTENSION COURSES

Credit toward a degree will be given students who satisfy the entrance requirements of the college in which credit is desired and who successfully complete any of the extension courses of university grade. This applies to all the courses listed under academic or collegiate courses, unless otherwise specified. It also applies to nearly all the business courses. No courses listed under engineering carry credits. Credit in any extension course will be awarded only to those students who pass the final examinations of that course. Such credits will be recorded upon matriculation in the University. Courses requiring one evening (two hours) a week for recitation normally carry 2 semester credits. Those requiring more time usually carry correspondingly more credits. In the Extension Division credits are still reckoned on the semester, not the quarter, basis. The school year is divided into two semesters of sixteen weeks each, with an extra week devoted to examinations. Normally each class meets one night a week for two hours.

The statement concerning credit for the Certificates in Accountancy, in Finance, and General Business will be found on pages 27, 28, and 29 in the Announcement of Evening Classes.

Students *must indicate at the time of registration whether or not they desire university credit in the courses pursued.*

### *Regulations Concerning Credit in the College of Science, Literature, and the Arts*

1. All courses for which credit is given in the College of Science, Literature, and the Arts must be authorized with the credits by the Advisory Committee. But credit shall be given only to those extension courses which are conducted in essentially the same manner as the corresponding courses in the University and which are carried on under similar conditions as to attendance, term's work, quizzes, and examinations.

2. Each credit course shall be directly in charge of a member of the faculty.

3. Any regularly enrolled University student successfully completing an approved course shall receive an appropriate credit.

4. Any person shall receive a certificate upon satisfactorily completing an approved course. The certificates entitle the holder to the corresponding University credits whenever he has earned 30 credits in residence. The University examiner shall in all cases pass upon the qualifications of the student.

5. The maximum credit towards a degree for work done in extension courses shall not exceed one half the unit hours required for graduation.

6. Credit for an amount not exceeding one quarter of the unit hours required for graduation may be given at the University of Minnesota to students of such other extension schools or departments as may be approved by the advisory committee, provided that such credit shall be subject to the same provisions as govern credits in the General Extension Division of the University of Minnesota.

#### RESIDENT STUDENTS

1. No University student may enroll for extension courses for the purpose of removing a condition or failure.

2. No University student may enroll for an extension course if this would increase his credit hours beyond what the rules allow.

3. Any University student who wishes to enroll for an extension course must first obtain the approval of the dean of his college.

#### FEEs

Collegiate courses meeting one evening a week require a fee of from \$5 to \$7.50 a semester of sixteen weeks. For collegiate courses meeting two evenings a week, the fee is from \$10 to \$15 a semester.

The fee for the business and engineering courses for a single subject is \$7.50 a semester, with the exception of a few advanced or technical courses for which the fee is \$10 a semester. Each class is a separate unit. The grouping of subjects into courses does not affect the unit fee for each subject.

The fee does not include the cost of texts or materials. The cost of these items varies from \$1 to \$3 a course.

All fees are payable at the time of registration, and registration should not be deferred longer than the second meeting of class. Checks should be made payable to the University of Minnesota.

Special arrangements are made with organizations, clubs, and business concerns, whereby instruction may be given to groups of students within the organization at a sum which will somewhat reduce the individual rate per member. However, such classes can not be restricted to that group alone but must be open to the general public.

#### REFUNDS

No fee will be refunded on account of withdrawal from any course. Exceptions to this rule will be made only in case of (a) removal from



the city or (b) illness or physical disability as attested by the certificate of a reputable physician. Application for pro rata refund under the above conditions *will not be considered later than fifteen days after registration.*

#### LENGTH OF COURSE

A semester consists of sixteen weeks of instruction with an additional week for the final examination.

#### PLACES FOR CONDUCTING CLASSES

Most of the classes in engineering will be held in the Main Engineering Building, Electrical Engineering Building, the Mechanical Engineering, or the Experimental Engineering Building.

Other classes in Minneapolis are conducted at the University, at the Public Library, at the City Hall, and in some of the public schoolhouses. Definite locations for each class will be announced in a circular to be published about September 15.

In St. Paul the work will be carried on at the City Hall and the Public Library. Additional accommodations will be provided for in some cases.

In Duluth the work will be carried on in the St. Louis County Court-house.

#### NUMBER FOR WHOM CLASSES WILL BE ORGANIZED

Classes will not be organized for a smaller enrolment than fifteen and in some courses a larger registration will be required.

#### TIME OF MEETING

Classes ordinarily meet at 7:30 and dismiss at 9:30. Classes in business subjects frequently meet at 6:30.

#### ENROLMENT

Registration for the first semester takes place during the week preceding the organization of classes (September 19-24). Students are advised to register with the instructor at the first meeting of the class.

#### RULE REGARDING ABSENCES

The attention of students and faculty is called to the following rule regarding absences:

"No student whose absences exceed three (3) of the regular scheduled sessions of the course for a semester shall be admitted to the final examination of the course without special permission of the director of University Extension."

#### PROGRAM OF CLASSES

Folders will be issued about September 15, giving the program of classes and schedules of meeting places. It should be understood that *not all the courses listed in this bulletin are given in any one year.* Final announcement may be found in the special folder. Folders will be issued for the

collegiate courses, the business courses, and the engineering courses. Separate bulletins are also issued for each of these groups of courses.

#### LOCATION OF EXTENSION OFFICES

The offices of the General Extension Division may be found on the ground floor of the Main Engineering Building, on Washington Avenue and Church Street Southeast. To telephone the office call N. W. Dinsmore 2760 and ask the University central for the General Extension Division

## DEPARTMENT OF BUSINESS INSTRUCTION

### PURPOSE

The Department of Business Instruction recognizes the professional status of the business executive. It aims to give prospective executives thoro training for the work they are to undertake. Professional education rather than detailed drill in narrow technical processes is the object toward which instruction is directed. Scientific method in analyzing business data, trained intelligence in dealing with the human relationships with which business is made up, and well-developed sense of moral responsibility will be the foundations of business effectiveness in the future. Experience has proved that those persons whom the department is reaching can, by being actively employed during the day, comprehend and appreciate this course of instruction in a particularly advantageous manner. The courses are conducted in close coöperation with the School of Business of the University.

### INSTRUCTION

The subjects of instruction are divided into three groups of courses of study; namely, those aiding in a preparation for accountancy, those aiding in preparation for banking, and those having for their object a general business training. In each of these courses certain fundamental subjects such as business law, economics, and business English are required.

Upon the completion of one of these courses, a University Certificate in Accountancy, Banking, or General Business, as the case may be, will be granted.

### ADMISSION TO COURSES

All persons may be admitted to extension courses provided they are sufficiently mature and can satisfy the instructors in whose classes they wish to register that they are able to carry the work profitably to themselves and without hindrance to the classes. Students who are high-school graduates are invited to file, with the University registrar, their regular university entrance requirements so that credits earned in the department may apply toward a University degree as well as toward a departmental certificate. Attention is called to the fact that those persons who are not high-school graduates may work off university entrance requirements in several different ways. They may take the Minnesota State High School Board examination, they may pass the University entrance examinations, or they may successfully complete the required courses in the Correspondence Study Department of the University. (See University bulletin of general information.) The admission requirements for business students are as follows:

1. Four units of English; or three units of English and four units of a foreign language; or three units of English and two units each of two foreign languages.

2. One unit of algebra and one unit of plane geometry, and enough additional work to make in all fifteen units, of which not more than four may be in Group F.

The term unit means not less than five recitations of forty minutes each week for a school year of at least thirty-six weeks. In manual subjects and kindred courses, it means the equivalent of ten recitation periods a week for thirty-six weeks.

A detailed statement of the entrance subjects required, grouped into six groups may be found in the University bulletin of general information. The completion of preparatory courses as above outlined will also be accepted by the State Board of Accountancy as the preliminary high-school training qualification required of applicants for the degree of C.P.A.

#### CREDITS

The Department of Business Instruction gives credit upon the successful completion of any of its courses. A final examination is required in every instance. Such credit can be applied towards a University Certificate in Accountancy, Finance, or General Business as the case may be, and in addition, where the student has presented university entrance requirements may be applied towards a degree from the School of Business under certain restrictions. For further information on this subject see the University bulletin of general information and the bulletin of the School of Business.

#### FEES

The fee for each business course is \$7.50 a semester, with the exception of a few advanced courses for which the fee is \$10 a semester. Each class is a separate unit. The grouping of subjects into courses does not affect the unit fee for each subject.

#### TEXT MATERIAL

When text material is furnished in printed or mimeographed form the student is required to reimburse the University for its cost. This amount will vary from \$1 to \$3 a course.

#### RULE REGARDING ABSENCES

The attention of students and faculty is called to the following rule regarding absences:

"No student whose absences exceed three (3) of the regular scheduled sessions of the course for a semester shall be admitted to the final examination of the course without special permission of the director of University Extension."

#### LENGTH OF COURSE

A semester consists of sixteen weeks of instruction with an additional week for the final examination.

#### THE HERBERT C. PALIN ADVERTISING PRIZE

Mr. Herbert C. Palin, of Los Angeles, California, has presented a silver loving cup to the advertising class. On this cup is to be inscribed each year the name of the student who, after taking a full year's course in advertising, submits the most constructive plan for an advertising campaign. The cup is to remain in the possession of the winner for one year.

## COURSE IN ACCOUNTANCY

This course is designed to meet the needs of two classes of students, namely, those who wish to prepare to take the state C.P.A. examinations with a view to becoming public accountants, and those who aim to fit themselves for responsible positions with private business firms.

For the student who wishes to pursue either object we recommend that he plan to take the regular course herein outlined and thus secure a broad foundation for his work.

In addition to the courses enumerated below, attention is called to the subjects given in the four-year course of the School of Business, many of which may be taken by correspondence or in evening classes outside of this department. See the announcements of the collegiate and engineering courses, General Extension Division.

Upon the satisfactory completion of this course, the University Certificate in Accountancy will be granted.

Beginning with the year 1917-18 the course requires a total of 30 credits, each one-semester subject counting for 2 credits, with the exception of the accounting laboratory which counts for one credit. Each subject requires one two-hour class recitation per week for one semester of sixteen weeks with an additional meeting for a final examination.

In order to secure the University Certificate in Accountancy, 14 credits in accounting are necessary, including Principles of Accounting A, Principles of Accounting B, Accounting Laboratory A, Accounting Laboratory B, Accounting Practice and Procedure A, and Accounting Practice and Procedure B; 6 credits in business law including Business Law A and Business Law B; 2 credits in economics, and 2 credits in business English. The student may elect subjects to cover the remaining 6 credits.

Students of experience and some maturity may join the class by registering as auditors, in case they do not care to secure credit for the course toward a Certificate in Accountancy. These students will not be called upon to take part in the discussions nor to turn in work which is required of students registering for credit. In this way the University hopes to make available the benefits of the courses to those who feel they lack the opportunity or time to do the work regularly required in the course.

The following subjects are required for the course:

Principles of Accounting A (2)	Auditing A (2)	} Elective
Principles of Accounting B (2)	Auditing B (2)	
Accounting Laboratory A (1)	Cost Accounting A (2)	
Accounting Laboratory B (1)	Cost Accounting B (2)	
Accounting Practice and Procedure A (2)	Business Law A (2)	
Accounting Practice and Procedure B (2)	Business Law B (2)	
	Business Law C, D, or E (2)	
	Economics (2)	
	Business English (2)	
	Elective subjects (6)	

## COURSE IN BANKING AND FINANCE

This course is designed to meet the needs of two kinds of students: (1) those who are preparing for, or who are now engaged in, such financial callings as banking, corporation management, stock and bond brokerage, credit work, or financial journalism; and (2) business men who wish to utilize in the upbuilding of their particular business all of the modern scientific knowledge of a practical financial nature.

### *University Certificate in Finance*

Those students who wish to secure a thoro knowledge of finance, and an adequate knowledge of general business for a financial occupation, are urged to arrange their registration so as to obtain the Certificate in Finance as offered by the University.

Beginning with the year 1917-18 this certificate will be granted to those who complete a total of 30 credits distributed as follows:

Principles of Economics (2)	Accounting Laboratory A (1)
Banking Practice (2)	Accounting Laboratory B (1)
Investments and Speculation (2)	Business Law A (2)
Corporation Finance (2)	Business Law B (2)
Business English (2)	Business Law C or D (2)
Principles of Accounting A (2)	Elective subjects (8)
Principles of Accounting B (2)	

### *The American Institute of Banking*

The American Institute of Banking recognizes the evening courses of the General Extension Division of the University of Minnesota as fulfilling all the requirements of its educational department. Students who complete these courses in finance are accredited by the institute without further examinations or formality.

By this arrangement, the members of the Minneapolis, St. Paul, and Duluth chapters of the American Institute of Banking may obtain the A. I. B. Certificate upon completion of economics (2 credits), banking (2 credits), and Business Law A, B, C, and D (8 credits).

The advanced courses in finance coincide with the requirements of those who wish to receive the title of associate from the institute for post-graduate study.

## COURSE IN GENERAL BUSINESS

For the benefit of those students who do not care to specialize in either accounting or in finance, yet wish to secure recognition as having completed a definite group of subjects, the following course is arranged. It is likely that certain of the subjects herein outlined will be more fully developed and later, together with the fundamental subjects, form courses in themselves.

It is planned that each of these courses will furnish a preparation for a definite calling, such as advertising, salesmanship, and sales management, railroad traffic, and office management.

### *University Certificate in General Business*

Beginning with the year 1917-18 this certificate will be granted to those who successfully complete a total of 30 credits distributed as follows:

Business English (2)	Principles of Accounting B (2)
Business Law A (2)	Accounting Laboratory A (1)
Business Law B (2)	Accounting Laboratory B (1)
Business Law C (2)	Economics A (2)
Business Law D (2)	Economics B (2)
Principles of Accounting A (2)	Electives (10)

The electives should be selected with a view to specializing in some particular field, as in advertising and selling, in railroad traffic, and the like

NOTE: It is possible for a student to obtain two of the certificates listed above. However, a second certificate will not be granted until the student has earned an additional 6 credits over the 30 credits required for the first certificate.

## DESCRIPTION OF SUBJECTS

### ACCOUNTING

The various courses in accounting are designed to subdivide the work in order that there may be proper sequence as well as to make possible sufficient emphasis on each phase of the subject. In the first year the subdivision is as follows: first, a series of lectures and discussions in the principles of accounting; and second, the putting of those principles to practical application by the working out of specific problems. Students not desiring to specialize in accounting may elect to omit this latter course, i.e., Accounting Laboratory A and B, but all taking the laboratory courses are required to take the corresponding courses in accounting principles.

1. INTRODUCTION TO ACCOUNTING. This is a course designed for those who are not prepared by experience or training to enroll immediately in Principles of Accounting, but who nevertheless desire to overcome their deficiencies and pursue the regular accounting courses. The course will take up the purposes of accounting, the use of books of original entry, posting to the ledger, the trial balance, closing the ledger, preparation of simple trading statements. No credit. MR. HOUSTON, MR. BLANDIN.
2. PRINCIPLES OF ACCOUNTING A. Fundamental classification of the balance sheet and operating accounts. The books and records primarily essential to disclose the data necessary for such balance sheets and operating accounts. Special discussions on the trading margins, operating expenses, etc. Various bookkeeping and accounting operations, such as accruals, deferred charges; special systems of handling accounting data, such as departmentization of accounts, imprest cash systems, the treatment of controlling accounts and auxiliary ledgers; preparation of simple working sheets and statements. Two credits (one evening a week); first semester. MR. HEILMAN, MR. BLANDIN, MR. HARPER, MR. HOUSTON, MR. RINGHAM, MR. SHANNON.

3. PRINCIPLES OF ACCOUNTING B. Continuation of Principles of Accounting A with more special reference to manufacturing and corporation accounts; treatment of good-will and depreciation, accountant's working sheet; adjusting of surplus, sinking funds, and reserve accounts; drafting condensed balance sheets and income statements. Two credits (one evening a week); second semester. MR. HEILMAN, MR. BLANDIN, MR. HARPER, MR. HOUSTON, MR. RINGHAM, MR. SHANNON.
4. ACCOUNTING LABORATORY A. The working out of practical problems covering the subject-matter discussed in Principles of Accounting A, under the guidance of an instructor. One credit (one evening a week); first semester. MR. BLANDIN, MR. HINES, MR. NIEMACKL, MR. SHANNON, MR. SMITH, MR. WHITE.
5. ACCOUNTING LABORATORY B. Work of a similar kind covering the subject-matter discussed in Principles of Accounting B. One credit (one evening a week); second semester. MR. BLANDIN, MR. HINES, MR. NIEMACKL, MR. SHANNON, MR. SMITH, MR. WHITE.
6. ACCOUNTING PRACTICE AND PROCEDURE A. An advanced course for the accounting student following the study of accounting principles. The object of the subject is two-fold: first, to familiarize the student with the peculiar accounting problems of business; and, second, to afford the student the means to secure that necessary insight and skill which practicing accountants must possess in order to meet the demands made upon them. The subject-matter is presented chiefly by means of a more or less exhaustive study of a representative business. The work consists of the following: (a) a study of the distinctive group of accounting problems which are likely to arise in a business organization through a series of years and the scientific solution of those problems; (b) a study of the accounting problems peculiar to representative business. The manner of presenting the subject is essentially practical, the students being required to work out for themselves problems similar to the ones studied. Two credits (one evening a week); first semester. MR. ROTZEL, MR. HARPER, MR. WAGNER.
7. ACCOUNTING PRACTICE AND PROCEDURE B. A continuation of Course 6. Two credits (one evening a week); second semester. MR. ROTZEL, MR. HARPER, MR. WAGNER.
8. COST-ACCOUNTING A. The elements of cost, i.e., prime cost and indirect expense of burden, kinds of cost-accounting, continuous process and production order costs. The materials ledger. Methods of accounting for labor. Methods of distributing indirect or "overhead" expense. The machine-rate method, and when applicable. Methods of compensating labor. Predetermined standard costs, and their relation to "scientific management." The cost ledger and its relation to the general ledger.



Modern industry demands that each plant be equipped with adequate accounting facilities for ascertaining the cost of operation. These costs are necessary to show, first, the profitableness of each branch of the industry so as to enable the management to push the profitable, and to drop the unprofitable lines, or to place them upon a paying basis; second, the cost of each article as a basis of price-making; third, so far as possible, the cost of each operation, so as to enable the management to plan economies in the operation of the plant. Two credits (one evening a week); first semester. MR. NOBLE, MR. TUTTLE.

9. COST-ACCOUNTING B. A continuation of Course 8. Two credits (one evening a week); second semester. MR. NOBLE, MR. TUTTLE.
10. AUDITING A. This course is essentially practical and is intended only for those whose previous training in the principles of accounting has been sufficient to enable them to be benefited by this advanced work. The chief aim will be to give students the training necessary to enable them to conduct audits and investigations either as private auditors or public accountants; to set up accounts for various purposes as a result of such audits or investigations and to prepare suitable reports thereon. Two credits (one evening a week); first semester. MR. ROTZEL.
11. AUDITING B. A continuation of Course 10. Two credits (one evening a week); second semester. MR. ROTZEL.
12. INCOME-TAX PROBLEMS. Course offered to those who have completed Principles of Accounting A and B for the purpose of familiarizing the accounting student with the accounting ramifications of the federal income tax law, and its application to various businesses and also to varying business conditions. The purpose of the course also will be to point out possible errors likely to be made in the preparation of the regular tax reports. Lectures, discussions, and working out of problems. Two credits (one evening a week); first semester. MR. PRESTON.

## BANKING AND FINANCE

21. BANKING. The documents created by transactions in goods; the function of a bank in aiding industry; the steps in organization of national or state banks; corporate powers, rights, and liabilities of stockholders and directors; bank administration and the various offices and departments; deposits, depositors, and receiving tellers; bank reserves and circulating notes; the clearing-house, handling country checks, and transit departments; collections; domestic exchange; foreign exchange; discounts and collateral loans; credit department; how profits are made on government deposits, by note issue, in buying and selling exchange, by analysis of depositor's accounts; accounting methods and general balances; examination; supervision and reports; and bank policy from the analysis of local bank reports.

This course aims to explain the various functions of an up-to-date bank and to teach the methods by which its work is accomplished. A careful survey will be made of the economic basis, legal status, accounting methods, and financial problems of banking as carried on by large commercial institutions having a full complement of banking operations including city, country, and foreign business. The method of presentation comprises reading references, lectures, review questions, and use of the blackboard for all computations. Two credits (one evening a week); first semester. MR. EBERSOLE, MR. POWELL.

22. MONEY AND CREDIT. The origin, evolution, and functions of money; the gold standard, forms of money current in the United States; government paper, bank notes, and deposit currency described and analyzed; credit and its effects; the causes of general price changes; various types of standards and currency systems including bimetallism and the gold exchange standard; discount rates, the problem of securing an elastic currency, and the distribution of the world's gold among the nations; the problem of securing an ideal money. Textbook and money-market articles in current newspapers will furnish material for discussion.

A thoro understanding of the character and functions of money and of the principles of credit is the cornerstone of modern business intelligence. This course in money and credit constitutes an interesting and scientific treatment of the forces that determine value and prices, of the processes of exchange, and of the many forms of media of payment represented by monetary and credit instruments. Two credits (one evening a week); first semester.

- 23 (145). CORPORATION FINANCE. The evolution of the private corporation and its relation to other business units; the organization of a corporation; charters and articles of association; directors and officers, manner of their selection, their functions and responsibilities; forms of corporation stocks and bonds and their respective legal and financial characteristics; the marketing of securities; capital and revenues; intangible values; books and accounts; dissolutions, consolidations, and reorganization; trust and holding companies; the taxing of corporations; corporation statistics; the preparation and analysis of corporation reports; the corporation before the law.

Modern business in all of its major forms is directed through corporate organization. The course in corporation finance is designed to give the student such a knowledge of corporations and their administration as to make clear the general organization of industry and commerce. Texts will be extensively supplemented by informal lectures, class discussions, and topical essays. Two credits (one evening a week); first semester. MR. STEHMAN.

- 24 (142). INVESTMENTS AND SPECULATION. Stocks, bonds, endowments, annuities, and other forms of investment considered with regard to their security, income, and opportunity for rise or fall in value. The

social process of saving and investment; the investment fund; various classes of investments; the criteria of a good investment applied to government, corporation, and real-estate loans; railroad, industrial, timber, and mining securities compared; the laws of investment values. Stock exchange operations; money market and other influences affecting prices; analysis of present fundamental conditions. The actual operations upon the stock and produce exchanges are used to illustrate the study of speculation, and the course of the markets and the bank rates is closely followed as a basis of deduction in the analysis of cause and effect. Textbook and interpretation of financial quotations and reports. Two credits (one evening a week); second semester. MR. EBERSOLE.

## BUSINESS LAW

NOTE: The subjoined courses in business law give credit toward a University degree only to those students who have earned 6 credits in political science or 6 in economics or three in each. Students who have not met these prerequisites may, however, take these courses for credit toward one of the University certificates in business. Specially qualified and mature extension students may petition for university credit.

31. BUSINESS LAW A—CONTRACTS AND AGENCY. Contracts: definition of a contract; offer and acceptance; special formality; consideration; capacity of parties; contractual powers of minors, or persons mentally deficient, and of married women; reality of consent, mistakes, misrepresentation, fraud, undue influence, legality of object; the operation of contracts; assignment of contracts; interpretation of contracts; methods of discharging contracts.

Agency: methods of forming agencies; methods of terminating agencies; the rights and obligations of principals, agents, and third parties. Text, lectures, and class discussion. Two credits (one evening a week; first semester. MR. CHAPIN, MR. CHILD, MR. GLICK, MR. PALMER, MR. RUMBLE.

This course is fundamental and must be completed before registration will be accepted for other courses in business law.

32. BUSINESS LAW B—SALES AND NEGOTIABLE INSTRUMENTS. Sales: sales of personal property; definition of a sale and its distinction from a bailment; when the title passes to the buyer; what title passes; rights of the seller (a) to set the contract aside on the ground of fraud, (b) to enforce lien for the purchase money, (c) to obtain stoppage in transit; rights of the purchaser (a) to demand goods of a certain quality, (b) to demand warranty of the purchaser's title.

Negotiable instruments: nature and characteristics: (a) definitions and characteristics, (b) uniform negotiable instruments law; form; (a) what a negotiable instrument must and must not contain (b) non-essential, (c) effect of blanks and delivery; negotiation: (a) negotiation, indorsement, and delivery, (b) holder in due course and his rights; maker's and acceptor's contract: (a) maker's contract on a promissory

note, (b) acceptor's contract on a bill of exchange, (c) presentment of a bill of exchange for acceptance; drawer's and indorser's contract: (a) drawer's contract on a bill of exchange, (b) indorser's contract on a bill or note, (c) presentment for payment, (d) notice of dishonor. (e) protest, (f) checks, (g) position of indorser after liability is fixed. Text, lectures, and class discussion. Two credits (one evening a week); second semester. For those who have completed Course 31. MR. CHAPIN, MR. CHILD, MR. DULEBOHN, MR. GLICK, MR. RUMBLE.

33. BUSINESS LAW C—PARTNERSHIPS AND CORPORATIONS. BANKRUPTCY. Partnerships: formation of partnerships; articles of co-partnerships; methods of terminating partnerships; rights and obligations of partner (a) toward his co-partners, (b) as an agent of the firm, (c) toward the firm's creditors, (d) for an accounting; special partners; limited partnerships.

Joint stock companies: how distinguished from ordinary partnerships; how like ordinary partnerships; statutory requirements.

Corporations: formation of corporations of various classes; termination of corporations; membership in corporations, methods of transferring interest, fraudulent issuance of stock by corporate officers; rights of stockholders (a) to dividends, (b) to inspect and control corporate affairs; liability of stockholders (a) on stock subscriptions, (b) to pay assessments, (c) for the corporate debts; the doctrine of ultra vires; rights and obligations of corporate directors; corporate mergers and consolidations; domestic and foreign corporations.

Insolvency and bankruptcy proceedings. Discharge in bankruptcy. Text, lectures, and class discussions.

For those who have completed Course 31. Two credits (one evening a week); first semester. MR. KENNY, MR. PALMER, MR. SMILEY.

34. BUSINESS LAW D—REAL PROPERTY AND MORTGAGES. Real property: estates in land, estates held jointly or in common, equitable estates, relative rights of adjoining owners, trespass, easements, sales of real property, the contract to sell, conveyances, wills, mortgages, and liens; landlord and tenant, the lease, assignment and subletting, rent, and remedies for non-payment; abstracts, title, insurance, Torrens titles. Two credits (one evening a week); second semester. MR. KENNY, MR. PALMER, MR. SMILEY.

## ECONOMICS AND COMMERCE

- 41 (1a). ELEMENTS OF ECONOMICS. A fundamental course in economic principles as a basis for the study of current economic problems. Two credits (one evening a week); first semester. MR. CUMMINGS, MR. MYERS.
- 42 (B). ECONOMIC PROBLEMS. Current problems of importance will be studied, for example: business cycles and industrial depressions, taxation, labor organizations, combinations and monopoly, immigration,

international trade, and others. Two credits (one evening a week); second semester. MR. CUMMINGS, MR. MYERS.

NOTE: Economic Problems may be taken before Elements of Economics, but credit for it will not be granted until the elementary course has been successfully completed.

43. PRINCIPLES OF BUSINESS MANAGEMENT. Principles of organization showing comparative values and uses of line, staff, and combination types. Methods of saving time, money, and energy in the moving of work and materials. Making a scientific analysis of a particular operation, the operation of a department, and the operation of a plant. How to make use of the analysis in reducing waste, time, energy, money, and material. Principles underlying the establishment and maintenance of the improved methods and conditions obtained by the above study. These principles include a method of determining upon proper and clearly defined policies and a study of their use and value; the necessity for and proper means of profiting by the experience of others. How to develop business judgment in yourself and your subordinates. The principles governing executive control and the maintenance of discipline; discussion of methods of determining upon a wage scale and legitimate profits; the relation of physical condition to success, and its bearing upon production. Some principles underlying proper management of finances. The relation of home management to industrial and commercial efficiency; the organization and management of the sales department; training the salesman. The general problem of selection of help with a brief outline of a modern system of scientific selection and placement by a study of individual characteristics. No credit toward a degree, 2 credits for certificate in business (one evening a week); first semester. MR. PAYNE.

51. ELEMENTARY ADVERTISING. This course is intended for those who desire sufficient knowledge of the elements of advertising to prepare reasonably satisfactory copy for newspapers, magazines, street-car cards, circulars, and booklets. The fundamental elements of display, layout, headings, and copy are carefully outlined and the student is given practice in the preparation of advertisements.

This course is intended to acquaint the student with what may be called "the tools of advertising" before he undertakes either of the two advanced courses in the planning and preparation of advertising campaigns. No credit toward a degree, 2 credits for certificate in business (one evening a week); first semester. MR. MARTIN.

52. NATIONAL ADVERTISING. A study of advertising from a new angle. The student puts himself in the place of one having a product for sale, and from the first lesson to the last each lecture is so planned as to give the methods pursued in conducting the many different steps in an advertising campaign.

The student first analyzes the product from the standpoint of its advisability. He considers the planning of a trademark, the organization of the sales force, the selling points, the prices, and the profits. He then thoroly analyzes the market, chooses the advertising medium most adaptable to his particular campaign, and decides on the appropriation.

Students will be furnished with pamphlets for these lectures which will give reference to practically everything which has so far been published on subjects taken in the course. In this way the experience of probably three hundred of the leading advertising men of this country will be available to the student. No credit toward a degree, 2 credits for certificate in business (one evening a week); second semester. MR. MARTIN.

- 6I. SALESMANSHIP. A course for insurance men, specialty men, traveling salesmen. Lectures and demonstrations on the principles underlying successful salesmanship, as follows: the proper approach; securing attention; arousing interest; creating desire; closing the sale; the psychology of salesmanship; the use of suggestion in selling; the use of argument.

The chief feature of the work will be the demonstration sales. So far as possible each student will be given an opportunity to take part in a sufficient number of demonstrations that he may apply the principles laid out in the course. No credit for degree, 2 credits for certificate in business (one evening a week); each semester. (Not offered in 1921-22.)

- 7I. RAILWAY TRAFFIC AND RATES. A practical study of the Act to Regulate Commerce and the other laws and regulations covering the transportation of property, locally and in foreign commerce, both by rail and by water. The student is acquainted with the correct compilation and interpretation of freight tariffs and economical and efficient methods in shipping. The lectures are comprehensive and embrace rate-making bases, the classifying and tracing of freight, the preparation of claims, etc. Rulings of the Interstate Commerce Commission and of the various state commissions are referred to and rates are quoted from current tariffs and classifications. Four credits (one evening a week); both semesters.

#### ENGLISH AND SPANISH

- 8I. BUSINESS ENGLISH. Not a lecture course nor a dry, prosy study of technical English grammar and composition, but a new practical course designed for business men and women who recognize the value of a command of English for business and every-day writing and conversation. The main object of the course is to acquaint the student with the various types of business letters, reports, etc., and to teach him how to write and use them effectively. A secondary object of the course is to show students how training in expression—written or

oral—is primarily training in thinking and analysis and hence is a very real stimulus to general business efficiency. The types of letters to be studied include complaint and answer, reminder, acknowledgment, recommendation, application, collection, form, follow-up, sales, interdepartmental, and composite. Students will be expected to write letters and take part in the weekly discussions of actual problems in business correspondence. Ability to write simple, grammatically correct English is a prerequisite to this course. No credit toward a degree, two credits for a certificate in business (one evening a week); first semester. Repeated second semester.

82. PUBLIC SPEAKING. For description see Department of Collegiate Instruction. One evening a week; both semesters.
90. SPANISH. For description see Department of Collegiate Instruction. One evening a week; both semesters.

### MATHEMATICS

100. MATHEMATICS OF BUSINESS A. A practical course dealing with certain fundamental mathematical operations peculiar to business transactions. The subject will cover percentage, simple interest, compound interest and discount, use of interest tables, problems in banking and taxation, graphical statistics, logarithms, elements of the theory of annuities—certain, use of annuity tables, application of annuities to problems in amortization, sinking funds and bond computations, and the elements of the mathematics of life insurance.

Prerequisites: 2 years of high-school mathematics. Two credits (one evening a week); first semester. MR. HART.

101. MATHEMATICS OF BUSINESS B. A continuation of Course 100.

Prerequisites: Course 100 or college algebra and trigonometry. Two credits (one evening a week); second semester. MR. HART.

### DENTAL MECHANICS

A course in Dental Mechanics is offered by the General Extension Division in coöperation with the College of Dentistry. This course extends over a period of one college year beginning with the fall quarter. It requires for admission completion of eighth-grade work and a minimum age of eighteen years except in cases of students who have completed one or more years of high-school work.

The expenses for this course include a tuition fee of \$50 a quarter or \$150 for the year; and approximately \$150 additional for instruments.

The course of study includes the following: prosthetic technic: a course of lectures, recitations, and laboratory technic covering equipment

and arrangement of the dental laboratory, impression materials, study models, vulcanite and metallic dentures. Courses of lectures and laboratory work covering the following subjects: Oral Anatomy, Crown and Bridge Work, Operative Technic, and Orthodontia Technic with their practical application in the dental infirmary.

Upon the successful completion of the course the University certificate for Dental Mechanics will be granted.



## CERTIFICATE HOLDERS

### CERTIFICATE HOLDERS OF 1917

On May 25, 1917, the following persons were granted University business certificates in the courses indicated:

#### *Certificates in Accountancy*

Bayley, Charles S., Minneapolis	McHenry, Robert D., Minneapolis
Cottor, Emil F., St. Paul	Schwartz, Solomon, Minneapolis
David, Charles A., Minneapolis	Smith, Arthur V., Minneapolis
Haselbeck, Henry, St. Paul	Wing, Llewellyn F., Minneapolis
Loberg, James M., Minneapolis	Wood, George, Minneapolis

#### *Certificates in General Business*

Gruber, J. Jeffrey, St. Paul	Kennedy, Thomas F., Minneapolis
	Rose, Carrol H., Minneapolis

#### *Certificates in Finance*

Berry, Harry E., Minneapolis	Johnson, Evan M., Minneapolis
Danielson, Andrew W., St. Paul	Jones, Earl R., Minneapolis

### CERTIFICATE HOLDERS OF 1918

On May 28, 1918, the following persons were granted University business certificates in the courses indicated:

#### *Certificates in Accountancy*

Erbalang, Alphonse A., St. Paul	Linnerooth, Sidney, St. Paul
Gustafson, Victoria, Minneapolis	Nimerfroh, Gertrude, Minneapolis
	Welliver, Le Roy, Minneapolis

#### *Certificates in General Business*

Corcoran, John J., St. Paul	Melamed, Louis, St. Paul
	Schaffelke, Henry A., St. Paul

#### *Certificates in Finance*

Oberg, Ezra, Minneapolis

#### *In Absentia*

Hauge, Arthur, Certificate in General Business	Shannon, Thomas, certificate in Accountancy
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### CERTIFICATE HOLDERS OF 1919

On May 26, 1919, the following persons were granted University business certificates in the courses indicated:

#### *Certificates in Accountancy*

Gothe, Oscar E., St. Paul	Melamed, M. L., St. Paul
Johnson, Lillian P., Minneapolis	Schmal, G. P., Minneapolis

#### *Certificates in General Business*

Barton, A. D., Minneapolis	Ekblad, E. G., Minneapolis
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## CERTIFICATE HOLDERS OF 1920

On May 25, 1920, the following persons were granted University business certificates in the courses indicated:

### *Certificates in Accountancy*

Anderson, C. A. L., St. Paul	Chailquist, F. R., Minneapolis
Anderson, R. W., Minneapolis	Gadacz, Stanley J., St. Paul
Barton, A. D., Minneapolis	Kulp, Delmar C., Minneapolis
Benson, J. Raymond, Minneapolis	Schilling, P. A., Minneapolis

### *Certificates in Finance*

Haselbeck, Henry, St. Paul

### *Certificates in General Business*

Elmquist, Nan C., St. Paul

## CERTIFICATE HOLDERS OF 1921

On May 31, 1921, the following persons were granted University business certificates in the courses indicated:

### *Certificates in Accountancy*

Blandin, A. A., St. Paul	Kjelsberg, Clara, Minneapolis
Buetow, Herbert P., St. Paul	Le Borious, William, St. Paul
Doe, Richard H., St. Paul	Munson, Clifford A., St. Paul
Ekblad, E. G., Minneapolis	Oberg, Ezra N., Minneapolis
Hauge, Arthur W., Minneapolis	Wright, Ethel J., Minneapolis
Huffman, H. H., Minneapolis	Wright, William W., Minneapolis

### *Certificates in Finance*

Jensen, Ernest W., Minneapolis	Kulp, Delmar E., Minneapolis
	Peterson, Clarence A., Minneapolis

### *Certificates in General Business*

Bolstad, Alfred C., Minneapolis	Lee, Reynold, Minneapolis
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On May 31, 1921, the following persons were granted University engineering certificates:

### *Certificates in Engineering*

Livermore, Harvey J., St. Paul	Stachle, Gilbert C., Minneapolis
Ryan, James L., St. Paul	Trierweiler, Dominic G., St. Paul

REGISTRATION 1920-1921  
SIGNIFICANCE OF SYMBOLS

- \*Also in St. Paul Business
- \*\*Also in St. Paul Collegiate
- \*\*\*Also in Engineering
- †Also in Minneapolis Business
- ††Also in Minneapolis Collegiate
- †††Also in Minneapolis Collegiate and Minneapolis Business
- °Also in Minneapolis Business and St. Paul Business
- \*††Also in Minneapolis Collegiate and St. Paul Business
- ‡Also in St. Paul Business and St. Paul Collegiate

MINNEAPOLIS—BUSINESS

- Ahlen, Mauritz, 3036 10th Ave. S.  
Aitkens, F. A., 681 40th Ave. N.E.  
Alexander, Helen D., 1103 S.E. 4th St.  
Allen, Samuel L., 1024 20th Ave. N.E.  
Allen, Willis G., 3324 Bryant Ave. S.  
Amundson, Alfred, 1320 Vine Place.  
Anderson, Arthur Edw., 3917 11th Ave. S.  
††Anderson, Arthur E. L., 4004 Oakland Ave. S.  
Anderson, A. W., 715 N.E. Fillmore St.  
Anderson, Carl B., 2445 15th Ave. S.  
Anderson, David, 4001 Girard Ave. N.  
Anderson, E. F., 3118 Grand Ave.  
Anderson, Earl, 1709 Chicago Ave.  
Anderson, Edwin W., 2731 E. 24th St.  
Anderson, Fortner C., 3014 Holmes Ave. S.  
Anderson, Godfrey, 3622 Bryant Ave. S.  
Anderson, G. E., 3836 Elliott Ave.  
Anderson, Harold V., 1706 N.E. Washington St.  
Anderson, Leora, 2531 15th Ave. S.  
Anderson, Lloyd W., 2440 10th Ave. S.  
Anderson, Ray E., St. Louis Park, Minn.  
Anderson, Rudolph H., 244 S.E. Bedford St.  
Anderson, R. N., 1100 15th Ave. S.E.  
Anderson, W. Roy, 1112 S. 8th St.  
Andrews, W. R., 1908 Hennepin Ave.  
††Applebee, Ruby Marie, 4331 Stevens Ave.  
Armstrong, Philip S., 2618 Fremont Ave. N.  
Arvidson, Carl W., 907 14th Ave. S.  
Aura, Jno. W., 808 S.E. 4th St., Apt. 3
- Auran, Nellie, 3715 Bloomington Ave. S.  
Babb, W. M., 2218 E. 35th St.  
Bailey, Howard D., 2423 Central Ave. N.E.  
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Berry, Harry Edwin, 3601 Upton Ave. N.

Berry, Leonard Lind, 2614 Stevens Av.  
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 Borgen, Inga, 2640 Penn Ave. N.  
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 Bowers, Warren C., 520 13th Ave. S.E.  
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 Boyd, Barry F., 1009 Park Ave.  
 Brackett, Scott, 3037 Bloomington Ave.  
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 Brambach, Florence, 2516 15th Ave. S.  
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 Carlson, Maurice G., 305 30th Ave. N.  
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 Gibbons, E. J., 2417 Bryant Ave. S.  
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 Gudenberg, Abe H., 2206 Riverside Ave. S.  
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 Gustafson, Clarence L., 1310 E. 22d St.  
 Gustafson, Lawrence D., 20 N. 13th St.  
 Gustafson, Walter F., 3201 34th Ave. S.  
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 S.  
 Lundquist, Axel B., 3012 10th Ave. S.  
 Lundstrom, Lyle G., 2708 Pillsbury  
 Ave.  
 Lyle, Raymond A., 2616 N.E. Taylor  
 St.  
 Lyon, Dorothy B., 1205 Mary Place  
 Lysen, Milford E., 3147 Longfellow  
 Ave. S.  
 McAfee, J. L., 3120 Blaisdell Ave.  
 McBride, Douglas N., 3528 Nicollet  
 Ave.  
 McCarthy, W. F., 2431 Grand Ave.  
 McClurg, D. Gordon, 713 E. 15th St.  
 McCormack, J. N., 3336 Harriet Ave.  
 McDonough, Martin, 2119 Cedar Ave.  
 McDowell, J. B., 5137 Bryant Ave. S.  
 ††McElroy, Monica, 2008 E. 22d St.  
 McFarland, R. M., 4201 France Ave. S.  
 McGovern, A. J., 1920 2½ St.  
 McGrath, Edward J., 1416 Portland  
 Ave.  
 McGuire, Francis H., 1527 James Ave.  
 N.  
 McHardy, J. A., 1710 Stevens Ave.  
 McIntire, Ralph B., 1917 Aldrich Ave.  
 S.  
 McKnight, Thomas, 3136 E. 53½ St.  
 McLaughlin, Clarence E., 2230 N.E.  
 Hayes St.  
 McLeod, J. Blair, 1451 W. Lake St.  
 McNickle, M. J., 500 E. 15th St., Apt.  
 36  
 McNiff, Ray F., 4008 Columbus Ave.  
 Mactavish, Robert F., 1408 W. 28th St.  
 Magnuson, Ernest E., 1116 15th Ave.  
 S.E.  
 Maleitzka, Walter C., 1142 Lyndale  
 Ave. N.  
 Malone, F. T., 3217 Park Ave.  
 Malstrom, R., 47 Winnipeg, St. Paul  
 Mandel, David, 127 Highland Ave.  
 Mangney, Dora, 4311 Lyndale Ave. S.  
 Mangney, Winifred, 4211 Lyndale Ave.  
 S.  
 Margulis, Sidney, 786 Aurora Ave., St.  
 Paul  
 Martin, Mrs. F. B., 4148 Upton Ave. S.  
 Martin, R. E., 1003 Park Ave.  
 May, Charles H., 3857 14th Ave. S.  
 May, Margaret G., 4129 Elliott Ave.  
 May, Walter T., 3008 Pleasant Ave.  
 Mayberg, Marcus N., Hampshire Arms  
 Meder, Herman P., 2100 N. 6th St.  
 Meehl, George H., 3232 23d Ave. S.  
 Merrill, Louis M., 1302 Linden Ave.,  
 Apt. 206  
 Mettler, Merrill Warren, 4532 Pleasant  
 Ave. S.  
 Mikolajczk, Ray A., 1506 N.E. 4th St.  
 Miller, C. R., 1806 11th Ave. S.  
 Miller, Ed Larry, 4805 Washburn Ave.  
 S.  
 Miller, Elbert W., 26 Nourse St., St.  
 Paul  
 Miller, George G., 1430 Newton Ave. N.  
 Miller, Joseph C., 1104 24th Ave. N.E.  
 Mitchell, Howard A., 406 13th Ave.  
 S.E.  
 Mitchell, Raymond L., 401 E. 39th St.  
 Mitton, Clarence E., 391 Wilder Ave.,  
 St. Paul  
 Mitton, Russell W., 1512 Clinton Ave.  
 Moak, Floyd R., 2630 Territorial Road,  
 St. Paul  
 Molloy, Douglas N., 5000 Nicollet Ave.  
 Montgomery, H. L., 3025 Fremont  
 Ave. S.  
 Moore, S. R., 1073 12th Ave. S.E.  
 Moore, W. W., Wayzata, Minn.  
 Morehouse, Paul, 723 S.E. 7th St.  
 Morneau, Alfred J., 19 N.E. 2d St.  
 Morton, Mabel Catherine, 5122 Wash-  
 burn Ave. S.  
 Moulton, Freda, 903 E. 15th St., Apt. 5  
 Muckenbirt, John C., 1614 Aldrich Ave.  
 N.  
 Muehlberg, Lloyd J., 1810 N. Dupont  
 Ave.  
 Muehlberg, Orville H., 125 E. Henne-  
 pin Ave., Apt. 4  
 Mueller, A. H., 3233 1st Ave. S.  
 Mueller, Robert, 2309 Dupont Ave. N.  
 Murphy, Michael, 1012 S.E. Essex St.  
 ††Murphy, Theresa, 3505 Sheridan Ave.  
 N.  
 Murray, Olive, 2622 3d Ave. S., Apt. 8  
 Mussman, Helen, 2817 Fremont Ave. N.  
 Myers, W. A., 1327 N.E. 6th St.

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 Nash, Ada B., 511 University Ave. N.E.  
 Naumann, Richard, 89 Ash St.  
 Neils, Gerhard F., 729 10th Ave. S.E.  
 Nelson, Carl O., 3411 43d Ave. S.  
 Nelson, Cecil O., 130 East 18th St.  
 Nelson, Clifford E., 2432 Chicago Ave.  
 Nelson, Eunice De Bartlett, Metropolitan National Bank  
 Nelson, G. R., 2219 Irving Ave. N.  
 Nelson, Henry C., 3532 13th Ave. S.  
 Nelson, Libby E., 4652 Vincent Ave. S.  
 Nelson, Reuben R., 37th N.E. Marshall St.  
 Nelson, Sophus, 2409 Harriet Ave. S.  
 Nero, Boyd E., 2942 Nicollet Ave.  
 Ness, Lillian, 2329 S. 9th St.  
 Neudeck, Clara I., 1934 N.E. Lincoln St.  
 Nevin, Genevieve M., 3322 Clinton Ave.  
 Newby, Joyce, 1012 Marquette Ave  
 Newman, W. J., 3452 Nicollet Ave.  
 Nielsen, K. Charles, 3428 Lyndale Ave. S.  
 Niles, John Dickerman, 826 Penn Ave. N.  
 Nora, O. K., 1208 W. 28th St.  
 Nordstrom, Adolph G., 3154 15th Ave. S.  
 Noreen, Paul W., 3723 Washington Ave. N.  
 Norman, Astrid, 506 S.E. Delaware St.  
 Norstad, John Wm., 5025 York Ave. S.  
 Nuber, Paul J., 3028 Bryant Ave. S.  
 Nygard, Carlton O., 3502 N.E. 3d St.  
 O'Brien, Frank C., 2644 15th Ave. S.  
 O'Grady, W. J., 4146 Pillsbury Ave.  
 O'Hearn, Harry, 322 West Minnehaha Blvd.  
 O'Loughlin, Frank J., 529 2nd Ave. S.  
 Oberg, Ezra N., 3330 32d Ave. S.  
 Ohnstad, Arthur W., 324 Hampshire Arms  
 Ohrbeck, J. E., 5000 Aldrich Ave. S.  
 Oleson, John O., 1411 Second Ave. S.  
 Olmen, Melvin R., 1016 W. 28th St.  
 ††Olmen, Stella L., 1016 W. 28th St.  
 Olmscheid, John J., 428 S. 8th St.  
 Olsen, Edwin E., 2749 Columbus Ave.  
 Olsen, F. A., 84 Spruce Place  
 Olsen, Marie, 801 Fauquier St., St. Paul  
 Olson, Earl W., 412 S.E. Walnut S.  
 Olson, Elven O., 1519 N.E. Adams St.  
 \*\*\*Olson, Martin H., 2416 17th Ave. S.  
 Olson, Melville, 643 E. 18th St.  
 Olson, Palmer S., 423 30th Ave. N.  
 Ondrey, Cyril M., 2215 N.E. Grand St.  
 Opheim, Edwin R., 18 N. 13th St.  
 Opsal, Elmer C., 2520 18th Ave. S.  
 Osborn, J. A., 2414 Como Ave. S.E.  
 Osen, Walter, 215 S.E. St. Mary St.  
 Ostgaard, Ole, 3206 Morgan Ave. N.  
 Overseth, A. P., 3814 Chicago Ave.  
 Paine, Erle A., 4243 Washburn Ave. S.  
 Palmer, Harry R., 3149 Emerson Ave. S.  
 Palmer, Robert E. A., 2300 Lyndale Ave. S.  
 Parkhill, T. E., 4708 Abbott Ave. S.  
 Parks, Carl H., 4245 Bryant Ave. S.  
 Patterson, Einer T., 4418 Colfax Ave. S.  
 ††Patterson, Howard G., 86 Willow St.  
 Paulson, Carolus M., 514 W. Grant St.  
 Pederson, Clifford A., 3855 Aldrich Ave. N.  
 Peel, Leon R., 738 E. 16th St.  
 Peppard, Melville J., 2532 3d Ave. S.  
 Perkins, Roscoe D., 3244 4th Ave. S.  
 Perlich, Arthur G., 223 Oak Grove St.  
 Perry, Jeannette Edith, 4401 Pillsbury Ave.  
 Peters, Ray J., 325 University Ave. N.E.  
 Peterson, Carl R., 3137 19th Ave. S.  
 Peterson, Clarence A., 3818 Chicago Ave.  
 Peterson, Edwin A., 1421 Park Ave.  
 Peterson, Elmer W., 4016 3d Ave. S.  
 Peterson, Elroy, 2211 Russell Ave. N.  
 Peterson, Fritz A., 520 13th Ave. S.E.  
 \*\*\*Peterson, Harold R., 3317 Blaisdell Ave.  
 Peterson, Mabel G., 4832 28th Ave. S.  
 \*\*\*Peterson, Ray C., 3025 5th Ave. S.  
 Peterson, Reuben E., 1207 E. 21st St.  
 Peterson, Roland A., 113 W. Grant St.  
 Peterson, Russell W., 2724 Oakland Ave.  
 Peterson, Selma, 2100 25th Ave. S.  
 Peterson, Wallace E., 113 W. Grant St.  
 Petrock, Edw. J., 603 S.E. Oak St.  
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 Phillips, F. Stanley, 2036 Upton Ave. S.  
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 Pierce, Harold E., 1100 N.E. Jefferson St.  
 Pike, Elliot T., 2812 15th Ave. S.  
 Pinkerton, F. M., 3249 3d Ave. S.  
 Plant, J. H., 3634 Oakland Ave.  
 Platzer, Ruth M., 3410 Garfield Ave.  
 Plummer, Lawrence D., 4648 Beard Ave. S.  
 Post, H. L., 4901 Emerson Ave. S.  
 Powell, G. C., 1420 Portland Ave.

Powell, Gomer R., 2734 14th Ave. S.  
 Pratt, F. Alden, 2435 Grand Ave.  
 Price, Clarence R., 112 W. 27th St.  
 Price, Velma, 1025 20th Ave. S.E.  
 Prytherch, William T., 3026 10th Ave. S.  
 Puelston, Ray E. J., 1117 Portland Ave.  
 Quackenbush, Edward W., 4733 Blaisdell Ave.  
 Quigley, J. M., 4742 Beard Ave. S.  
 Quist, C. Verner, 1213 S. 9th St.  
 Randall, Edith, 1800 1st Ave. S.  
 Rapson, George P., 2547 N.E. Jefferson St.  
 Reed, Jesse H., 4840 York Ave. S.  
 Reiter, S. R., 3014 Holmes Ave. S.  
 Remo, Cora D., 710 University Ave. S.E.  
 Repair, Thomas, Minneapolis  
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 Rheberg, Arthur J., 2220 Oakland Ave.  
 Rice, Rose M., 2623 Stevens Ave.  
 Rischmueller, M. Martha, 3335 Hennepin Ave.  
 Ritchie, C. H., 4618 Pillsbury Ave.  
 Ritchie, Lyndsay K., 4537 Nicollet Ave.  
 Robben, Alma J., 100 E. 16th St.  
 Rochat, J. B., 1938 N.E. Hayes St.  
 Rodier, Mabel A., 1719 Newton Ave. N.  
 Rodwold, Ole O., 3943 Queen Ave. N.  
 Rose, Carroll H., 926 13th Ave. S.  
 Rose, Lawrence C., 515 S. 9th St.  
 Rose, Lawrence E., 926 13th Ave. S.  
 Rose, L. V., 325 W. 5th St.  
 Rosenstein, Charles H., Buckingham Apts.  
 Rosquist, Lees, 1210 19th Ave. N.E.  
 Ross, Laurette E., 52 Oliver Ave. N.  
 Rossman, John G., 203 W. Grant St., Apt. 12  
 Rowe, Lambert H., 3600 Garfield Ave.  
 Rowe, Ina B., 2150 Carter Ave., St. Paul  
 Roy, Maria E., 922 N.E. 2d St.  
 Rudberg, Mel, 2714 N. 3d St.  
 Rusch, Hugo H., 523 S. 9th St.  
 Rush, Ruth H., 3346 Columbus Ave.  
 Ryan, Ruth G., 3624 Lyndale Ave. S.  
 Ryan, Jos. M., 416 7th Ave. N.E.  
 Rychman, Jos., 2644 30th Ave. S.  
 Rydeen, Maurice R., 2013 S. 7th St.  
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 St. Cyr, C. C., Robbinsdale, Minn.  
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 Sahl, Ole, 812 4th Ave. S.  
 Sampson, M. S., 2122 S. 5th St.  
 Sandahl, Harold E., 108 E. 32d St.  
 Sandberg, A. G., 3006 Logan Ave. N.  
 Sandberg, F. H., Northwestern Natl Bank  
 Sandgren, Arthur N., 4122 Emerson Ave. N.  
 Sandt, Arthur S., 3849 Grand Ave. S.  
 Schadegg, Theophilus, 1894 Roblynn Ave., St. Paul  
 Scharpf, Elmer Louis, 1805 1st Ave. S.  
 Schectman, Sam, 1015 N. 5th St.  
 Scherer, Anton A., 1911 Park Ave.  
 Schmidt, Harold, 2310 Penn Ave. N.  
 Schneider, Raymond T., 1511 Lagoon Ave.  
 Schober, Edmund G., 1027 University Ave. S.E.  
 Schoenborn, Adam H., 2424 Oakland Ave.  
 Schreiber, Leo, 1717 Thomas Ave. N.  
 Schroven, Paul A., 3908 17th Ave. S.  
 Schultz, Walter H., Room 825, Central Y.M.C.A.  
 Schutta, Lloyd, 710 N.E. Fourth St.  
 Schwarble, Cornelius H., 1138 N.E. Adams St.  
 Schwartz, Ethel, 1921 2d Ave. S.  
 Schwarz, Alfred B., 1415 16th Ave. N.  
 Sears, Frank, 2517 4th Ave. S.  
 Sell, Jeanette E., 3436 Fremont Ave. S.  
 \*Shapiro, Herbert D., 131 E. 13th St., St. Paul  
 Sheakley, Norris, 3631 Lyndale Ave. S.  
 Shean, James C., 3333 18th Ave. S.  
 Sheldon, Clare E., 107 Spruce Place  
 Sheridan, Chas. R., 3737 2d Ave. S.  
 Shirk, C. W., 215 St. Mary's Ave. S.E.  
 Sills, John B., 1724 Irving Ave. S.  
 Silverman, Mitchell I., 2122 Chicago Ave.  
 Sims, Kenneth H., Excelsior, Minn.  
 Singer, A. E., 4005 Minnehaha Ave.  
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 Skaarsheim, A. J., 818 E. 18th St.  
 Skahen, Marion E., 1514 Newton Ave. N.  
 Skalor, Miss, Minneapolis  
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 Sklar, Frances, 536 Fremont Ave. N.  
 Skog, Carl Edwin, 1416 S.E. 6th St.  
 Skog, Frank A., 4033 Garfield Ave.  
 Sletto, James E., Y.M.C.A.  
 Smith, Edward D., 3641 Portland Ave.  
 Smith, J. W., 22 W. 49th St.  
 ††Smith, Margaret L., 1958 Carroll Ave., St. Paul  
 Smith, May M., 427 S.E. 6th St.  
 Smith, William A., 1711 University Ave. S.E.  
 Smithey, Burgess A., 3136 Holmes Ave. S.

Solem, Lavern Edw., 2514 15th Ave. S.  
 Sorenson, Roy C., 1512 S. 21st St.  
 Soukup, Fred G., 2645 Lyndale Ave. S  
 Stabliski, Frans S., 2135 N. 4th St.  
 Stamm, Walter C., 1824 Lyndale Ave  
 S.  
 Stanchfield, Steele S., 1110 13th Ave  
 S.E.  
 Stavos, Benoni J., 4940 Columbus Ave.  
 Stebbins, Robert, 3119 Clinton Ave.  
 Steele, Dorothy R., 3612 Elliott Ave.  
 Steen, J. A., 1806 16th Ave. S.  
 Steen, Simon, 1801 N.E. Pierce St.  
 Steenerson, Gudrun, 757 8th Ave. S.  
 Steer, Frederick L., 2200 Garfield Ave.  
 Steffes, J. J., 1902 4th Ave. S.  
 Stege, Wesley C., 3229 Clinton Ave.  
 Stenvig, Lennex S., 1910 Elliott Ave.  
 S.  
 Stevens, F. A., Room 1218, Y.M.C.A.  
 Stone, Francis, 3843 Grand Ave.  
 Strand, John, 2905 28th Ave. S.  
 Strand, Theo C., 409 S. 6th St.  
 Strandberg, Daniel W., 2853 41st Ave.  
 S.  
 Strassburg, Everett R., 2025 19th Ave.  
 N.E.  
 Stratton, M. E., 3636 Pleasant Ave.  
 Struble, Mildred, 2734 14th Ave. S.  
 Sturtevant, Abby L., 956 23d Ave. N.E.  
 Susag, Lawrence M., 3349 30th Ave. S.  
 Swagger, Wesley E., 10 S.E. Bedford  
 St.  
 Swalen, Clarence J., 3231 15th Ave. S.  
 Swanish, P. T., 1110 S.E. 5th St.  
 Swanson, C. W., 2727 Grand Ave.  
 Swanson, George H., 2609 5th Ave. S.  
 Swanson, Martin S., 4121 11th Ave. S.  
 Swanson, O. R., 2319 10th Ave. S.  
 Swanson, Reuben T., 3816 2d Ave. S.  
 Swanson, Reuben W., 4230 Nicollet Ave.  
 Swanson, Reynold A., 3837 Cedar Ave  
 Swanstrom, Gust E., 1816 S.E. 4th St.  
 Sweet, Albert, 807 Dupont Ave. N.  
 Swenson, Clarence T., 1109 Hawthorne  
 Ave.  
 Swigerd Joseph C., 1932 Beard Ave. S.  
 ††Syhl, Philip N., 1688 Lafond St., St.  
 Paul  
 Syse, Edward, 5015 41st Ave. S.  
 Tadsen, Fred C., 4404 44th Ave. S.  
 Tambornino, J. Louis, 221 S.E. Bed-  
 ford St.  
 Tanchin, William, 2616 N.E. Washir-  
 ton St.  
 Tarasar, Paul, 1535 6th Ave. N.E.  
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 S.E.  
 Tettmoyer, Vanda, 52 S. 10th St.  
 Thayer, R. O., 4330 Wentworth Ave  
 Theisen, John Leo, 2219 Emerson Ave.  
 N.  
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 Thomas, Ellis C., 3237 Garfield Ave. S.  
 Thomas, Owen E., 719 Stewart Ave.,  
 St. Paul  
 Thompson, Lewis E., 1650 Hennepin  
 Ave.  
 Thompson, Mart, 408 S. 7th St.  
 Thompson, Roy C., 4728 Wentworth  
 Ave.  
 Thomson, Glen L., 1929 N.E. 2d St.  
 Thorsness, Marvin, care First National  
 Bank  
 Thorson, Theo C., 106 E. 16th St.  
 Thyberg, Clarence W., 3121 19th Ave.  
 S.  
 Thyberg, Helen M., 3133 19th Ave. S.  
 Timm, Margaret M., 1400 Yale Place  
 Tozer, Stanley J., 1619 Lagoon Ave.  
 Travis Myrwood J., 506 15th Ave. S.E.  
 Tromanhauser, Ailsa, 2406 James Ave.  
 N.  
 Tryon, Philip D., 2115 Girard Ave. S.  
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 Tunheim, Thoralf, 1918 S. 7th S  
 Tupper, Elmer, 901 Lowry Ave. N.E.  
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 cago Ave.  
 Tusler, F. H., 4044 Pleasant Ave.  
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 Ave. N.  
 Von Stocken, Ewald, 3538 N.E. 2d St.  
 Vosika, Walter J., 1612 N. 4th St.  
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 Wahlquist, Joe, 1707 N.E. Lincoln St.  
 Waldo, E. A., 3003 Holmes Ave. S.  
 Waller, Frank A., 1706 Stevens Ave.  
 Wallin, A. R., 4050 40th Ave. S.  
 Wallin, Herbert B., 2221 30th Ave. S.  
 Walsh, Leo J., 2155 Selby Ave., St.  
 Paul  
 Walton, Grace S., 802 Mt. Curve Ave.  
 Walz, Carl F., 114 W. Grant St.  
 Wandell, W. M., 608 S.E. Huron St.  
 Wang, Alfred, 3501 17th Ave. S.  
 Ward, Thomas C., 3319 Stevens Ave.  
 Warner, Russell O., 2820 Grand Ave.  
 Wasgatt, John A., 406 13th Ave. S.E.  
 Waskey, George, 627 S.E. Oak St.

Weindel, John E., 2442 11th Ave. S.  
 Weisel, A. W., 2530 Lyndale Ave. S.  
 Weisenberger, Albert C., 2916 11th Ave. S.  
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 Weld, Frank E., 417 11th Ave. S.E.  
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 West, Sigurd O., 3103 Logan Ave. N.  
 Westerlund, Fritzof Wm., 514 S.E. Delaware St.  
 Wharton, Marion P., 125 W. Grant St., Apt. 110  
 Whear, F. B., 1612 Park Ave.  
 Wheeler, Carrie M., 3336 Irving Ave. S.  
 Wheeler, Maud Z., 4216 Upton Ave. S.  
 Whitmira, R. J., 1827 Elliott Ave.  
 Whitten, J. Grace, 427 S.E. 6th St.  
 Wiberg, Frederick H., 311 S.E. Walnut St.  
 Wichmore, Edward W., 2421 Girard Ave. S.  
 Wieseke, Carl F., 1823 25th Ave. N.  
 Wilde, Lawrence E., 5045 Aldrich Ave. S.  
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 Wilkinson, James B., R. No. 2, Robbinsdale, Minn.  
 Will, Fred L., 139 Sheridan Ave. N.  
 Williams, Albert L., 1831 Park Ave.  
 Williams, Bernice G., 2816 Blaisdell Ave.  
 Williams, B. Lee, 2008 Lyndale Ave. S.  
 Williams, James E., 4232 Linden Hills Blvd.  
 Williams, J. Guy, 2310 N.E. Monroe St.  
 Williams, W. L., 3326 Oakland Ave.  
 Willoughby, Marion M., 4532 York Ave. S.  
 Willson, Mary E., 2423 Blaisdell Ave.  
 Wilson, Martin M., 1236 Upton Ave. S.  
 Wise, Curtis C., 4028 Emerson Ave. N.  
 With, Egil, 410 17th Ave. S.E.  
 Wolfson, Gertrude, 2718 Dupont Ave. S.  
 ††Wolfson, Wilfred, 1810 13th Ave. S.  
 Wollum, Edward, 810 9th Ave. S.  
 Wood, Benj. K., 3220 Bryant Ave. S.  
 Wood, Mrs. Clara, 1510 Linden Ave.  
 Worum, T., 965 Bayless Ave., St. Paul  
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 Wright, Thurman, 3317 Calhoun Blvd.  
 Wright, Wm. Wallace, 4314 Humboldt Ave. N.  
 Wyman, A. M., 19 E. 25th St.  
 Wyrell, Mrs. Marie, 2942 Park Ave.  
 Young, Carl H., 665 S.E. Erie St.  
 Youngquist, J. G., 4342 45th Ave. S.  
 Yurecko, George, 410 S.E. Ontario St.  
 Zander, Franklin, 681 Tuscarora Ave., St. Paul  
 Zimmerman, R. G., 3415 4th Ave. S.

ST. PAUL—BUSINESS

- Adam, Theresa M., 566 Edmund St.  
 Ahlman, Ernest, 530 Collins St.  
 Altman, Louis, 2126 Thomas Ave. N.  
 Amundson, Alfred, 76 Summit Ave. W.  
 Amundson, Fritjof A., White Bear Lake  
 Anderson, A. D., St. Anthony Park  
 State Bank  
 Anderson, Allen R., 593 Summit Av.  
 Anderson, Arthur C., 714 Case St.  
 Anderson, Arthur Wm., 1109 26th Av.  
 N.  
 Anderson, C. A. L., 954 Westminster St.  
 Anderson, C. Robert, 663 E. Marylard  
 St.  
 Anderson, Garret E., care St. P. F. &  
 M. Ins. Co.  
 Anderson, Leonard J., 596 Laurel Ave.  
 Anderson, O. Nicholas, 114 W. Cook St.  
 Anderson, Wallace S., 375 Iglehart Ave.  
 Anderson, Walter A., 574 Dayton Ave.  
 Angell, C. E., 605 Ottawa Ave.  
 Angell, J. Fred, 605 Ottawa Ave.  
 Armstrong, Alice A., 917 Hague Ave.  
 Arndt, Arthur L., 1107 Hawthorne St.  
 Atlas, Sam, 583 Carroll Ave.  
 Axness, C. Edwin, 1387 Breda St.  
 Baillie, Monroe, 988 Lincoln Ave.  
 Baillon, Paul V., 413 Hoily Ave.  
 Baird, John Broden, 210 S. Victoria St.  
 †Barenbaum, Jack M., 656 Broadway  
 ††Barker, Leland H., 1810 3rd Ave. S.,  
 Mpls.  
 \*\*Barwise, Thos C., 2064 James St.  
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 Ave.  
 Beavens, U. B., 1313 James St.  
 Becker, Wm. A., 796 Manomin Ave.  
 Bergquist, F. W., 729 Case St.  
 Bergquist, W. J., 729 Case St.  
 Bibus, Anthony A., care Stockyards  
 Nat'l Bank  
 \*\*Billingsley, Merle, Piedmont 33 E  
 Birnberg, J. V., 628 Lowry Bldg.  
 Blandin, A. A., 1015 Grand Ave.  
 Bocarde, Isabel A., 665 Fairmount Ave.  
 Boese, Alvin H., 571 Como Ave.  
 Bohman, Oscar W., 50 Como Ave.  
 Bohmert, J. H., 640 Bedford St.  
 †Bolstad, Alfred C., 1100 12th Ave. S.E.  
 Mpls.  
 Borovansky, Francis J., 399 Super or  
 St.  
 Breher, Aloysius F., 1506 Lincoln Ave,  
 \*\*Broadstone, Erminie, 1662 Capitol  
 Ave.  
 Broders, M. C., 214 E. Page St.  
 Brotten, Anton, 484 Blair St.  
 Brown Cyrus P., Jr., care N. W. Trust  
 Co.  
 Brusell, Cecil J., 327 Fuller Ave.  
 Buetow, Carl H., 428 N. Victoria St.  
 Buetow, Herbert P., 733 Charles St.  
 Bunde, Carl M., 734 Lafond St.  
 Burke, P. S., 807 Jessamine St.  
 Butke, Henry B., 625 Wabasha St.  
 †Byrnes, Wm. H., 228 Pleasant Ave.  
 Calender, George E., 580 Laurel Ave.  
 Carlson, Albin Wm., 1836 E. 3rd St.  
 Carlson, Melvin B., 753 Laurel Ave.  
 Cedarblade, Richard C., 3039 31st Ave.  
 S., Mpls.  
 Chenery, John H., 175 N. Avon St.  
 Chrest, Rubert W., 894 E. 3rd St.  
 \*\*\*Christensen, L. C., 473 N. Fairview  
 Clapp, Warrer H., 1882 Ashland Ave.  
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 Coffey, John J., 1731 Laurel Ave.  
 Conklin, O. J., 2334 Alden Place  
 Connolly, J. L., Knights of Columbus  
 Hall  
 Conroy, Henry M., 1093 Jenks St  
 Contois, Irene C., 1005 Portland Ave.  
 Copland, A. E., 86 Western Ave. N.  
 ††Curtis, Dorothea, 589 Portland Ave.  
 Darwitz, Wm. A., 1063 E. 3rd St.  
 Delander, N. Paul, 710 Laurel Ave.  
 DeMeules, E. A., 180 W. George St.  
 Desmond, R. A., 986 Sherburne Ave.  
 †Doe, Richard H., 404 Dewey Ave.  
 Doeren, Frank H. C., 695 E. 7th St.  
 Dolan, George F., 1155 Beech St.  
 \*\*\*Donaldson, Cary E., 1815 Emerson  
 Ave. N.  
 Dorfner, Josephine K., 409 Lafond St.  
 Dougher, Otto, 772 Fairmount Ave.  
 Dramdahl, George H., 908 Sims St.  
 Dreher, R. F., 1425 Lincoln Ave.  
 Driscoll, Gregory L., 1942 Selby Ave.  
 Dushek, Henry, 783 Marshall Ave.  
 Egan, Peter T., 797 Cedar St.  
 Egan, Raymond W., St. Thomas College  
 Ekland, Chester A., 959 Burr St.  
 Ells, C. J., 1084 Goodrich Ave.  
 Epstein, Israel, 312 Fuller Ave.  
 Etter, Frank, 833 York St.  
 Fandel, Frayne, 222 Iglehart Ave.  
 Fanning, Joseph H., 1354 Lincoln Ave.  
 Farrell, Arthur J., 866 Charles St.  
 Faulkner, Louis R., 1378 Charles St.

Felton, Nat. L., Simon & Bircher Ave.,  
S. St. Paul  
Fleischhacker, R. B., 232 W. Rose St.  
Flesher, Blanche, 357 Maria Ave.  
Flesher, Herbert J., 357 Maria Ave.  
Foreman, John P., 419 S. Hamline  
\*\*\*Fornare, Harry F., 1557 Roblyn Ave.  
Fortune, John W., 837 Marshall Ave.  
\*\*Fox, Edward J., 535 Ashland Ave.  
Franke, E. P., 1248 Marshall Ave.  
Freeman, Neil, 1625 Middleton  
†Gates, Edgar B., 665 Marshall Ave.  
Gehoke, Edward A., 782 Fuller Ave.  
†Gerner, Otto J., Jr., 587 Michigan St.  
Gillespie, Mary, 326 Harrison Ave.  
Gourhan, George, 969 Randolph St.  
Greenman, Marion, 1056 Goodrich Ave.  
Greer, Herbert L., 1134 Edgerton St.  
Gregerson, Earl N., 899 Grand Ave.  
Gregerson, George, 670 Charles St.  
Greaves, G. H., 2191 Carter Ave.  
\*\*Greeley, Margaret, 278 Dayton Ave.  
Greig, Paul B., 815 Portland Ave.  
Grohs, Louis A., 426 Cherokee Ave.  
Hackner, Herbert M., 720 Armstrong  
Ave.  
Hakensen, Walter P., 1171 Seminary  
Ave.  
Hanrahan, Leo H., 241 E. Robie St.  
Hansen, Erling M., 1422 Breda St.  
Hansen, Theo. L., 1422 Breda St.  
††Harpole, Leon Ray, Y.M.C.A.  
Hauenstein, Irene M., 948 Osceola Ave.  
Haun, Albert A., 645 Central Park Pl.  
Heaton, William R., 819 Stellar St.,  
Mpls.  
Heck, Helen M., 418 Rice St.  
Heimbach, E. M., 1299 Lincoln Ave.  
Henley, Harold J., 271 Prescott St.  
Hille, Henry M., 102 4th Ave. S.  
Hirsch, Alfred G., care Capitol Trust  
& Savings Bank  
Hoag, R. L., 10 W. Belvidere St.  
Horeish, F. Robert, 17 Wilkin St.  
Horrigan, Wm. J., 900 Dayton Ave.  
Horton, W. S., 551 Laurel Ave.  
Hoslett, Ernel J., 722 Marshall Ave.  
Howe, Frank W., 1708 Blair St.  
†Huffman, Harry H., 2325 Grand Ave.  
\*\*\*Hull, Henry O., 1508 Sherburne  
Ave.  
Hultkrans, Beda T., 1608 Van Buren St.  
Hultman, T. W., 886 Burr St.  
Hultquist, Charles E., 76 West Sum-  
mit Ave.  
Imsdahl, A. J. A., 704 E. Lawson St.  
Jackson, Carroll, 656 Cherry St.  
Jackson, Claire A., 1616 Edmund St.  
Jacobson, John A., 1319 Blair St.

Jennings, Thomas J., 467 Selby Ave.  
Johanson, Raymond John, 627 E. Jessa-  
mine St.  
Johnson, Arthur K., 694 Oakland Ave.  
Johnson, Edwin L., 828 Sirus St.  
Johnson, George A., 420 Osceola Ave. S.  
Johnson, H. C., 687 Manomin Ave.  
Johnson, Harry L., 667 Magnolia St.  
Johnson, Walter, 667 Magnolia St.  
Jones, Edmund J., 848 Lafond St.  
Jordan, Loretto, 80 Western Ave.  
Jorgensen, Harold M., 843 Selby Ave.  
Jorgensen, Joseph M., 655 Charles St.  
Jorgenson, P. H., 910 St. Anthony Ave.  
Kadela, A. L., 389 View St.  
Kahlert, Wm. A., 2084 Buford Ave.  
††Kantor, George J., 1618 Charles St.  
Keefe, Herbert H., 1385 Palace St.  
Kennedy, Daniel, 1296 Hague Ave.  
Kerfoot, K. S., 1523 Hewitt Ave.  
King, Clarence M., 716 Hudson Ave.  
Kirchhoff, E. Norman, 839 Lafond St.  
Klock, Frank L., 625 Wabasha St.  
Knudson, Walter O., 35 Como Ave.  
Knudsen, Wm. A., 35 Como Ave.  
Koenen, William B., 318 S. Franklin St.  
Kohler, Clara M., 579 Holly Ave.  
Kohner, Henry J., 544 Smith Ave. S.  
Kortmann, Roland A., 169 E. Belvidere  
St.  
Krieger, Carolyn, 1081 Goodrich Ave.  
Kuklay, Ray L., 610 Holly Ave.  
Kvaase, Gustav J., 722 Marshall Ave.  
\*\*\*Landey, Jens, 2540 W. 7th St.  
Lane, Elvie A., 217 Pleasant Ave.  
Langlois, Wm. J., 886 Fuller St.  
Lanphear, Harry M., 1443 Blair St.  
Laqua, John Jacob, 827 Van Buren St.  
Larson, Esther M., 942 Osceola Ave.  
Lavigne, John E., 397 Smith Ave. N.  
Lawrenz, Olga A., 642 Ashland Ave.  
Leahy, Maurice G., 472 Hall Ave.  
LeBoribus, Wm., 342 Bates Ave.  
Leonard, Wm. N., 833 Carroll Ave.  
Leseemann, E. C., 833 Margaret St.  
Lewis, Harry, 1737 Lincoln Ave.  
Lewis, James D., 923 DeSota St.  
Looby, Mary J., 843 Edmund St.  
Loomis, Muriel Louise, 744 Robert St.  
S.  
Lowe, Victor G., 34 Cambridge Ave.  
Luecke, Henry G., 910 E. 5th St.  
Luedtke, Rose, 1549 Grand Ave.  
Lundgren, Albert L., 891 Iglehart Ave.  
MacKnight, Mary V., 355 St. Anthony  
Ave.  
Mackintosh, William J., 515 S. 3rd St.,  
Stillwater  
McCarl, Scott, 593 Summit Ave.

McClung, Harrison, 665 Portland Ave.  
 McConell, Harold G., 77 Langford Park  
 Place  
 McConnon, B. J., Bircher & Concord's  
 McCreight, Harry A., 1037 Iglehart Ave.  
 McMahon, John D., 1779 Carroll Ave.  
 McNulty, N. W., 299 Dayton Ave.  
 Makiesky, Jack, 799 Cedar St.  
 Malone, E. W., 217 Fairview Ave. S.  
 Margulis, Sidney, 786 Aurora Ave.  
 Marke, Frederick W., 803 W. Van Bu-  
 ren St.  
 Markve, Stuart F., 1805 Portland Ave  
 Marsh, Fred C., 1393 Hewitt Ave.  
 Mattson, C. Henning, 1350 Edmund St.  
 Medley, Mable, 1065 Hague Ave.  
 Mellgren, Carl A., 857 Fremont Ave.  
 Meyer, Albert J., 905 Armstrong Ave.  
 Miller, C. F., 1223 Laurel Ave.  
 Miller, Geo., 503 Fred St.  
 Moberg, Clarence W., 292 E. 13th St.  
 Moffett, J. J., 220 Mackubin St.  
 Monick, Eugene A., 837 Margaret St.  
 Moore, Betty, 1051 Sherburne Ave.  
 Moreland, Grace E., State Hospital,  
 Phalen Park  
 Morkin, Mary, 2149 Roblyn Ave.  
 Mullery, John F., 1696 Iglehart Ave.  
 Mulliken, C. E., 521 Cleveland Ave. S.  
 Munson, Clifford R., 118 N. Dale St.  
 Murphy, Marie, 925 Edmund St.  
 Nelson, Clifford M., 150 Fairview Ave.  
 N.  
 Nelson, Elmer, 1357 Wynne St.  
 Nelson, Henry, 164 Thomas Ave.  
 Nelson, Hugo E., 2024 Selby Ave.  
 Nelson, James B., 2024 Selby Ave.  
 Neubauer, Henry R., 778 Tuscarora  
 Ave.  
 Neutson, Douglas C., 1667 W. Minne-  
 haha St.  
 O'Brien, Charles, 571 Ashland Ave.  
 ††Okland, Herman J., 29 N.E. 2nd St.,  
 Mpls.  
 Olson, Alexander A., 1268 Dayton Ave.  
 Olson, George, 604 Jenks St.  
 Olson, Martin N., 627 Cable Ave.  
 Olson, Walter E., 963 E. Minnehaha St.  
 Oltman, C. E., 1361 Van Buren St.  
 Pampush, Joseph R., 420 Lafond St.  
 Pearson, Godfrey, 1955 Lincoln Ave.  
 Perrier, O. J., 947 Wakefield Ave.  
 Peterson, A. M., 411 Forest St.  
 Peterson, Melvin A., 253 Fuller Ave.  
 Peterson, Rohland O., 716 E. Rose St.  
 Peterson, Winfield, 1126 Jessie St.  
 Pioske, A. H., care Produce Exchange  
 Bank  
 Power, Robert E., 494 Ashland Ave.  
 Randt, Walter A., 772 Cortland St.  
 Rasmussen, Gustav C., 669 Grand Ave.,  
 Flat 6  
 Read, Cecil, 457 Ashland Ave.  
 Reber, Joseph W., 512 Edmund St.  
 Rice, J. M., Lakewood, White Bear  
 Lake, Minn.  
 Risinger, Dean J., 217 Pleasant Ave.  
 Risser, C. D., 298 Nelson Ave., Apt. 17  
 Ristan, L. A., 382 Avon St.  
 Robbins, Jacob J., 130 E. Colorado St.  
 Rochetto, Russell E., 821 Manomin Ave.  
 Rooney, John G., 1239 Hewitt Ave.  
 Rosenbloom, Maurice Wm., 868 Hague  
 Ave.  
 Rowe, Chas. M., 178 Summit Ave. W.  
 \*Rowles, Florence L., 1958 Selby Ave.  
 Russell, Edgar D., 657 Goodrich Ave.  
 Ryan, Wm. P., 9 W. George St.  
 Samuelson, H. E., 1611 Ashland Ave.  
 Sandberg, Florence, 222 Arundel St.  
 Scharff, E. W., 1260 Laurel Ave.  
 Schmid, John A., 272 Baker St.  
 Schmit, Michael A., 866 Central Ave.  
 W.  
 Schrankler, Anna, 1200 Buchanan St.  
 Schroeder, Chester E., 1175 Goodrich  
 Ave.  
 Schroeder, N. J., 211 Goodrich Ave.  
 Schwartz, Henry F., 217 Pleasant Ave.  
 \*\*Schwartz, Mary, 1031 St. Clair St.  
 Scribner, Michael A., 666 E. Lake Como  
 & Phalen Ave.  
 \*Shaker, Elias, 1626 Ashland Ave.  
 Shapiro, Herbert David, 131 E. 13th St.  
 Shepard, Albert, 299 Harrison  
 Shugard, Mrs. Ella M., 1725 Iglehart  
 Ave.  
 Shugard, Verna, 1725 Iglehart Ave.  
 Skeoch, Walter K., 1010 E. 5th St.,  
 White Bear  
 Soderman, Harold, 756 Burr St.  
 Sorensen, Roy T., 1964 Goodrich Ave.  
 Stevenson, James R., 118 Western Ave.  
 N.  
 Stiles, Hazel, 1272 Raymond Ave.  
 Stoeckmann, Reuben C., 590 Mendota  
 St.  
 Strom, Alfer B., 716 E. Rose St.  
 Strut, George W., 246 E. Lake Como  
 & Phalen Ave.  
 Stubbs, E. H., 771 Dayton Ave.  
 Stutzman, W. J., care Merchants Nat'l  
 Bank  
 Svoboda, Gerald J., 784 Pleasant Ave.  
 Swanson, Albert F., 516 Laurel St.,  
 Stillwater



Tegner, J. G., 1517 Portland Ave.  
Thomas, Leo, 673 Iglehart Ave.  
\*\*\*Timmons, Martin J., 71 Tilton St.  
Toensing, Arthur F., 695 Blair St.  
Torgersen, Raymond W., 785 Lawson  
St.  
Trapp, Paul Fred, 659 Lafond St.  
Trueblood, Clarence, Forest Lake, Minn.  
\*\*Tufvesson, Harold Nels, care Van  
Sant Trust Co.  
Turnburke, V. P., 1832 Portland Ave.  
Turnquist, Arthur E., 1342 Raymond  
Ave.  
Vogel, J. Harold, 722 Central Ave. W.

\*\*Wattles, Fern, Piedmont Apt.  
Webb, H. H., 610 Holly Ave.  
Wells, Katherine, 1453 Hythe St.  
Wiblishauser, Jos. A., 193 Midway Ave.  
Wicktor, Elmer C., 1717 Van Buren St.  
Wilhelmi, R. J., 1039 Arkwright St.  
Williams, Anna K., 1061 Fairmount  
Ave.  
Winkler, Roy A., 1110 Edmund St.  
Winter, Emil Otto, 4053 York St.  
Wise, Marion C., 642 Portland Ave.  
Wood, Richard A., 975 Laurel Ave.  
\*\*Woodruff, Earl A., 820 Ohio St.  
Yungbauer, William, 777 Marshall Ave.

DULUTH—BUSINESS

Anderson, Agnes E., 2508 W. 2d St.  
 Anderson, Fred, 612 N. 6th St. W.  
 †Anderson, Lawrence O., 2526 E. 1st St.  
 Antenucci, Bennie, 432 E. 7th St.  
 Arenson, Anna C., 2510 W. 2d St.  
 Aske, Lilla, 5707 Otsego St.  
 Bagley, Mathew, 5118 Roosevelt St.  
 Barines, David L., 2123 Dunedin Ave.  
 Bartholdi, Walter, 822 E. 4th St.  
 Bauman, Alfred E., 322 W. 2d St.  
 Beaupre, Charles G., 216 E. 2d St.  
 Bergquist, Harold A., 2032 London Road  
 Berly, O. L., 507 22nd Ave. W.  
 Bernard, H. W., 2624 W. Huron St.  
 Bishop, I. L., 2517 W. 2nd St.  
 Bjorge, Oscar B., 1535 Woodland Ave.  
 Boggio, Joseph C., 4717 Gladstone St.  
 Burke, Mary A., 832 E. 2nd St.  
 Burke, Mary J., 216 W. 3d St.  
 Campbell, G. F., Western Hotel  
 Coad, J. H., 108a 2d St.  
 Cowen, R. L., 2109 E. 2d St.  
 Craig, Horace B., 1119 E. 1st St.  
 Crawford, James A., 831 E. 1st S.  
 Deighton, J. D., 1720 E. 5th St.  
 Deline, Kenneth P., Lincoln Park Gardens  
 Draper, Warren A., 1723 E. 2d St.  
 Dunham, C. E., 4932 Tioga St.  
 Dunning, Ralph A., 529 Woodland Ave.  
 Durbrow, G. DeWitt, 1831 London Rd.  
 Evans, C. G., 21 E. 6th St.  
 Evans, John L., 1715 E. 7th St.  
 Feranar, Leonard C., 1021 E. 6th St.  
 Finn, Leo S., 201 E. 2nd S.  
 Forbes, Robert J., 9B 4th St., Morgan Park  
 Franseen, Carl G., 712 1st Ave. E.  
 Germeroth, R. M., 912 7th Ave. E.  
 Guthrie, Catherine, 2311 E. 4th St.  
 Hanford, Dana R., 1418 Jefferson St.  
 Hann, Fred J., 2825 W. 2nd St.  
 Harley, Sydney A., 619 10th Ave. E.  
 Hegardt, Wm. Gordon, 1708 E. 1st St.  
 Henriksen, John, 716 E. 1st St.  
 Henriksen, Sigurd F., 716 E. 1st St.  
 Highmark, T. L., 411 N. 59th Ave. W.  
 Hoff, John Edw., 2235 Roslyn Ave.  
 Holmberg, Harry, 2813 W. Huron St.  
 Horrigan, Marie, 301 W. 4th St.  
 Hubbard, Burt C., 432 E. 2nd St.  
 Hunt, W. S., 815 12th Ave. E.  
 Idzorek, G. I., 1424 E. 5th St.  
 Johannsen, Emil B. L., 3113 Vernon St.  
 Johnson, Axel A., 624 Lake Ave. N.  
 Johnson, C. M., 306 W. 5th S.  
 Johnson, George W., 2913 W. 3rd St.  
 Johnson, Lillian A., 915 E. 4th St.  
 Kelly, James C., 2003 W. 4th St.  
 Kennedy, Lauren A., 2022½ E. 2nd St.  
 Kenny, Lillian, 1818 E. 4th St.  
 Knutson, H., 702 E. 2nd St.  
 Laskowski, Frank S., 215 N. 34th Ave W.  
 Larson, E. R., 1012 Garfield Ave.  
 Lavelle, W. F., 1518 London Road  
 Linne, Thore J., 2217 W. 10th St.  
 Loubert, Albertine M., 2410 W. 2nd St.  
 Lowry, Raymond R., 120 12th Ave. E.  
 Luster, C. A., Jr., 1717 E. 1st St.  
 Lyons, A. M., 630 36th Ave. N.  
 MacGregor, Donald, 4031 W. 4th St.  
 McCarthy, J. R., 2204 E. 1st St.  
 McGiffert, John R., 2324 E. 15th St.  
 McGiffert, S. Y., Ashtabola Apts.  
 Malone, E. W., 217 S. Fairview, St. Paul.  
 Marjamaa, Jafet, 506½ E. 4th St.  
 Mason, H. A., 4130 W. 3rd St.  
 Meehan, Kathryn, 329 5th Ave. W.  
 Moir, Hazel M., 320 N. 27th Ave. W.  
 Mullin, H. J., 1501 E. 2nd St.  
 Neimeyer, John C., 13 5th Ave. E.  
 Nelson, Eric W., 2229 W. 12th St.  
 Nelson, Sigfred, Box 16, Riverside  
 Norman, Chas., 3017 Vernon St.  
 O'Brien, Ruth, 227 W. Victoria St.  
 O'Gorman, Samuel A., 423½ E. 2nd St.  
 Palin, Erhard R., 2125 W. 7th St.  
 Pederson, Dan, 2827 W. 1st St.  
 Pederson, P. A., 2710 W. 6th St.  
 Pedrizette, Virgil J., 515½ W. 4th St.  
 Peterson, Alvin, 2001 E. 4th St.  
 Peterson, J. A., 1225 E. 7th St.  
 Philstrom, H. A., 309 E. 6th St.  
 Plotnicky, Andrew F., 616 7th Ave. E.  
 Plotnicky, Stella A., 616 7th Ave. E.  
 Potter, R. K., 506½ E. 4th St.  
 Reid, V. V., 1330 E. 6th St.  
 Rice, Franklin S., 1418 E. Superior St.  
 Rief, Emil A., 1331 E. 7th St.  
 Rodger, Ben, 705 E. 3rd St.  
 Rosborough, Chester S., 4805 W. 6th St.  
 Rosborough, G. D., 4004 W. 5th St.  
 Samuelson, Miss S. E., 2728 W. Michigan St.

Schroer, C. W., 1919 Jefferson St.  
Sell, Myrtle, 116 E. 3rd St.  
Sellhorn, Bertha M., 408 8th Ave. E.  
Signorelli, Louis, 418 W. 6th St.  
Siring, Letta, 1601 E. 8th St.  
Small, J. J., Morgan Park  
Spearin, E. M., 525 3rd Ave. E.  
Strickland, Ruth G., 219 Fairmont St.  
Thorson, Valentine I., 711 W. Boulevard  
Toft, A. B., 15 N. 54th Ave. W.

Troyer, Marc D., 1724 Greysolon Road  
Turnquist, Mr., 1809 E. 8th St.  
Wagen, Allen E., 5417 Onieda St.  
Walker, C. D., 1421 E. Superior St.  
Westrom, Henry C., 5615 W. 6th St.  
Whelan, James H., 1815 E. 5th St.  
Wickstrom, I. Albert, 217 E. 5th St.  
Wiking, Ernest F., 321 E. 1st St.  
Wilhelmsen, J. A., 421 1st Ave. E.  
Williams, Albert O., 209 Pittsburg Ave.  
Wiltse, Opal B., 512 2nd Ave. E.

VIRGINIA—BUSINESS

Anderson, John I., Buhl, Minn.  
Biron, J. F., 516 N. 11th St.  
Brude, A. C., 526 First National Bank  
Bldg.  
Dennis, C. L., 511 N. 11th St.  
Ekstrom, Robert E., Box 443, Hibbing,  
Minn.  
Emmons, A. C., 314 S. 4th St.  
Girard, Michael, 205 S. 6th St.  
Hawkinson, C. M., 301 S. 4th St.  
Jarvey, William A., 618 S. 5th Ave. W.  
Lucas, C. E., Buhl, Minn.  
Rolfe, F. A., 228 S. 2d St.  
Rowe, L. A., 322 S. 3d St.  
Rutherford, W. J., 506 S. 7th St.  
Sullivan, Steve, 619 S. 3d St.  
Tancig, E. A., 201 W. Oak St., Chis-  
holm, Minn.  
Tornquist, Edwin T., 228 S. 5th St.  
Tumble, George V., 416 N. 1st St.  
Wasgatt, A. J., 502 First National  
Bank Bldg.  
Wickman, John, Hibbing, Minn.  
Williams, C. H., 321 S. 8th St.

*The Bulletin  
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Minnesota*

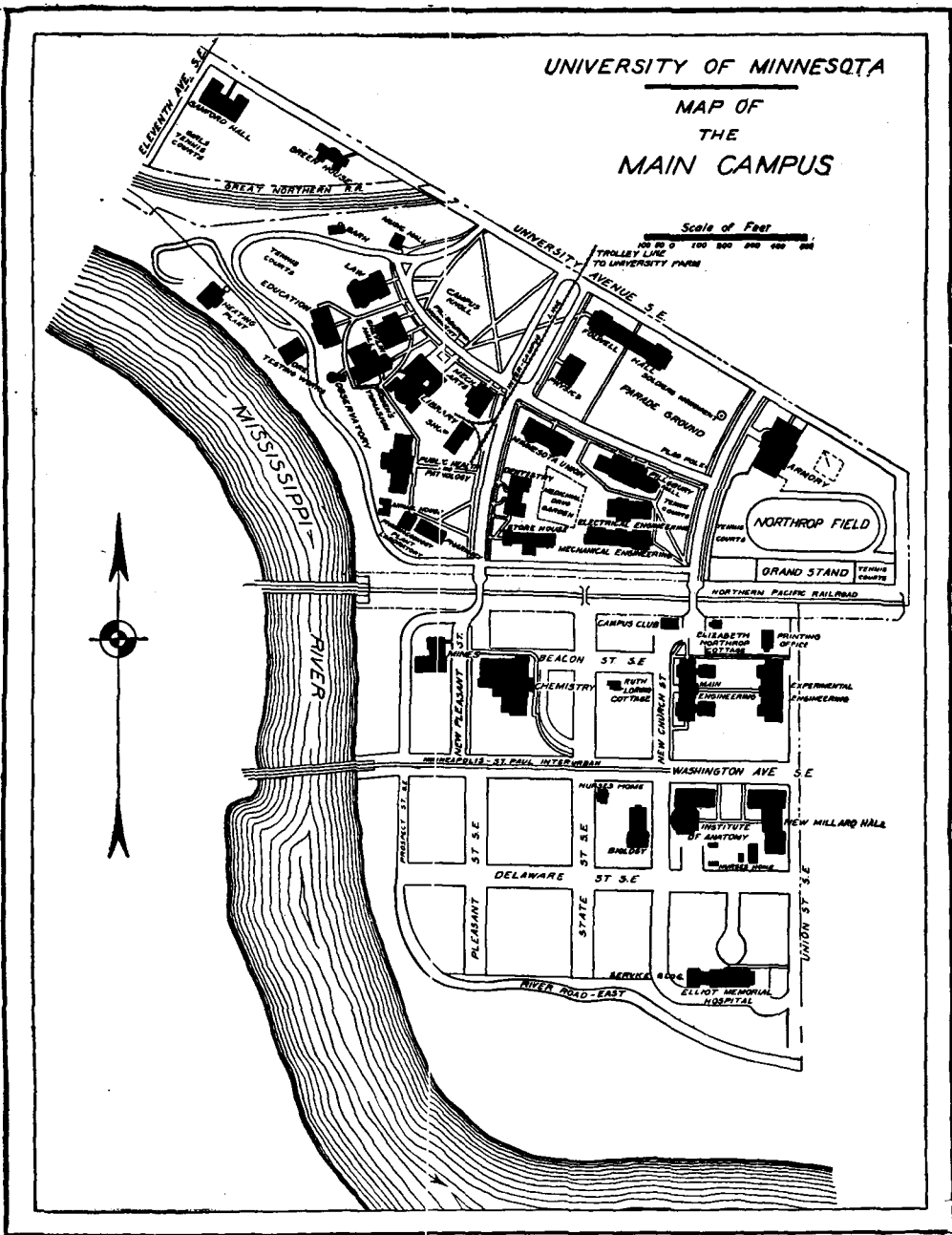
*The College of Agriculture, Forestry,  
and Home Economics  
Announcement of  
Courses in Home Economics for the Year  
1921-1922*



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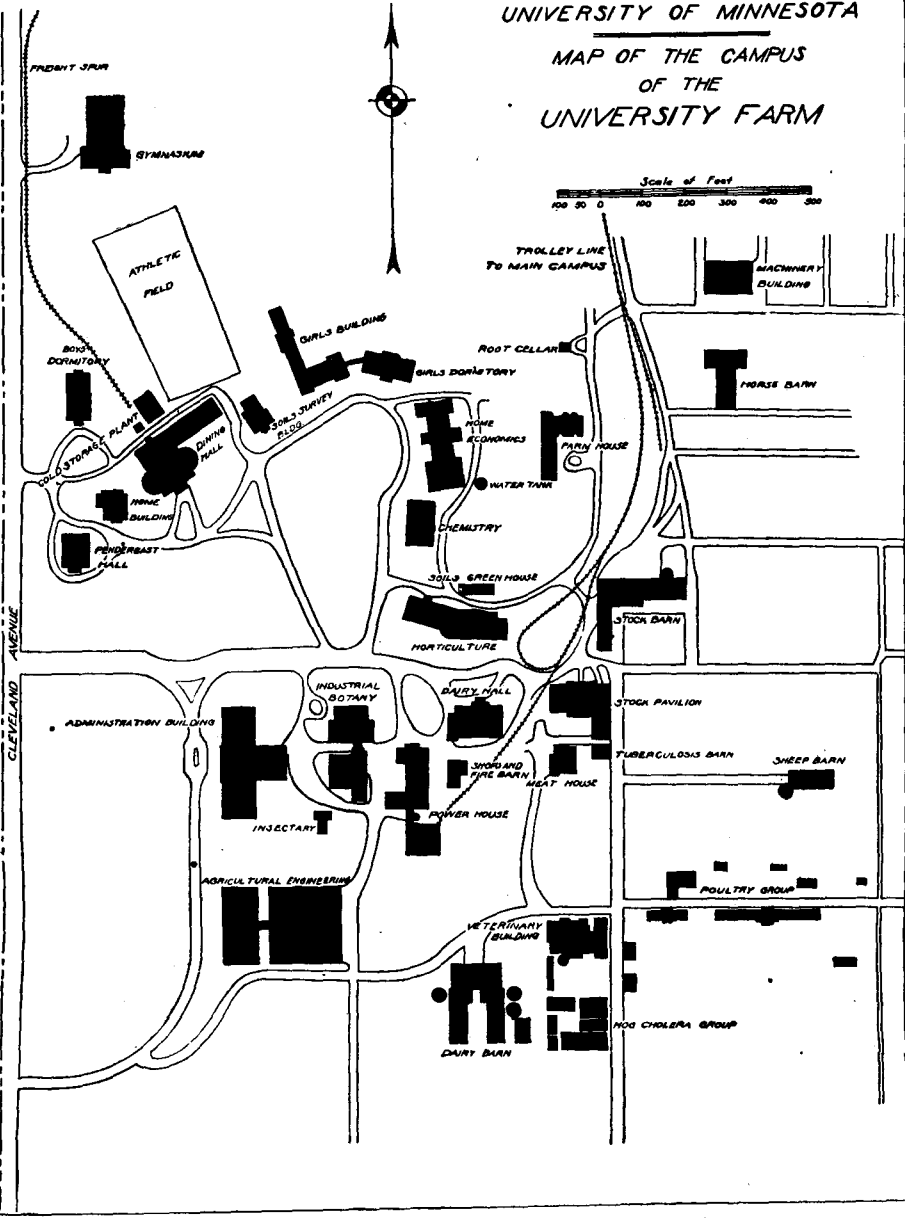
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Area of Main Campus, 108.5 acres

UNIVERSITY OF MINNESOTA  
 MAP OF THE CAMPUS  
 OF THE  
 UNIVERSITY FARM



Area of University Farm, 422.56 acres

1921							1922													
JULY							JANUARY							JULY						
Su	Mo	Tu	W	Th	Fr	Sa	Su	Mo	Tu	W	Th	Fr	Sa	Su	Mo	Tu	W	Th	Fr	Sa
..	..	..	..	..	1	2	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	5	6	7	..	..	..	..	..	..	1
3	4	5	6	7	8	9	8	9	10	11	12	13	14	2	3	4	5	6	7	8
10	11	12	13	14	15	16	15	16	17	18	19	20	21	9	10	11	12	13	14	15
17	18	19	20	21	22	23	22	23	24	25	26	27	28	16	17	18	19	20	21	22
24	25	26	27	28	29	30	29	30	31	..	..	..	..	23	24	25	26	27	<b>28</b>	29
31	..	..	..	..	..	..	..	..	..	..	..	..	..	30	31	..	..	..	..	..
AUGUST							FEBRUARY							AUGUST						
Su	Mo	Tu	W	Th	Fr	Sa	Su	Mo	Tu	W	Th	Fr	Sa	Su	Mo	Tu	W	Th	Fr	Sa
..	1	2	3	4	5	6	..	..	..	1	2	3	4	..	..	1	2	3	4	5
7	8	9	10	11	12	13	5	6	7	8	9	10	11	6	7	8	9	10	11	12
14	15	16	17	18	19	20	12	13	14	15	16	17	18	13	14	15	16	17	18	19
21	22	23	24	25	26	27	19	20	21	<b>22</b>	23	24	25	20	21	22	23	24	25	26
28	29	30	31	..	..	..	26	27	28	..	..	..	..	27	28	29	30	31	..	..
..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
SEPTEMBER							MARCH							SEPTEMBER						
Su	Mo	Tu	W	Th	Fr	Sa	Su	Mo	Tu	W	Th	Fr	Sa	Su	Mo	Tu	W	Th	Fr	Sa
..	..	..	..	1	2	3	..	..	..	1	2	3	4	..	..	..	..	..	1	2
4	5	6	7	8	9	10	5	6	7	8	9	10	11	3	4	5	6	7	8	9
11	12	13	14	15	16	17	12	13	14	15	16	17	18	10	11	12	13	14	15	16
18	19	20	21	22	23	24	19	20	21	22	<b>23</b>	<b>24</b>	<b>25</b>	20	21	22	23	24	25	26
25	26	27	<b>28</b>	29	30	..	<b>26</b>	<b>27</b>	<b>28</b>	<b>29</b>	30	31	..	24	25	26	27	28	29	30
..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
OCTOBER							APRIL							OCTOBER						
Su	Mo	Tu	W	Th	Fr	Sa	Su	Mo	Tu	W	Th	Fr	Sa	Su	Mo	Tu	W	Th	Fr	Sa
..	..	..	..	..	..	1	..	..	..	..	..	..	1	1	2	3	4	5	6	7
2	3	4	5	6	7	8	2	3	4	5	6	7	8	8	9	10	11	12	13	14
9	10	11	12	13	14	<b>15</b>	9	10	11	12	13	14	15	15	16	17	18	19	20	21
16	17	18	19	20	21	22	16	17	18	19	20	21	22	22	23	24	25	26	27	28
23	24	25	26	27	28	29	23	24	25	26	27	28	29	29	30	31	..	..	..	..
30	31	..	..	..	..	..	30	..	..	..	..	..	..	..	..	..	..	..	..	..
NOVEMBER							MAY							NOVEMBER						
Su	Mo	Tu	W	Th	Fr	Sa	Su	Mo	Tu	W	Th	Fr	Sa	Su	Mo	Tu	W	Th	Fr	Sa
..	..	1	2	3	4	<b>5</b>	..	1	2	3	4	5	6	..	..	..	1	2	3	4
6	7	8	9	10	<b>11</b>	12	7	8	9	10	11	12	13	5	6	<b>7</b>	8	9	10	11
13	14	15	16	17	18	19	14	15	16	17	18	19	20	12	13	14	15	16	17	18
20	21	22	23	<b>24</b>	25	26	21	22	23	24	25	26	27	19	20	21	22	23	24	25
27	28	29	30	..	..	..	28	29	<b>30</b>	31	..	..	..	26	27	28	29	30	..	..
..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
DECEMBER							JUNE							DECEMBER						
Su	Mo	Tu	W	Th	Fr	Sa	Su	Mo	Tu	W	Th	Fr	Sa	Su	Mo	Tu	W	Th	Fr	Sa
..	..	..	..	1	2	3	..	..	..	..	1	2	3	..	..	..	..	..	1	2
4	5	6	7	8	9	10	4	5	6	7	8	9	10	3	4	5	6	7	8	9
11	12	13	14	15	16	17	11	12	<b>13</b>	14	15	16	17	10	11	12	13	14	15	16
18	19	20	<b>21</b>	<b>22</b>	<b>23</b>	<b>24</b>	18	19	<b>20</b>	21	22	23	24	17	18	19	20	21	22	23
25	26	27	28	29	30	31	25	26	27	28	29	30	..	24	25	26	27	28	29	30
..	..	..	..	..	..	..	..	..	..	..	..	..	..	31	..	..	..	..	..	..



## CALENDAR

1921-1922

1921			
September	14	Wednesday	Registration closes except for new students
September	20-27	Week	Examinations for removal of spring quarter conditions. Entrance examinations Registration of new students. Payment of fees Physical examinations for new students
September	28	Wednesday	Fall quarter begins, 7:45 a.m.
October	3	Monday	School of Agriculture, first term begins
October	15	Saturday	Class Scrap Day; all classes dismissed the fourth hour
October	20	Thursday	Senate meeting, 4:30 p.m.
October	28	Friday	Last day for removal of spring quarter incompletes
November	5	Saturday	Home Coming Day; classes dismissed the third and fourth hours
November	11	Friday	Armistice Day; a holiday
November	14-26		Advanced Creamery Operators' Short Course
November	24	Thursday	Thanksgiving Day; a holiday
November	28	Week	Ice-Cream Makers' Short Course
December	3		
December	5-10	Week	Milk-Plant Operators' Short Course
December	15	Thursday	Senate meeting, 4:30 p.m.
December	21	Wednesday	Last day for winter quarter registration except for new students Fall quarter closes, 4:50 p.m. School of Agriculture, first term closes Christmas vacation begins, 4:50 p.m.
December	27	Week	Registration of new students. Payment of winter quarter fees
January	3		
1922			
January	2-7	Week	Farmers' and Home-Makers' Week Short Course
January	2		
February	11		Beginning Creamery Operators' Short Course
January	4	Wednesday	Winter quarter begins, 8:15 a.m.
January	9	Monday	School of Agriculture, second term begins
February	3	Friday	Last day for removal of fall quarter incompletes

## COURSES IN HOME ECONOMICS

February	13-26	Week	Advanced Cheese-Makers' Short Course
February	16	Thursday	Senate meeting, 4:30 p.m.
February	22	Wednesday	Washington's Birthday; a holiday
March	18	Saturday	Last day for spring quarter registration except for new students
March	23	Thursday	Winter quarter closes. Spring vacation begins, 5:20 p.m.
March	23-28	Week	Registration of new students. Payment of spring quarter fees
March	29	Wednesday	Spring quarter begins, 7:45 a.m. School of Agriculture, second term closes
April	3-8	Week	Boys' and Girls' Week Short Course
April	28	Saturday	Last day for removal of winter quarter incompletes
May	18	Thursday	Senate meeting, 4:30 p.m.
May	30	Tuesday	Memorial Day; a holiday
June	11	Sunday	Baccalaureate service
June	13	Tuesday	Spring quarter closes
June	14	Wednesday	Fiftieth annual commencement
June	17-19		Summer session registration. Payment of fees
June	20	Tuesday	Summer session begins
July	28	Friday	Summer session closes

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MARGARET B. BAKER, Assistant State Leader Boys' and Girls' Club Work

<sup>1</sup>Leave of absence, 1921-22.

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 CHARLES E. LIVELY, M.A., Instructor in Sociology  
 HAZEL S. MARTIN, Instructor in Art Education  
 MILDRED D. MUDGETT, B.A., Supervisor of Field Work in Sociology  
 VICTOR H. PELZ, M.A., Instructor in Economics  
 GERTRUDE REEVES, Instructor in Pianoforte  
 ADOLPH RINGOEN, M.A., Instructor in Animal Biology  
 GERTRUDE D. ROSS, Instructor in Art Education  
 KARL SCHEURER, Instructor in Violin  
 DAVID O. SPRIESTERSBACH, M.S., Instructor in Bacteriology and Immunology  
 CLARA F. SYKES, B.A., B.S., Instructor in Economics  
 ALONZO G. GRACE, B.A., Assistant in Anthropology  
 ROBERT G. GREEN, B.A., Assistant in Bacteriology  
 HATTIE SPAHR, B.A., Teaching Fellow in Physiology  
 WILLIAM W. SWANSON, B.A., B.S., Teaching Fellow in Physiology

## FACULTY COMMITTEES

1921-1922

*Executive.*—The Executive Committee of the Department of Agriculture.

*Curriculum.*—Mr. Freeman, Miss Biester, Mr. A. Boss, Mr. Cheyney, Mr. Eckles, Mr. Riley, Mr. Storm, Miss Weigley, Miss Weller, Mr. West.

*Enrolment.*—Mr. Field, Miss Clara Brown, Mr. Wentling, Mr. Morrow, Mr. West.

*Students' Work.*—Mr. Freeman, Miss Weigley, Mr. Alderman, Mr. Cheyney, Mr. Nicholson, Mrs. Ladd.

*Student Organizations.*—Mr. Lansing, Mr. Dutcher, Miss Morse, Miss Weller, Mr. Freeman.

*Faculty Business.*—Mr. Gortner, Mr. Stakman, Miss Phelps, Mr. Ruggles.

*Farm Experience.*—Mr. A. Boss, Mr. Alderman, Mr. Eckles.

*Program.*—Mr. Fitch, Mr. Allison, Mr. Ruggles, Mr. Hayes, Miss Child.

*Scholarships.*—Mr. Eckles, Miss Weigley, Mr. Gortner, Mr. Hayes, Mr. Black, Mr. Freeman.

## GENERAL INFORMATION

### ADMISSION

New students are admitted at the opening of any quarter.

All students entering for the first time must submit their credentials to the Enrolment Committee.

Admission is either by certificate or by examination. Candidates must have completed the equivalent of a four-year high-school course and must present:

1. Four units of English; or 3 units of English and 4 units of a foreign language; or 3 units of English and 2 units in each of two foreign languages.
2. One unit of elementary algebra and 1 unit of plane geometry.
3. Enough additional work to make in all 15 units, of which not more than 4 may be in subjects not listed in the admission groups in the general information bulletin.

Graduates of the School of Agriculture of the University of Minnesota who have completed the two summers of supervised work offered in the school course, one additional school year, and one additional summer's work, or the equivalent thereof, will be admitted to the College of Agriculture, Forestry, and Home Economics.

For details of admission requirements and definition of "unit," see the bulletin of general information.

Applicants for admission are urged to present physics (1 unit), and chemistry (1 unit), for entrance credits. If these subjects are not completed in the high school, they will have to be taken in the University, thus postponing some of the vocational courses.

### FEEES

*Free tuition.*—The state will pay the tuition of any student who served in the army, navy, or marine corps of the United States during any war in which the United States has been involved, including members of the national guard or who, upon the call of the president performed military service outside the borders of Minnesota in any trouble with Mexico and of any student who performed overseas service as a regularly enlisted full-time worker of the Red Cross, engaged in nursing the sick or assisting in the care of soldiers in any government hospital, field, or camp which service has been officially recognized by the national government. The amount of this free tuition is not to exceed \$200 for any one person and the benefits of this act will not extend beyond July 1, 1924. The amount to be paid in any year will be limited by the legislative appropriation for that year. Application for this free tuition should be made to the secretary's office at the time of registration. This applies only to students, who at the time of enlistment were citizens and residents of the state of Minnesota. Any amount applied for in bonus under the state bonus law is deducted from the \$200 available for tuition.

Tuition includes all of the regular quarter charges listed below except the deposit and penalty fees for change of registration, late registration, condition examinations, etc.

Tuition fee (per quarter)	
Residents of Minnesota.....	\$20.00
Non-residents .....	30.00
Deposit (first quarter only).....	5.00
Health fee (per quarter).....	2.00
Shevlin Hall fee (per quarter).....	1.00
Post-office box (per quarter).....	.20
Special fees:	
Examination for removal of conditions.....	1.00
Examinations for credit (after the first quarter in residence).....	5.00
Special examinations .....	5.00
Change of registration.....	2.00

*Late registration.*—Old students must indicate their registration not later than two weeks before the day set for classes to begin. All students must complete their registration (including payment of fees) before the day set for classes to begin. Penalty for delay in either indicating or completing registration is two dollars. An additional dollar is charged for each day of delay after the last day set for the completion of registration and a similar charge for each day of delay after the last day set for payment of fees.

*Important.*—The regulations require that no student be allowed to register after the quarter opens except by special committee action.

#### FACULTY REGULATIONS

Students are held responsible for compliance with all faculty regulations. These regulations are published in a booklet issued to students at the time of registration.

#### REQUIREMENTS FOR GRADUATION AND DEGREES

After the completion of one of the prescribed courses of study, including all of the required work and the requisite amount of elective work equivalent to a total of 189 credit hours, candidates will be recommended for graduation with the degree of Bachelor of Science.

#### CANDIDATES FOR THE TEACHER'S CERTIFICATE IN AGRICULTURE AND HOME ECONOMICS

Beginning with the year 1921-22, the University Teacher's Certificate will be granted only to graduates of the College of Education. Students expecting to receive this certificate upon graduation shall be registrants in the College of Education from the beginning of the junior year. Students in the College of Agriculture, Forestry, and Home Economics desiring the University Teacher's Certificate shall in addition to their registration in this college register also in the College of Education.

## BOARD AND ROOM

*Sanford Hall.*—The one dormitory for University women, is located near the Minneapolis campus. It accommodates ninety women, about one half of whom may be freshmen. The charge for room and board is \$300 for the University year. Applications should be sent to the director of Sanford Hall, University of Minnesota.

*House-management houses.*—Two residences for women, located near the University Farm campus, are maintained by the Division of Home Economics, furnishing accommodations for a small number of students. The charge is \$90 each quarter, payable in advance. This covers the cost of living in the houses, with the exception of luncheon for the first five days of the week. Applications should be sent to the chief of the Division of Home Economics, University Farm, St. Paul. A deposit of \$10 is required when a room is reserved.

*Private houses.*—After June 1 the housing bureau will supply a list of approved boarding and rooming places.

## COURSES OF STUDY

The courses of study are designed (a) to prepare women for the responsibilities of citizenship and of home-making; (b) to prepare teachers for the extension of home-economics education; (c) to prepare women for vocations which have as their foundation, work of the home-economics group.

A number of courses of study are outlined on the following pages. In addition, opportunity is offered through substitutions and selections of electives to prepare for other special fields of work. The outlined courses of study include:

1. General course in home economics as a type of general arts education for women
2. Course in foods and nutrition
3. Course in textiles and clothing
4. Course for students preparing for positions as dietitians
5. Course for students preparing for positions as institutional managers
6. Course for students preparing for positions in home economics extension work
7. Additional requirements for students preparing to teach in either the general field of home economics or the special fields of foods and home management, textiles and clothing, and related art.

These teachers' courses, designed to prepare for the teaching of vocational courses in home economics, are arranged in accordance with the provisions of the Smith-Hughes Act.

The College of Agriculture, Forestry, and Home Economics, and the College of Education cooperate in the preparation of teachers of home economics as outlined in the Teachers' Course in Home Economics, Teachers' Course in Foods and Home Management, the Teachers' Course in Textiles and Clothing, and the Teachers' Course in Related Art.

The required work of the freshman and the sophomore years is the same in each course of study. Specialization is provided for in the junior and senior years.

### HOME PRACTICE

Home practice in garment-making is required of students who have completed H.E. 11, as a prerequisite to H.E. 13. The character and amount of the home-practice work will be arranged with a member of the faculty of the textile and clothing section.

Home practice in foods and cookery is required of students who have completed H.E. 21 and 22, and should be completed prior to registering for H.E. 5. The character and amount of the home-practice work will be arranged with a member of the faculty of the foods and cookery section.

### EXPLANATION OF COURSE NUMBERS

The quarters in which courses are offered are indicated by the letters f (fall), w (winter), s (spring), and su (summer) following the course number. For example: 5f,w,s indicates that Course 5 is given in the fall

quarter and repeated in the winter quarter and again in the spring quarter; 5f-6w indicates a two-quarter course extending through the fall and winter quarters and 5f,w-6w,s indicates that Course 5-6 is given in the fall and winter quarters and repeated through the winter and spring quarters.

All undergraduate courses are numbered from 1 to 100. All courses open to undergraduates and graduates are numbered from 101 to 200.

Numbers following the descriptive name of a course indicate the number of credit hours.

Course numbers in parentheses following the number of credit hours indicate prerequisite courses.

Descriptions of the courses listed in the following outline of the curricula, together with those of additional courses offered as electives, will be found on pages 26-52. The schedule of classes will be found on pages 53 to 121. The divisional statements are arranged alphabetically according to the names of the divisions.

One credit hour is equivalent to (1) one lecture or recitation period requiring two hours of preparation, (2) two periods of laboratory work requiring one hour of preparation, or (3) three periods of laboratory work with no preparation, each week for one quarter.

## GROUP I. GENERAL REQUIREMENTS FOR ALL STUDENTS IN HOME ECONOMICS

### FRESHMAN YEAR

All of the following work is required of every student except for the exemptions indicated. For some students this represents more than the regular amount of work of 15 credit hours per quarter. In such cases those subjects listed below which can not be taken in the freshman year must take precedence in the following year. Registration for from 14 to 16 credit hours of work each quarter will be allowed without special permission. Care should be taken in registration to give precedence to courses offered only one quarter.

1. *Non-credit courses* required for graduation in addition to the 189 credit hours. Freshman lectures. A course of lectures, one hour per week, intended primarily to familiarize the new student with the college, college customs, and methods of procedure. Offered only in the fall quarter.
- Phys. Educ. 1f-2w-3s, Elementary Physical Training. Three hours per week throughout the year.
- Phys. Educ. 4f, Personal Hygiene.
2. *General courses.*—The following courses may be registered for any quarter that they are offered except that the proper sequences of continuation courses and the prerequisites must be observed.
- An. Biol. 14f-15w-16s, General Zoology, 9. Bot. 8s, General Botany, 5, may be substituted for An. Biol. 3s.
- Chem. 1f-2w-3s, General Inorganic Chemistry, 12. Students presenting a year of high-school chemistry may omit this course and register for Chem. 9-10. Those required to take this course because of inability to carry Chem. 9-10 successfully will be allowed not more than 10 credits.
- Chem. 9f-10w, Advanced General Inorganic Chemistry, 10. Those required to take Chem. 1-2-3 are exempt.



- Farm Eng. 23f,s, General Physics, 5. Those presenting a year of high-school physics may omit this course and substitute 5 credits elective later in their course of study.
- H. E. 3f,w,s, Textiles, 5
- H. E. 11f,w,s, Garment-Making, 3
- H. E. 51f,w,s, Drawing and Design, 3
- Rhet. 1f,w,s, <sup>1</sup>Rhetoric I, 3
- Rhet. 2f,w,s, Rhetoric II, 3 (Rhet. 1.)
- Rhet. 3f,w,s, Rhetoric III, 3 (Rhet. 2.)
- Rhet. 4f,w,s, Elementary Rhetoric, 3. Required only of those who are found to be unable to carry Rhet. 1.

## SOPHOMORE YEAR

1. *Non-credit courses* required for graduation in addition to the 189 credit hours.
- Phys. Educ. 43f,w,s, Elementary Swimming. Not required of those who can pass the swimming test in their freshman year.
2. *Freshman courses* which were not completed during the freshman year.
3. *General courses*.—The following courses may be registered for any quarter that they are offered except that the proper sequence of continuation courses and prerequisites may be observed. From 15 to 17 credit hours should be selected each quarter.
  - Agr. Biochem. 3f,w, Types of Carbon Compounds, 6 (chem. 10 cred.)
  - Bact. 1f,w,s, Elementary Bacteriology, 5 (chem. 10 cred., F.)
  - H. E. 13f,w,s, Dressmaking, 5 (H. E. 3, 11, 51, home practice in garment-making)
  - H. E. 21f,w,s, Foods and Cookery, 5 (chem. 5 cred., Physiol. 4 or parallel.)
  - H. E. 22f,w,s, Food Economics, 5 (H. E. 21.)
  - Physiol. 4f,w,s, Human Physiology, 5 (chem. 10 cred., biol. 9 cred.)
  - Psychol. 1f-2w, General Psychology, 6
  - Rhet. 11f,w,s, Argumentation, 3 (Rhet. 3): or Rhet. 31f,w,s, Survey of English Literature, I, 5 (Rhet. 3)
  - Sociol. 1f,w,s, Introduction to Sociology, 3
4. *Electives*.—Enough elective credits should be selected to make, with the required work of the freshman and sophomore years a total of 93 credit hours. The number selected will vary from 1 to 11 credit hours depending upon the specific high-school preparation of each student. Those whose programs permit are advised to register for Rhet. 22, Public Speaking, 3, otherwise required in the junior year.

## JUNIOR YEAR

1. *General courses*.—The following courses may be registered for any quarter that they are offered except that the proper sequence of continuation courses and prerequisites must be observed.
  - Econ. 5, General Economics, 5
  - H. E. 37f,s, Home Care of the Sick, 3 (chem. 5 cred., Bact. 1)
  - H. E. 52f,w, Art History and Appreciation, 3 (H. E. 51)
  - H. E. 53f,w,s, Advanced Design, 4 (H. E. 51)
  - H. E. Educ. 40f, Child-Training, 3 (Psychol. 1-2)
  - Rhet. 22f,w,s, Public Speaking, 3 (Rhet. 3)
2. *Special courses* as prescribed by the curriculum of the line of specialization selected. See special requirements on pages 22 to 24.
3. *Electives*. Enough electives should be selected to make, with those listed in 1 and 2 above, from 15 to 17 credit hours each quarter. Full work for the year consists of 48 credit hours.

## SENIOR YEAR

1. *General courses*.—The following courses may be registered for any quarter that they are offered except that the proper sequence of continuation courses and prerequisites must be observed.
  - H. E. 34f,w,s, Home Management: Operation and Maintenance, Lectures, 3 (H. E. 22, Econ. 7 or parallel)

<sup>1</sup> Special attention is called to rules on delayed credit and to regulations for students with insufficient preparation in English on page 47.

- H. E. 35f,w,s. Home Management: Operation and Maintenance, Laboratory, 6 (H. E. 22, 37, H. E. Educ. 40, or parallel; must parallel H. E. 34) (home practice in foods and cookery advised)
- H. E. 45w, Home Economics Survey, 2
- H. E. 131f,w,s, Home Management: House-Planning and Equipment, 5 (52, 53)
2. *Special courses* as prescribed by the curriculum of the line of specialization selected. See special requirements on pages 22 to 24.
3. *Electives*.—Enough electives should be selected to make, with those listed above, from 15 to 17 credit hours each quarter. Full work for the year consists of 48 credit hours.

## GROUP II. SPECIAL REQUIREMENTS IN THE DIFFERENT LINES OF SPECIALIZATION (SUPPLEMENTARY TO GROUP I)

### GENERAL COURSE IN HOME ECONOMICS

#### *Junior year:*

- H. E. 23f,w, Nutrition I, 5 (H. E. 22, Bact. 1, Agr. Biochem. 3)
- H. E. 108f,s, Nutrition II, 5 (H. E. 23)

#### *Senior year:*

- H. E. 71f,w,s, Advanced Clothing Construction, 3 (H. E. 13, 52, 53)
- H. E. 103f,w,s, Dietetics, 5 (H. E. 108)
- H. E. 123f,w,s, Clothing Economics, 2 (H. E. 13, Econ. 5)

### COURSE IN FOODS AND NUTRITION

Those students planning to specialize in foods and nutrition should add the following courses to those listed in the general course.

#### *Junior year:*

- Agr. Biochem. 2w, Quantitative Methods, 5 (chem. 10 cred.)
- Agr. Biochem. 108s, Chemistry of Wheat and Wheat Products, 3 (Agr. Biochem. 3)
- H. E. 109s, Advanced Nutrition, 5 (H. E. 108, Agr. Biochem. 2)

#### *Senior year:*

- H. E. 105w, Experimental Cookery, 3 (H. E. 22, 108)

### COURSE IN TEXTILES AND CLOTHING

Those students planning to specialize in textiles and clothing should register for Advanced Clothing Construction and Clothing Economics in the junior year and add the following courses to those listed in the General Course, omitting Nutrition I, Nutrition II, and Dietetics.

#### *Junior year:*

- H. E. 55f,s, Decorative Needlework and Other Crafts, 3 (H. E. 3, 11, 51, 53, or parallel)

#### *Senior year:*

- H. E. 18f,s, Commercial Clothing Manufacture, 4 (H. E. 17, or parallel)
- H. E. 122f,w, Advanced Textiles, 3, Agr. Biochem. 2)

### COURSE FOR DIETITIANS

Those students planning to become dietitians may omit the following courses from the General Course:

Advanced Clothing Construction, Clothing Economics

They should add the following courses to those listed in the General Course.

#### *Junior year:*

- Agr. Biochem. 2w, Quantitative Methods, 5 (chem. 10 cred.)
- Educ. Psychol. 45f,w,s, Elementary Educational Psychology, 3 (Psychol. 1-2) or Agr. Educ. 11f,w,s, Principles of Vocational Education, 3
- H. E. 109s, Advanced Nutrition, 5 H. E. 108, Agr. Biochem. 2)

H. E. Educ. 42f,w,s, Special Methods in Teaching Home Economics, 5 (H. E. 13, 22, Psychol. 1-2)

*Senior year:*

H. E. 61f,s, Large Quantity Cookery and Marketing, 4 (H. E. 22)

H. E. 63f,w, Institutional Experience, 3 (H. E. 22)

H. E. 105w, Experimental Cookery, 3 (H. E. 22, 108)

H. E. 151w, Institution Management, 4 (H. E. 61, 63)

#### COURSE IN INSTITUTION MANAGEMENT

Those students specializing in institution management may omit the following courses from the General Course in home economics:

Advanced Clothing Construction, Clothing Economics

They should add the following courses to those listed in the General Course:

*Junior year:*

H. E. 61f,w, Large Quantity Cookery and Marketing, 4 (H. E. 22)

H. E. 63f,w, Institutional Experience, 3 (H. E. 22)

*Senior year:*

Econ. 85f,s, Principles of Marketing, 3 (Econ. 5)

Econ. 28s, Principles of Accounting, 5 (Econ. 5)

H. E. 69s, Institution-Management Practice, 3 (H. E. 151)

H. E. 105w,s, Experimental Cookery, 3 (H. E. 22, 108)

H. E. 151w, Institution Management, 4 (H. E. 61, 63)

#### COURSE IN EXTENSION WORK

Students planning to become home economics extension workers should add the following courses to those listed in the General Course:

*Junior year:*

H. E. 23f,w,s, Nutrition I, 5 (H. E. 22, Bact. 1, Agr. Biochem. 3)

H. E. 108f,w,s, Nutrition II 5 (H. E. 23)

H. E. Educ. 42f,s, Special Methods of Teaching Home Economics, 5 (H. E. 13, 22, Psychol. 1-2)

Agr. Eng. 34w, Household Mechanics and Heat, 4 (F. Eng. 23 or equiv.)

Ent. 20w, Home-Economics Entomology, 3 (an. biol. 6 cred.)

*Senior year:*

H. E. 17f,w,s, Advanced Clothing Construction, 3 (H. E. 13, 52, 53)

H. E. 103f,w,s, Dietetics, 5 (H. E. 108)

H. E. 110s, Special Problems in Dietetics, 3 (H. E. 103)

H. E. 123f,w,s, Clothing Economics, 2 (H. E. 13, Econ. 5)

H. E. Educ. 44s, Methods in Home Economics Extension Work, 3 (H. E. Educ. 42)

H. E. Educ. 49f,w, Observation and Teaching, 8 (H. E. Educ. 42, Educ. 45 or Agr. Educ. 11)

#### COURSES FOR TEACHERS

##### TEACHERS' COURSE IN HOME ECONOMICS

Students specializing in this course must complete the required work of the General Course in home economics and in addition the following professional subjects:

*Junior year:*

Educ. 5s, Public Education in the U. S., 3 (Psychol. 1-2)

Educ. 45f,w,s, Elementary Educational Psychology, 3 (Psychol. 1-2) or Agr. Educ. 11f, w,s, Principles of Vocational Education, 3

H. E. Educ. 42f,s, Special Methods of Teaching Home Economics, 5 (H. E. 13, 22, Psychol. 1-2)

*Senior year:*

H. E. Educ. 49f,w, Observation and Teaching, 8 (42, Educ. 45 or Agr. Educ. 11, scholarship requirements, see page 41.

## TEACHERS' COURSE IN FOODS AND HOME MANAGEMENT

Students specializing in this course must complete the required work of the course in foods and nutrition and in addition the following professional subjects:

*Junior year:*

- Educ. Admin. 5s, Public Education in the U. S., 3 (Psychol. 1-2)  
 H. E. Educ. 42f,s, Special Methods of Teaching Home Economics, 5 (H. E. 13, 22, Psychol. 1-2)  
 Educ. Psychol. 45f,w,s, Elementary Educational Psychology, 3 (Psychol. 1-2) or Agr. Educ. 11f,w,s, Principles of Vocational Education, 3

*Senior year:*

- H. E. Educ. 47f,w, Observation and Teaching, 8 (H. E. Educ. 42, Educ. Psychol. 45 or Agr. Educ. 11, scholarship requirement, see page 41)

## TEACHERS' COURSE IN TEXTILES AND CLOTHING

Students specializing in this course must complete the required work of the course in textiles and clothing and in addition the following professional subjects:

*Junior year:*

- Educ. Admin. 5s, Public Education in the U. S., 3 (Psychol. 1-2)  
 Educ. Psychol. 45f,w,s, Elementary Educational Psychology, 3 (Psychol. 1-2) or Agr. Educ. 11f,w,s, Principles of Vocational Education, 3  
 H. E. Educ. 42f,s, Special Methods of Teaching Home Economics, 5 (H. E. 13, 22, Psychol. 1-2)

*Senior year:*

- H. E. Educ. 48f,w, Observation and Teaching, 8 (H. E. Educ. 42, Educ. Psychol. 45 or Agr. Educ. 11, scholarship requirement, see page 41)

## TEACHERS' COURSE IN RELATED ART

Students specializing in the teaching of related art may omit the following courses from the Teachers' Course in Textiles and Clothing:

Commercial Clothing Manufacture, Advanced Textiles, Observation and Teaching: Textiles and Clothing

They should add the following courses:

*Junior year:*

- Art Educ. 32f-33w, Freehand Drawing and Composition, 6  
 H. E. 58w, Costume Design, 3 (H. E. 52, 55)

*Senior year:*

- Art Educ. 31s, Fundamental Principles of Design, 3 (29-30 or H. E. 51, 53) or Art Educ. 40f, Principles of Harmony of Form and Color, 3 (29-30-31 or instructor's permission)

- H. E. 54s, Interior Design, 3 (H. E. 52, 53, 131)  
 H. E. 57w, Weaving and Other Crafts, 3 (H. E. 3, 51, 53)

In addition to the above they should add the following professional courses:

- H. E. Educ. 43w, Organization and Methods for Related Art Teaching, 3 (H. E. 52, 53, 131)  
 H. E. Educ. 46f,w, Observation and Teaching of Related Art, 8 (13, 52, 53, Educ. Psychol. 45 or Agr. Educ. 11, H. E. Educ. 42, scholarship requirement, see page 41)

## ELECTIVES

Students should consult with the faculty of the section in which they have chosen to major, with reference to the elective courses which must be chosen to make up the 189 credit hours required for graduation.

Only a limited number of elective courses are open to freshmen. First-year students, who for any reason are unable to follow the regular curriculum, are advised to fill their programs with a required course from the sophomore schedule, if possible, and postpone the choice of electives

until the sophomore year. This plan will enable the student to obtain a better viewpoint from which to select electives and allow a wider range of subjects from which to choose.

In selecting electives, note particularly (a) prerequisites, (b) classes of students (fr., soph., jr., or sr.) to which courses are offered, (c) number of credits, (d) quarter or quarters offered, and be sure that provision is made in registration for the proper sequence of continuation courses.

#### FRESHMAN ELECTIVES

The following divisions and departments offer elective work to freshmen. For the descriptions of available courses see pages 26 to 52, and for departments marked S., L., and A. see the bulletin of the College of Science, Literature, and the Arts.

Botany (S., L., and A.)	Horticulture
Dairy Husbandry	Mathematics (S., L., and A.)
German	Poultry Husbandry
History (S., L., and A.)	Romance Languages

#### SOPHOMORE, JUNIOR, AND SENIOR ELECTIVES

Nearly all of the divisions offer elective work to sophomores, juniors, and seniors.

Elective courses in the College of Science, Literature, and the Arts, are separated into Junior College courses, open to freshmen and sophomores, and Senior College courses, open to juniors and seniors. In addition to satisfying other prerequisites an average grade of C must be maintained for the first two years in order to register for a Senior College elective.

## DESCRIPTION OF COURSES

For explanation of course numbers and credits see page 19.

### AGRICULTURAL BIOCHEMISTRY

Professors ROSS A. GORTNER, CLYDE H. BAILEY; Associate Professors R. ADAMS DUTCHER, LEROY S. PALMER; Assistant Professors CORNELIA KENNEDY, CLARENCE A. MORROW, JOHN J. WILLAMAN; Instructors ARTHUR K. ANDERSON, PAUL F. SHARP.

#### COURSES

2. QUANTITATIVE METHODS. A brief course in the principles of quantitative analysis, including a study of stoichiometric problems, practice in the use of the balance and in typical gravimetric and volumetric manipulations. MR. WILLAMAN.
3. TYPES OF CARBON COMPOUNDS. An elementary study of the different groups of carbon compounds, with special reference to their relationships and their occurrence in plant and animal materials used as food. MR. ANDERSON.
- 101-102. AGRICULTURAL QUANTITATIVE ANALYSIS. Estimation of inorganic and organic constituents of biological products, the proximate analysis of foods and feeding stuffs, the use of the polariscope, immersion refractometer, colorimeter and nephelometer, viscosimeter, and other special apparatus. MR. MORROW.
108. CHEMISTRY OF WHEAT AND WHEAT PRODUCTS. A lecture course, with collateral library reference work on the chemical technology of the production and milling of wheat and the conversion of its products into human food. MR. BAILEY.
110. FLOUR LABORATORY METHODS. Laboratory course in methods of analysis of wheat and its products; milling tests of wheat; baking and special tests of flour. Designed to train students of research and control work in the cereal industry. MR. BAILEY.
- 111-112. PHYTOCHEMISTRY. Advanced course dealing with the colloidal state, and the chemistry of proteins, carbohydrates, glucosides, tannins, fats, plant acids, enzymes, and pigments, and their physicochemical relations to the vital processes involved in growth and nutrition. MR. MORROW.
- 113-114. BIOCHEMICAL LABORATORY METHODS. A laboratory course paralleling the lectures in 111-112, using recent methods for the investigation of biologically important compounds, with especial reference to the detection and estimation of such compounds in cells or tissues. MR. MORROW, MR. SHARP.

116. CHEMISTRY OF "VITAMINES" AND DEFICIENCY DISEASES. Lectures, consultations, and library work on special nutritional problems accompanied by chemical and biological studies of food materials from the standpoint of the "vitamine" content. MR. DUTCHER, MISS KENNEDY.
118. LABORATORY PROBLEMS IN BIOCHEMISTRY. Special laboratory work in the preparation or isolation of pure compounds which occur in living cells, in the study of biochemical reactions, or in special methods of identification or determination of biochemical products. MR. GORTNER, MR. BAILEY, MR. DUTCHER, MR. PALMER, MR. MORROW, MR. WILLAMAN.

### AGRICULTURAL EDUCATION

#### COLLEGE OF EDUCATION

Professors ASHLEY V. STORM, DEXTER D. MAYNE; Assistant Professor WILLIAM P. DYER.

#### COURSES

11. PRINCIPLES OF VOCATIONAL EDUCATION. A study of the fundamental principles upon which education is based. Throughout the course emphasis is placed on those phases which are most closely related to vocational education. MR. DYER.
21. VOCATIONAL EDUCATION. A short history of vocational education; the present status in Europe and United States; manual training and home arts in an educational system; the place of agriculture in the public schools; trade and vocational schools. MR. MAYNE.

### AMERICANIZATION TRAINING AND ANTHROPOLOGY

#### COLLEGE OF SCIENCE, LITERATURE, AND THE ARTS

Professor ALBERT E. JENKS; Assistant ALONZO G. GRACE.

#### COURSES

1. INTRODUCTION TO ANTHROPOLOGY. Study of origin and development of human societies; various agencies which have determined type of social life; social organization, institutions, and progress; bearing of sociology upon other social sciences and arts. MR. JENKS, MR. GRACE.
4. CULTURAL ANTHROPOLOGY. Origin and early development of the most important activities and institutions which had their beginning among primitive men. MR. JENKS.
5. GENERAL IMMIGRATION. Facts of recent world migration. Chief causes of emigration from the old nests, and of immigration to the United States; federal and state problems of immigrant legislation, control, and distribution. MR. GRACE.
12. ETHNOLOGY. The different so-called races of men; their historical classifications; determinance of ethnic types; important ethnic problems. MR. GRACE.

110. PHYSICAL ANTHROPOLOGY AND AMALGAMATION. Theory of evolution as applied to natural and cultural man. Eugenics in theory, law, and practice. Studies in the amalgamation of races. MR. JENKS.
113. THE AMERICAN PEOPLE. OLDER IMMIGRANTS. Characteristics, contributions, and distribution of the older immigrant peoples in America, their modification and importance to us. MR. JENKS.
114. THE AMERICAN PEOPLE. NEWER IMMIGRANTS. Characteristics, contributions, and distribution of the newer immigrant peoples in America, their modification and importance to us. MR. JENKS.
115. THE AMERICAN PEOPLE. AMERICANISMS AND ASSIMILATION. Essential and unique historical Americanisms, and their value and virility for the future in America. Conditions and facts of assimilation. MR. JENKS.

## ANIMAL BIOLOGY

## COLLEGE OF SCIENCE, LITERATURE, AND THE ARTS

Professors HENRY F. NACHTRIEB, WILLIAM A. RILEY, CHARLES P. SIGERFOOS; Assistant Professor ELMER J. LUND; Instructor ADOLPH RINGOEN.

## COURSES

- 1-2. GENERAL ZOOLOGY. A survey of the animal kingdom, emphasizing the principles of development and structure in relation to functions and habit, heredity and evolution, and the animals of economic importance. Lectures, quizzes, and laboratory. MR. NACHTRIEB, MR. SIGERFOOS, MR. LUND, MR. RINGOEN.
- 14-15-16. GENERAL ZOOLOGY. Same as Course 1-2. Extended through three quarters. MR. RILEY, MR. SIGERFOOS.

## ART EDUCATION

## COLLEGE OF EDUCATION

Assistant Professor RUTH RAYMOND; Instructors HAZEL S. MARTIN, GERTRUDE D. ROSS.

## COURSES

- 29-30-31. FUNDAMENTAL PRINCIPLES OF DESIGN. MISS RAYMOND.
- 32-33-34. FREEHAND DRAWING AND COMPOSITION. MISS RAYMOND, MRS. MARTIN, MISS ROSS.
- 40-41-42. PRINCIPLES OF HARMONY IN FORM AND COLOR. MISS RAYMOND.

## BACTERIOLOGY AND IMMUNOLOGY

## MEDICAL SCHOOL

Professor WINFORD P. LARSON; Associate Professor ARTHUR T. HENRICI; Instructors ANNE G. BENTON, DAVID O. SPIESTERSBACH; Assistant ROBERT G. GREEN.



## COURSES

1. GENERAL BACTERIOLOGY. The preparation of culture media; the morphology of bacteria; methods of staining and identification; anaerobic bacteria; principles of sterilization and disinfection; examination of air, water, milk; relation of bacteriology to the industries. DR. LARSON, DR. HENRICI, MISS BENTON, MR. SPRIESTERSBACH, MR. GREEN.
- 105S. HOUSEHOLD BACTERIOLOGY. The decay, fermentation, and putrefaction of foodstuffs; molds; canning; bacterial food poisoning; bacteriology of the cleansing processes. MISS BENTON.

## BEE CULTURE

Professor FRANCIS JAGER; Assistant Professor GROVER C. MATTHEWS.

*General statement.*—Theoretical and practical instruction on bees, honey, and wax production. At least one year of botany should be completed before electing these courses. General zoology and economic entomology are also desirable. If not already completed they should be taken at same time as the courses in bee culture.

## COURSES

1. ELEMENTS OF BEEKEEPING I. Development, life history, and functions of the queen, worker, and drone. Habits and instincts. Handling and manipulation. Races of bees. Diseases and enemies. Tools and appliances. Honey sources. Arrangement of the apiary and equipment for beginner. MR. JAGER.
2. ELEMENTS OF BEEKEEPING II. Life of the colony. Fundamentals of colony behavior throughout the cycle of the year. Fundamentals of beekeeping practice throughout the cycle of the year. Production of comb and extracted honey. Indoor and outdoor wintering. MR. JAGER.
3. ADVANCED BEEKEEPING I. Practical anatomy. Psychology, instinct, and reflex action. Architecture of the honey comb. Pollen and honey chemistry. Pollenization and honey flora. Diagnosis and treatment of bee diseases. Influence of soil and climatic conditions upon honey secretions. MR. JAGER.
4. ADVANCED BEEKEEPING II. Professional beekeeping. Location and management of home and outapiaries. Migratory beekeeping. Transportation methods for commercial beekeeping. Central honey plants. Construction and equipment of bee houses, cellars, workshops. Power and up-to-date machinery. Organization. MR. JAGER.
5. QUEEN-RAISING. Queen-judging, principles of reproduction, grafting, drone-raising, mating. Nuclei, mailing, introducing, and re-queening. In connection with the University Farm queen-bee raising station. MR. JAGER.

## BOTANY

## COLLEGE OF SCIENCE, LITERATURE AND THE ARTS

Professors C. OTTO ROSENDAHL, ELIAS J. DURAND, LEE I. KNIGHT, JOSEPHINE E. TILDEN; Associate Professor FREDERIC K. BUTTERS; Assistant Professors WILLIAM S. COOPER, NED L. HUFF; Instructor ARTHUR M. JOHNSON.

## COURSES

- 1-2. GENERAL BOTANY. Fundamental principles of botany. Survey of organs of the flowering plant; its internal structure and physiology. Representatives of the algae, fungi, liverworts, etc., examined with special reference to tracing evolution of the vegetable kingdom. MR. DURAND, MR. BUTTERS, MR. HUFF, MR. JOHNSON.
7. TAXONOMY OF FLOWERING PLANTS. A general study of the classification and relationships of flowering plants. Laboratory and field practice in the determination of species, together with lectures and quizzes. MR. ROSENDAHL, MR. JOHNSON.
8. GENERAL BOTANY. Same as Course 1-2 condensed to one quarter for students in Home Economics only. MR. DURAND.
11. GENERAL MORPHOLOGY OF ALGAE AND FUNGI. A general survey of the structure, evolution, and classification of the algae and fungi. Lecture, laboratory and field work. MISS TILDEN.
15. ANATOMY OF VASCULAR PLANTS. A study of the microscopic structure of vascular plants, the cell, tissues, and tissue systems with particular attention to the development and evolution of the vascular system in the root, stem, and leaf. MR. BUTTERS.
51. HISTOLOGICAL METHODS. Training in methods used in the preparation and preservation of class material. Special attention is given to methods of killing, imbedding, sectioning, staining, and mounting. MR. DURAND.
52. PLANT PHYSIOLOGY. An introductory course giving a general survey of plant functions. MR. KNIGHT.
53. BOTANY OF ECONOMIC PLANTS. A survey course treating the most important botanical features of the common plants. MR. KNIGHT.
54. ELEMENTARY ECOLOGY. An introduction to the study of plants and their environment; investigation of the habitat; its effects upon plants as individuals and in mass; plant communities; plant successions. Laboratory and field work, lectures, and discussion. MR. COOPER.
55. ALGAE. A study of freshwater forms based on collections made by the class. Lectures, laboratory, and field work. MISS TILDEN.

62. GENERAL MORPHOLOGY OF BRYOPHYTES AND PTERIDOPHYTES. A general survey of the structure, evolution, and classification of the liverworts, mosses, and ferns. MR. HUFF.
63. GENERAL MORPHOLOGY OF ANGIOSPERMS AND GYMNOSPERMS. A general survey of the structure, evolution, and classification of seed plants. MR. BUTTERS.

## CHEMISTRY

## SCHOOL OF CHEMISTRY

Professors WILLIAM H. HUNTER, CHARLES F. SIDENER; Associate Professors FRANK H. MACDOUGALL, M. CANNON SNEED; Assistant Professor ISAAC W. GEIGER; Instructor WALTER M. LAUER.

## COURSES

- 1-2-3. GENERAL INORGANIC CHEMISTRY. Designed for those who have had no high-school chemistry. 1-2—A study of the general laws of chemistry and of the non-metals and their compounds. 3—A study of the metals and their compounds. MR. SNEED.
- 9-10. GENERAL INORGANIC CHEMISTRY. Designed for those who have had one year of high-school chemistry. 9—General laws of chemistry; the non-metals and their compounds. 10—Metals and their compounds and ionic equilibrium, considered quantitatively. MR. SNEED.
11. QUALITATIVE CHEMICAL ANALYSIS. Laboratory work in systematic qualitative analysis with lectures on solution, ionization, chemical and physical equilibrium, oxidation and reduction, and other subjects pertinent to qualitative analysis. For students who satisfy the requirements of general chemistry. MR. SNEED.
- 12-13. QUALITATIVE CHEMICAL ANALYSIS. Laboratory work in systematic qualitative analysis with lectures on solution, ionization, chemical and physical equilibrium, oxidation and reduction, and other subjects pertinent to qualitative analysis. For students who satisfy the requirements of general chemistry. MR. SNEED.
- 20-21. QUANTITATIVE ANALYSIS. An introductory course covering the general principles and methods of quantitative analysis, both gravimetric and volumetric. Typical problems will be assigned and attention given to proper laboratory practice. MR. SIDENER, MR. GEIGER.
- 35-36. ORGANIC CHEMISTRY. An introduction to the chemistry of carbon compounds. The laboratory work will include the preparation of characteristic substances. MR. HUNTER, MR. LAUER.
126. SANITARY WATER ANALYSIS. Lectures and laboratory practice in the chemical examination of potable waters. MR. SIDENER, MR. GEIGER.
- 141-142-143. PHYSICAL CHEMISTRY. A general survey of the subject. Laboratory work three to six hours per week. Nine, 12, or 15 credits, depending on amount of laboratory work. MR. MACDOUGALL.

## COURSES IN HOME ECONOMICS

## DAIRY HUSBANDRY

## ANIMAL HUSBANDRY GROUP

Professors CLARENCE H. ECKLES, JOSEPH R. KEITHLEY; Instructor CHESTER D. DAHLE; Assistant ELMER O. ANDERSON.

## COURSE

1. ELEMENTS OF DAIRYING. Composition of milk. Causes of variation in composition; milk constituents and their uses in dairy manufactures and as food; Babcock test; sanitary handling of milk and cream on the farm; cream-separating and farm butter-making. MR. KEITHLEY, MR. DAHL, MR. ANDERSON.

## ECONOMICS

## SCHOOL OF BUSINESS

Professors GEORGE W. DOWRIE, JOHN D. BLACK, Associate Professors FREDERICK B. GARVER, BRUCE D. MUDGETT; Instructors HILDING E. ANDERSON, HERMAN H. CHAPMAN, VICTOR H. PELZ, CLARA F. SYKES, VIRGIL R. WERTZ.

## COURSES

5. GENERAL ECONOMICS. The usual basic principles of economic science interpreted in terms of agriculture and forestry as well as of other industries. MR. ANDERSON, MR. WERTZ.
14. STATISTICS. Elementary principles of classification, analysis, and presentation of statistical materials, with primary emphasis on economic data. Lectures, readings, and laboratory work. MR. MUDGETT.
23. PRINCIPLES OF ORGANIZATION AND MANAGEMENT. Types of operating organization; specialization; coördination of men and departments; delegation of authority; establishment and maintenance of standards for materials, operation, machinery; determination of business policies; personnel problems. MR. PELZ.
28. PRINCIPLES OF ACCOUNTING. (For Agriculture, Forestry, and Home Economics students.) Principles of general and cost accounting presented in somewhat abridged form. MR. CHAPMAN.
85. PRINCIPLES OF MARKETING. Analysis of market functions, marketing channels and marketing agencies. MR. ANDERSON.
90. ECONOMICS OF CONSUMPTION. Nature of human wants; standards of living; cost of living; income, administration of income; nature of demand; demand and price; relation of consumption to the population problem. MR. GARVER.
94. OFFICE MANAGEMENT. Development of the office; organization; inter-relation of departments; correlation by records; standardization of office practice. Study of actual office organizations with especial attention to factors which have influenced their development. Observation, reading, reports. MISS SYKES.

## EDUCATIONAL ADMINISTRATION AND SUPERVISION

## COLLEGE OF EDUCATION

Professor FLETCHER H. SWIFT; Assistant Professor ROSS L. FINNEY; Instructor JEAN H. ALEXANDER.

## COURSES

3. EDUCATIONAL SOCIOLOGY. The school as a community factor; the present peculiar relation of the school to social problems; the function of the school in these relations. MR. FINNEY.
5. PUBLIC EDUCATION IN THE UNITED STATES. A brief survey of the factors determining the problem of public education in America, followed by a brief account of the development and organization of typical state-school systems. Not open to those who have credit in History and Philosophy of Education I. MR. SWIFT, MISS ALEXANDER.
119. THE ELEMENTARY-SCHOOL CURRICULUM. Principles underlying organization of subject-matter for courses in elementary school, including a critical examination of curricula, syllabi, and school texts in the light of their function in the teaching and administration of the curriculum.

## EDUCATIONAL PSYCHOLOGY

## COLLEGE OF EDUCATION

Assistant Professor HERMIONE L. DEALEY, MARVIN J. VAN WAGENEN.

## COURSES

45. ELEMENTARY EDUCATIONAL PSYCHOLOGY. A survey of fundamental facts of human behavior involved in educational activities. Open to seniors, juniors, and qualified students in third quarter of sophomore year upon advice of Mr. Haggerty. MISS DEALEY.
- 106-107-108. ADVANCED EDUCATIONAL PSYCHOLOGY. Advanced work in genetic psychology, origin and nature of human organism, development and control of instincts. Methods of measuring rate of learning; typical learning experiments. Group and individual differences, their relations to educational practice. MR. VAN WAGENEN.
- III. EDUCATIONAL DIAGNOSIS. Typical educational problems involving educational scales and standard tests. Nature of tests, methods of use, analysis of results obtained, and programs of remedial educational procedure, based on the results of the tests. MR. VAN WAGENEN.

## ENGLISH

## COLLEGE OF SCIENCE, LITERATURE, AND THE ARTS

Professors \_\_\_\_\_, RICHARD BURTON, ELMER E. STOLL, FREDERICK KLAEBER; Associate Professors JOSEPH W. BEACH, CECIL A. MOORE; Assistant Professor JAMES T. HILLHOUSE.

*General Statement.*—The following courses are recommended for election by the students of the College of Agriculture, Forestry, and Home Economics.

## COURSES

- 1-2-3. GENERAL SURVEY OF ENGLISH LITERATURE. Lectures, recitations, and assigned readings. Designed to prepare for more minute study of special periods. \_\_\_\_\_
4. OLD ENGLISH. The language, with reading of representative selections of Old English prose and poetry. The relation to modern English is particularly emphasized. Fall quarter \_\_\_\_\_; winter quarter \_\_\_\_\_
6. CHAUCER. Reading of tales from the Canterbury collection, with introduction dealing with the grammar and literary forms of fourteenth century English. Fall quarter \_\_\_\_\_; Winter quarter \_\_\_\_\_
8. SHAKESPEARE. An introductory study of Shakespeare's development as a poet and dramatist up to *King Lear*, with reading of representative plays. Fall quarter, MR. STOLL; winter quarter, MR. STOLL; spring quarter, MR. HILLHOUSE.
27. HISTORY OF THE ENGLISH LANGUAGE. Outline of the history of the language. Lectures and assigned readings. MR. KLAEBER.
40. THE BIBLE AS LITERATURE. A literary study of the Old Testament with special attention to forms and the critical study of selected readings. MR. BURTON.
41. BROWNING AND TENNYSON. A reading of the representative work of the two major poets of the Victorian era, in order to show their quality and contrasted power. (Not offered in 1921-22.) MR. BURTON.
- 44-45. AMERICAN LITERATURE. Lectures on American literature, with extensive readings from the principal poets and prose writers of the United States. MR. MOORE.
51. SPENSER. The forms and literary influences in the Elizabethan period illustrated in the poetry of Edmund Spenser, with brief readings from the minor poems and extended study of *The Faerie Queene*. MR. STOLL.
53. SEVENTEENTH-CENTURY LYRISTS. The tradition of the Elizabethan lyric traced in the work of the metaphysical and cavalier school of poetry. MR. MOORE.
- 58-59. NINETEENTH-CENTURY PROSE. Studies in the more important prose writers of the nineteenth century, with reference to their styles, personalities, opinions, and relations to their period. Readings by students and essays on approved topics. MR. BEACH.

62. MILTON. A special study of Milton, with some consideration of his contemporaries. MR. STOLL.
64. BACON. A study of Bacon as an essayist and as a promoter of learning. MR. STOLL.
66. THE ENGLISH NOVEL. Principles and personalities in the evolution of the English novel. Written reports on selected novels. MR. BURTON.

### ENTOMOLOGY AND ECONOMIC ZOOLOGY

Professors WILLIAM A. RILEY, ARTHUR G. RUGGLES; Assistant Professor OSCAR W. OESTLUND.

#### COURSES

- 1f,s,su. INTRODUCTORY ENTOMOLOGY. Lectures and laboratory work on the characteristics and habits of insects. MR. RILEY, MR. OESTLUND.
- 2w,su. ECONOMIC ENTOMOLOGY. The life history, habits, and methods of control of the insect pests of orchard, field, and garden. Laboratory work in the determination of the more important forms. MR. RUGGLES.
20. HOME ECONOMICS ENTOMOLOGY. Designed for home economics students. Insects as related to public health problems, insects of the household, and those attacking foods will be discussed. The principles of control of insect pests of plants will be considered. MR. RILEY, MR. RUGGLES.

### FARM ENGINEERING

Professor WILLIAM BOSS; Associate Professor EARL A. STEWART; Assistant Professor ARTHUR G. TYLER; Instructor MAURICE G. JACOBSON.

#### COURSES

3. MECHANICAL DRAWING. Lectures on drawing, exercise in the use of drawing instruments, lettering, and water colors. The making of working drawings with their practical value. MR. JACOBSON.
23. GENERAL PHYSICS. An introductory course in the elements of physics for those who have not had physics in the high school. The study of mechanics, heat, light, and electricity with laboratory work. MR. STEWART, MR. TYLER.
34. HOUSEHOLD MECHANICS AND HEAT. A series of lectures, recitations, and laboratory work on household appliances and methods of operation, such as water supply, plumbing, sewage disposal, washing, cooking, refrigeration, heating, and ventilation. MR. STEWART.
35. HOUSEHOLD ELECTRICITY AND LIGHT. A course with laboratory work on the fundamental principles of electricity and the use of electrical appliances in the home, with a special study of light, color, and lighting. MR. STEWART.

## GERMAN

Professor CARL SCHLENKER; Assistant Professor JAMES DAVIES; Instructors  
LYNWOOD DOWNS, COWDEN LAUGHLIN.

## COURSES

1. BEGINNING A. Pronunciation, conversation, grammar, and composition; selected readings in easy prose and verse. \_\_\_\_\_
2. BEGINNING B. Continuation of 1. \_\_\_\_\_
3. BEGINNING C. Selected texts from modern writers. \_\_\_\_\_
10. RAPID READING. Modern narrative prose. \_\_\_\_\_
11. ADVANCED RAPID READING. Continuation of 10. Representative works of the eighteenth and nineteenth centuries.
14. NINETEENTH-CENTURY PROSE. Narrative readings from modern novelists. \_\_\_\_\_
- 28-29. ADVANCED CHEMICAL GERMAN. Selections from more difficult works on chemistry. \_\_\_\_\_
- 31-32. MEDICAL GERMAN. Readings from general works on physiology, anatomy, and bacteriology.
40. COMMERCIAL GERMAN. Vocabulary of commerce, business forms; reading of texts on economics. \_\_\_\_\_
- 50-51-52. COMPOSITION. Aims to develop grammatical correctness. Translations from English selections. Essay-writing on assigned subjects. MR. LAUGHLIN.
- 53-54-55. CONVERSATION. Aims to develop ease and correctness of oral expression. Organized on the laboratory plan—one-hour credit with two hours of recitation and one hour of outside reading. MR. LAUGHLIN.
63. MODERN DRAMA. Plays of modern dramatists; Hauptmann, Sudermann, Fulda, and others. MR. DAVIES, MR. DOWNS.
64. CLASSIC DRAMA. Plays of Lessing, Goethe, and Schiller. MR. DAVIES, MR. DOWNS.
74. GERMAN POETS. Survey of German poetic literature. MR. DAVIES, MR. DOWNS.

## HISTORY AND PHILOSOPHY OF EDUCATION

## COLLEGE OF EDUCATION

Professor FLETCHER H. SWIFT; Instructor JEAN H. ALEXANDER.

## COURSES

1. BRIEF COURSE IN THE HISTORY OF EDUCATION. Current school problems and educational theories in the light of their history. Emphasis upon secondary education and those aspects of education of most immediate



concern to high-school teachers. Not open to those who have credit in Educational Administration 5. MR. SWIFT, MISS ALEXANDER.

101-102-103. FOUNDATIONS OF MODERN EDUCATION. Interpretative historical study of elements in modern education derived from Hebrews, Greeks, Romans, Middle Ages, etc. Emphasis on secondary and higher education and origin and results of monopoly of cultural conception of education and cultural studies. MR. SWIFT.

### HOME ECONOMICS

Professor MILDRED WEIGLEY; Associate Professors ALICE BIESTER, HARRIET GOLDSTEIN, MARION WELLER; Assistant Professors ALICE CHILD, AMY P. MORSE, E. MAUDE PATCHIN, ETHEL L. PHELPS, LUCY A. STUDLEY, NOLA TREAT; Lecturer MARTHA B. MOORHEAD; Instructors EDLA ANDERSON, CARLOTTA BROWN, RUBY COON, AMANDA EBERSOLE, HALLY J. FISHER, VETTA GOLDSTEIN, RUTH M. LINDQUIST, MABEL C. MCDOWELL, MARGARET K. MUMFORD, LENORE RICHARDS, HELEN RIDER; Extension Specialists MARY L. BULL, ESTHER B. COOLEY, LUCY CORBINER, ADELE KOCH, JULIA NEWTON, JUNIATA L. SHEPPARD.

*General Statement.*—The following courses are planned primarily for students majoring in home economics, and are required in the courses of study in home economics, outlined on pages 20-24. They are open for election to students in other courses who offer the prerequisites as stated on pages 88-94.

### COURSES

3. TEXTILES. A study of textile fibers, their structure, properties, and chemical reactions; of fabrics, their structure and processes of manufacture; of art and economic consideration in selection and purchase of materials for clothing and household-furnishing. MISS WELLER, MISS PHELPS.
4. TEXTILES. A condensed course for students in Science, Literature, and the Arts and Education. MISS WELLER, MISS PHELPS.
- 5-6. TEXTILES. Same as Course 4. For teachers. Extended through two quarters. MISS WELLER.
11. GARMENT-MAKING. Instruction and laboratory practice in hand sewing; in the reading and adaptation of commercial patterns; in the construction and use of the sewing machine; in designing, cutting, and making simple outer garments from washable materials. MISS MCDOWELL.
13. DRESSMAKING. Consideration of quality, suitability, and cost of materials adapted to technic involved in construction of simple wool and silk dresses; adaptation of art principles in selection of designs; instruction and practice in methods of construction. MISS PATCHIN, MISS MCDOWELL.

17. **ADVANCED CLOTHING CONSTRUCTION.** Laboratory course involving the application of principles of costume-modeling in the construction of one high-grade garment, suit, coat, or dress. One day a week will be given to a millinery problem. MISS WELLER, MISS PATCHIN, MISS CARLOTTA BROWN.
18. **COMMERCIAL CLOTHING MANUFACTURE.** A study of the organization of the clothing trades and industries; of wages and standards of efficiency in workmanship. Laboratory practice upon a commercial basis, measured by trade standards. MISS PATCHIN.
21. **FOODS AND COOKERY.** (a) Production, manufacture, chemical composition of typical foods; their classification into food principles; changes in digestion; function in nutrition. (b) Fundamental science principles from chemistry, physics, biology, bacteriology, and their application in typical cookery processes. MISS CHILD.
22. **FOOD ECONOMICS.** Cost and nutritive value of typical foods; the study of dietaries; preparation and serving of meals, the cost bearing a definite relation to the family budget. MISS CHILD.
23. **NUTRITION I.** A study of the chemistry and physiology of metabolism, involving a qualitative examination of the food principles and of the body tissues. MISS BIESTER, MISS MUMFORD, MISS ANDERSON.
24. **CAMP COOKERY.** This course is designed to give prospective foresters, engineers, and others a knowledge of the simpler cookery processes; and of such adaptations as are practicable in the several types of out-of-door camps. Not open to home economics students. (Given in alternate years. Offered in 1921-22.) MISS CHILD.
4. **HOME MANAGEMENT: OPERATION AND MAINTENANCE, LECTURES.** Discussion of management responsibilities of home-maker with special emphasis on budgets and household accounts. MISS LINDQUIST.
35. **HOME MANAGEMENT: OPERATION AND MAINTENANCE, LABORATORY PRACTICE.** (a) Twelve weeks' experience as manager and helper in a household of twenty members. (b) Experience in care and training of eighteen-months-old child. MISS STUDLEY, MISS LINDQUIST.
37. **HOME CARE OF THE SICK.** (a) First aid; communicable diseases; their transmission and prevention; hygiene of infancy, maidenhood, maturity. (b) The care of the sickroom; observation and care of the patient; elementary symptomatology. MISS MOORHEAD, MISS FISHER.
- 40, 42, 43, and 44. See Home Economics Education, page 41.
45. **HOME ECONOMICS SURVEY.** A discussion of the historical development of home economics with special emphasis upon current problems. MISS WEIGLEY.

- 46, 47, 48, 49. See Home Economics Education, page 41.
51. DRAWING AND DESIGN. Composition, perspective, color theory, and color harmonies applied to costume design and interiors; harmony, balance, rhythm, in line area design. MISS V. GOLDBSTEIN.
  52. ART HISTORY AND APPRECIATION. The historical development of art, architecture, decoration, furniture, and costumes, studied with special emphasis on design and influence upon modern styles. MISS H. GOLDSTEIN, MISS V. GOLDSTEIN.
  53. ADVANCED DESIGN. Problems in design for house furnishings and for costume, including dress-modeling. MISS H. GOLDSTEIN, MISS V. GOLDSTEIN.
  54. INTERIOR DESIGN. Special problems in interior decoration to be worked out as far as possible in actual materials. Special emphasis on color and texture combinations. MISS MORSE.
  55. DECORATIVE NEEDLEWORK AND OTHER CRAFTS. Applied design in needlework, lace, and appliqué, in problems relating to dress and house furnishings. MISS MORSE.
  57. WEAVING AND OTHER CRAFTS. Applied design in two and four harness hand-loom weaving, batik and block printing in problems relating to dress and house-furnishing. MISS MORSE.
  58. COSTUME DESIGN. A study of figure construction; line, color, and textures for beautiful arrangements and with reference to individual types. Laboratory work with fabrics and designs carried out in pencil and water colors. MISS H. GOLDSTEIN.
  61. LARGE QUANTITY COOKERY AND MARKETING. Application of principles of cookery to large quantity preparation; planning of meals for dining-hall and cafeteria; calculation of cost and calories in standard servings; study of problems involved in purchase of institution supplies. MISS RICHARDS.
  63. INSTITUTIONAL EXPERIENCE. Experience in the minor problems of administration. MISS TREAT, MISS RICHARDS.
  69. INSTITUTION-MANAGEMENT PRACTICE. A continuation of 63 with responsibility for management; field work in different types of institutions. MISS TREAT, MISS RICHARDS.
  70. FOOD PREPARATION IN RELATION TO SOCIAL WORK. A study of the principles underlying cookery with special emphasis on the preparation of foods to be used in homes with limited incomes. MISS LINDQUIST.
  71. ELEMENTARY DIETETICS FOR THE SOCIAL WORKER. Involves principles underlying adequate feeding. Food habits of different economic and racial groups forming the basis for actual planning and preparation of meals. MISS MUMFORD.

72. HOME-MANAGEMENT PROBLEMS. Involves the making of sound budgets. Studies are based upon racial groups and the size of the family together with the income. MISS LINDQUIST.
103. DIETETICS. The fundamental principles of human nutrition as applied to the feeding of individuals and groups under conditions of health, and under such pathological conditions as are chiefly dependent upon dietetic treatment. MISS BIESTER, MISS MUMFORD.
105. EXPERIMENTAL COOKERY. An intensive study of problems in foods and food preparation with individual laboratory problems. MISS WEIGLEY, MISS CHILD.
108. NUTRITION II. A continuation of 23, including a study of digestion and the qualitative examination of blood, bile, milk, and urine. MISS MUMFORD.
109. ADVANCED NUTRITION. Quantitative methods are applied in studying human metabolism. Opportunity is offered for the individual investigation of selected problems pertaining to metabolism. MISS BIESTER, MISS ANDERSON.
110. SPECIAL PROBLEMS IN DIETETICS. An intensive study of problems relating to diet involving assigned readings, discussions, and field work. MISS BIESTER, MISS MUMFORD.
111. SPECIAL FOOD PROBLEMS. A continuation of experimental cookery involving more advanced problems. MISS CHILD.
122. ADVANCED TEXTILES. An experimental study of special problems in textiles with a consideration of means for obtaining standardization. MISS WELLER, MISS PHELPS.
123. CLOTHING ECONOMICS. General consideration of the economic problems in clothing production; women's responsibility for conditions in textiles and clothing industries; study of the budget for clothing and household textiles; hygiene and standardization of dress. MISS WELLER.
131. HOME MANAGEMENT: HOUSE PLANNING AND EQUIPMENT. House-planning, house-furnishing and equipment, and construction and furnishing budgets. Types of domestic architecture; site; floor-plans; building materials; details of construction; heating; ventilating; lighting; plumbing; walls; rugs; furniture; color; hangings; pictures; gardens. MISS MORSE.
151. INSTITUTION MANAGEMENT. Lectures and discussions of the problems involved in institution management; organization; service; institution-planning, decoration, and equipment; budgets, and the study of different types of institutions. MISS TREAT.

## HOME ECONOMICS EDUCATION

## COLLEGE OF EDUCATION

Professor MILDRED WEIGLEY; Associate Professors HARRIET GOLDSTEIN, MARION WELLER; Assistant Professors ALMA L. BINZEL, CLARA M. BROWN, MAUDE J. MILLER; Instructors ELIZABETH BACON, JEAN M. DORSEY, AMANDA EBERSOLE, LOU LOMBARD, OLIVE B. MACCOMBER, HELEN RIDER; Extension Specialists JULIA NEWTON.

*General Statement.*—Special attention is called to the prerequisites for Courses 46, 47, 48, and 49 required for the professional certificate. No student may register for these courses who has not attained an average grade of C in the work of the first two years.

## COURSES

40. CHILD-TRAINING. Application of modern science in rearing, training, and educating children. Emphasis placed on the physical care of the baby; infant-feeding; infant diseases; early training; the obligation of the home; the obligation of the nation. MISS BINZEL.
42. SPECIAL METHODS OF TEACHING HOME ECONOMICS. Curricula, equipment, methods of teaching for home economics. Required of all students preparing to teach. MISS CLARA BROWN, MISS MILLER.
43. ORGANIZATION AND METHODS FOR RELATED ART-TEACHING. Organization of a related art course and methods of teaching art principles as applied to familiar objects and processes. MISS H. GOLDSTEIN.
44. METHODS IN HOME ECONOMICS EXTENSION WORK. Study of state and national plans for home economics extension work; methods of organization and practical presentation of subject-matter; preparation of illustrative material; field work. MISS LOMBARD, MISS NEWTON.
46. OBSERVATION AND TEACHING: RELATED ART. A course similar to 47, but dealing with the teaching of related art. MISS CLARA BROWN, MISS BACON.
47. OBSERVATION AND TEACHING: FOODS AND HOME MANAGEMENT. Observation of teaching in regular classes; criticism and discussion of class practice, lesson plans, methods, results, and examinations; preparation of lesson plans, and directed teaching of foods and cookery, and home management. MISS MILLER, MRS. DORSEY, MISS LOMBARD, MISS RIDER.
48. OBSERVATION AND TEACHING: TEXTILES AND CLOTHING. A course similar to 47, but dealing with the teaching of textiles and clothing. MISS CLARA BROWN, MISS BACON, MISS EBERSOLE, MRS. MACCOMBER.
49. OBSERVATION AND TEACHING: GENERAL HOME ECONOMICS. A combination of 47 and 48 giving the student experience in teaching both fields of work. Required of students in the general teaching course. Those

who have completed 46, 48 or 49 may register and receive 2 credits. MISS CLARA BROWN, MISS MILLER.

141. PROBLEMS IN HOME ECONOMICS EDUCATION. Problems of administration and supervision of home economics, study of curricula for the day, part-time and evening schools, consideration of home project, the hot lunch, and other related work. \_\_\_\_\_

### HORTICULTURE

Professor WILLIAM H. ALDERMAN; Associate Professor LEROY CADY.

#### COURSES

50. FLORICULTURE. Designed to give the student a working knowledge of the culture and uses of common house plants, annuals, perennials, and greenhouse plants. Lectures, reference reading, and laboratory. MR. CADY.
56. PROPAGATION AND NURSERY PRACTICE. Methods of propagating plants by seed, cuttings, layers, and grafting. Practical work in management of nursery stock, bulbs, and plants. Lectures, reference reading, and field trips. MR. CADY.
71. LANDSCAPE-GARDENING. The practice and principles of landscape-gardening as applied to the home and community. Lectures and field trips to parks and private grounds. MR. CADY.

### MUSIC

COLLEGE OF SCIENCE, LITERATURE, AND THE ARTS

Professor CARLYLE M. SCOTT; Assistant Professor DONALD N. FERGUSON; Instructors ABE PEPINSKY, GERTRUDE REEVES, KARL SCHEURER.

*General statement.*—Credit is offered to students in the College of Agriculture, Forestry, and Home Economics who may wish to elect work in the Department of Music. Nine credits may be obtained. The following courses are recommended:

#### COURSES

- 1-2-3. HARMONY. The study of chords, their construction, relations, and progressions. Written exercises on basses, the harmonization of given melodies. MR. SCOTT.
- 16-17-18. PIANOFORTE. Open to juniors who have mastered technical difficulties of the degree of Czerny's *School of Velocity* and the easier Haydn and Mozart sonatas. The fee is \$25 or \$45 a quarter. MR. SCOTT, MR. FERGUSON, MISS REEVES.
- 22-23-24. VIOLIN. Candidate must be able to play the first ten of Kreutzer's forty études, and the earlier Handel and Mozart sonatas. MR. PEPINSKY, MR. SCHEURER.

40-41-42. ORCHESTRA. MR. PEPINSKY.

43-44-45. CHOIR. MR. SCOTT.

46-47-48. APPRECIATION OF MUSIC. A non-technical course. MISS REEVES.

### PHYSICAL EDUCATION FOR WOMEN

Professor J. ANNA NORRIS; Assistant Professors MAY S. KISSOCK, VALERIA G. LADD, GERTRUDE B. SCHILL, ALICE H. TOLG; Instructors GERTRUDE M. BAKER, GLADYS A. FELLOWS, GERTRUDE K. LYON, GRACE M. ROCKWOOD.

*General statement.*—This department aims primarily to promote the health of the women students. It gives physical examination and advice to all on entrance; plans systematically to keep in close touch with them during their first year in college; conducts yearly consultations with, and examines when necessary, all upper-class students; gives courses in hygiene; organizes physical work to meet the varying needs and physical tastes of students; coöperates closely with the Women's Athletic Association in encouraging and organizing athletic sports; holds regular office hours for the purpose of consultation with all students who desire its advice.

Work in this department is required for all newly entering students (see Courses 1-2-3 and 4), of all sophomores who can not pass the swimming examination, and of all students permitted, for reasons connected with their physical condition, to carry less than the minimum number of credit hours. Physical examinations or consultations required annually of all students.

Elective classes arranged in gymnastics, dancing, swimming, field-hockey, basket-ball, and other organized games.

For a special four-year professional course designed to prepare graduates for the responsible direction of physical education activities see bulletin of the College of Education.

Six credits is the maximum number that can be gained by taking courses in exercise (Courses 34-35-36, 37-38-39, 40-41-42, 43-44-45).

#### *Shower-Bath Fees.*

Elementary Physical Training, per quarter.....	\$2.50
All other exercise courses including swimming, per quarter.....	2.00
Maximum fee for two or more courses, per quarter.....	3.50

### COURSES

1-2-3. ELEMENTARY PHYSICAL TRAINING. Lighter forms of gymnastics, orthopedic exercise, folk dancing, indoor and outdoor games. Individual health consultations. MISS KISSOCK, MISS LADD, DR. TOLG, MISS ROCKWOOD.

4. PRELIMINARY HYGIENE. One lecture a week. The most essential aspects of the care of the body. DR. NORRIS.

- 7-8-9. SOPHOMORE PHYSICAL TRAINING. Floor work, apparatus, and games.
- 10-11-12. SOPHOMORE ORTHOPEDIC GYMNASTICS. For those not able to take regular class work.
- 13-14-15. SOPHOMORE INTERPRETATIVE DANCING. An art and a phase of physical education designed to develop a sense of beauty and body control through rhythmic movements prompted by the imagination. MISS BAKER.
- 16-17-18. SOPHOMORE ORGANIZED GAMES AND FOLK DANCES. Suitable in strength for C-D girls. Conducted outdoors when weather permits.
- 19-20-21. SOPHOMORE MAJOR SPORTS. Suitable in strength for A-B girls. MISS KISSOCK.
- 22-23. SOPHOMORE ELEMENTARY SWIMMING. For beginners. MISS LYON.
- 28-29. SOPHOMORE ADVANCED SWIMMING. MISS LYON.
32. PERSONAL HYGIENE. Care of the personal health; elements of anatomy and physiology. DR. NORRIS.
33. HYGIENE OF THE FAMILY. Eugenics, prenatal care, maternity, puberty, sex education. DR. NORRIS.
- 34-35-36. INTERMEDIATE PHYSICAL TRAINING. Gymnastics and apparatus work. Written abstracts of prescribed reading. MISS ROCKWOOD.
- 37-38-39. ADVANCED PHYSICAL TRAINING. Gymnastics and apparatus work. Written abstracts of prescribed reading. (Not offered in 1921-22.)
- 40-41-42. INTERPRETATIVE DANCING. Similar to 13-14-15. Written abstracts of prescribed reading.<sup>1</sup> MISS BAKER.
- 43-44-45. FOLK DANCING AND ORGANIZED GAMES. Graded games, folk dances, and track for school and playground, two hours. A consideration of nature and function of play and practical conduct of playgrounds, one hour. Written abstracts of prescribed reading.<sup>1</sup> MISS KISSOCK.
- 46-47-48. HOCKEY, BASKET-BALL, AND BASEBALL. Hockey in the autumn, basket-ball in winter, baseball in spring. MISS KISSOCK, MISS ROCKWOOD.
49. GENERAL SWIMMING. For both beginners and advanced swimmers and divers. Shower-bath tickets may be bought of the matron. No registration necessary.

### PHYSIOLOGY

#### MEDICAL SCHOOL

Professors ELIAS P. LYON, JESSE F. McCLENDON, FREDERICK H. SCOTT;  
Associate Professors RICHARD O. BEARD, FRANCIS B. KINGSBURY,

<sup>1</sup> If taken for no credit, no reading or written work will be required.



CHAUNCEY J. V. PETTIBONE; Instructors CHARLES C. GAULT, ESTHER GREISHEIMER; Teaching Fellows HATTIE SPAHR, WILLIAM W. SWANSON.

## COURSES

4. HUMAN PHYSIOLOGY. Lectures and laboratory. DR. LYON, DR. BEARD, MISS GREISHEIMER, MISS SPAHR.
- 100-101. PHYSIOLOGIC CHEMISTRY. The components of the animal body; foods, digestion, the excretia and metabolism. MR. McCLENDON, MR. PETTIBONE, MR. KINGSBURY, MR. SWANSON.
103. PHYSIOLOGY OF MUSIC, NERVE, BLOOD, CIRCULATION, AND DIGESTION. MR. SCOTT, MR. GAULT, MISS GREISHEIMER.
104. PHYSIOLOGY OF THE NERVOUS SYSTEM AND SPECIAL SENSES. Respiration, metabolism, nutrition, and excretion. DR. LYON, MR. SCOTT, MR. GAULT, MISS GREISHEIMER.
150. SOME NEWER ASPECTS OF NUTRITION. Rôle of vitamins and inorganic constituents in nutrition; preservation of food to preserve vitamins; purification of vitamins; effect of vitamin deficiency on mineral metabolism; chemistry of rickets and pellagra. MR. McCLENDON.
153. ADVANCED PHYSIOLOGIC CHEMISTRY. Course arranged by instructors with qualified students for special work. May be taken one or more quarters. MR. McCLENDON, MR. PETTIBONE, MR. KINGSBURY.
163. METABOLISM. Lectures and laboratory work on special phases of metabolism. Lectures may be taken alone; number of students unlimited; laboratory course limited to ten students. MR. PETTIBONE.

## POLITICAL SCIENCE

Professor CEPHAS D. ALLIN; Associate Professor ROBERT E. CUSHMAN.

## COURSES

1. AMERICAN GOVERNMENT. Organization and actual workings of the national government: nature and origin of the American governmental system. \_\_\_\_\_
7. STATE AND LOCAL GOVERNMENT. Comparison of American state governments, especially Minnesota; relation of states to the United States and to local units of government; recent experiments such as initiative and referendum, the recall, and primaries; social and economic legislation. MR. CUSHMAN.

## POULTRY HUSBANDRY

## ANIMAL INDUSTRY GROUP

Professor ARTHUR C. SMITH; Extension Specialists ANNABEL CAMPBELL, NORTON E. CHAPMAN.

## COURSES

1. **POULTRY.** The poultry industry; best methods of care and management of fowls, turkeys, ducks, and geese, and the most important breeds of same. MR. SMITH.
2. **POULTRY-JUDGING.** The history, standard requirements, and common defects of the leading commercial standard breeds and varieties and determination and standard values by the score-card and comparison methods. MR. SMITH.
4. **INCUBATING AND BROODING.** Instruction and practice in incubation and brooding, selection of breeding stock and eggs for hatching, and feeding young chicks. Of practical value to teachers of agriculture and poultry raisers. MR. SMITH.
5. **ADVANCED POULTRY-JUDGING.** Practice in close selection for standard values of all different color patterns and principal types; mating to produce high standard quality. MR. SMITH.

## PSYCHOLOGY

## COLLEGE OF SCIENCE, LITERATURE, AND THE ARTS

Associate Professors RICHARD M. ELLIOTT, WILLIAM S. FOSTER, HERBERT WOODROW; Assistant Professors MABEL R. FERNALD, KARL S. LASHLEY; Instructor CHARLES BIRD.

## COURSES

- I-2-3. **GENERAL PSYCHOLOGY.** An introductory survey of psychology; its material, fundamental laws, applications, and relations to other sciences. MR. ELLIOTT.
- 4-5. **INTRODUCTORY LABORATORY PSYCHOLOGY.** Simple experiments providing the beginner illustrative material and training in the methods of laboratory psychology. MR. FOSTER.
7. **INTRODUCTORY LABORATORY PSYCHOLOGY.** Same as Course 4-5. MR. FOSTER.
- 101-102. **EXPERIMENTAL PSYCHOLOGY.** The theory and technic of the leading methods of experimental investigation in human psychology. One lecture, four laboratory hours per week. MR. WOODROW.
- 108-109. **ADVANCED GENERAL PSYCHOLOGY.** A systematic presentation of the laws of the normal adult mind, based upon study of experimental results. Lectures, recitations, and reports. —————
- 114-115. **HUMAN BEHAVIOR.** An analysis from the point of view of the objective school of psychologists. MR. ELLIOTT.
- 119-120. **ANIMAL BEHAVIOR.** The development of reaction-systems in animals, with emphasis upon the application of studies of animals to the solution of general problems in physiological psychology. MR. LASHLEY.

121. **NEURO-PSYCHOLOGY.** Specialization of functions in the nervous system in relation to behavior. Discussion from the standpoint of psychology of current theories of integration and localization. MR. LASHLEY.
- 125-126. **DIFFERENTIAL PSYCHOLOGY.** Important distinguishing characteristics (psychological) of individuals and of groups. Emphasis on experimental and statistical methods of discovering differences and of making comparisons. Each student participates in investigation of definite problems and analysis of results. MISS FERNALD.
127. **SOCIAL PSYCHOLOGY.** A study of the dependence of familiar forms of social organization and behavior upon the fundamental laws of mental activity. The adjustment of the innate mental equipment of the individual to the norms of social groups. MR. BIRD.
- 135-136. **DYNAMIC PSYCHOLOGY.** The constituents of character; their development, their interrelationship, and their rôle in the determination of human affairs. MR. WOODROW.
- 144-145. **ABNORMAL PSYCHOLOGY.** A systematic review of psychopathology in relation to normal behavior. MR. LASHLEY.

#### PUBLICATIONS AND RURAL JOURNALISM

Professor WILLIAM P. KIRKWOOD; Extension Specialist EDWIN C. TORREY.

*General Statement.*—The aim of this division is to give practical training in agricultural journalism and in agricultural publicity and bulletin-writing.

#### COURSES

- 10-11-12. **AGRICULTURAL JOURNALISM.** Gathering and writing agricultural news and writing articles for the agricultural press and other class papers; farm-paper editing. Lectures and practical work. MR. KIRKWOOD.
19. **AGRICULTURAL PUBLICITY.** Mediums and methods through which information may be brought to the attention of communities and people of the open country. MR. KIRKWOOD.

#### RHETORIC

Assistant Professors ROBERT C. LANSING, HARRY J. BURTIS; Instructors MINNIE M. CLAUSEN, JESSIE W. JENKINS, RUTH MOHL.<sup>1</sup>

*General statement.*—Rhetoric credits will not be granted officially until the close of the second quarter of the senior year.

Any instructor who finds that a student is deficient in English will submit the name of the student together with the evidence to the chairman of the Students' Work Committee. If the evidence warrants, the committee will send the student to the Section of Rhetoric for such additional work in English as is needed. This work the student must take, without credit, to validate his freshman and sophomore rhetoric credits.

<sup>1</sup> Leave of absence, 1921-22.

Students whose work in the rhetoric courses shows at any time an inadequate knowledge of the conventions of English will be required to drop the course and enter a class in elementary rhetoric. These students will be required to complete three additional credit hours in rhetoric.

## COURSES

1. RHETORIC I. Note-taking, gathering and organizing material, oral and written exposition, paragraph structure, supplementary reading. MR. LANSING, MISS CLAUSEN, MISS JENKINS.
2. RHETORIC II. Sentence structure, diction, exposition, supplementary reading. MR. LANSING, MISS CLAUSEN, MISS JENKINS.
3. RHETORIC III. Description, narration, supplementary reading MR. LANSING, MISS CLAUSEN, MISS JENKINS.
4. ELEMENTARY RHETORIC. Elementary grammatical and rhetorical principles. MISS JENKINS.
11. ARGUMENTATION. Gathering evidence, reasoning, briefing, formal and informal argument, persuasion, debating. MR. LANSING, MR. BURTIS.
22. PUBLIC SPEAKING. A practical course in fundamentals of speech-making. Rules of order and practice in conducting assemblies included. MR. BURTIS.
24. ADVANCED PUBLIC SPEAKING. A course in preparing and delivering occasional addresses and informal lectures. MR. BURTIS.
31. SURVEY OF ENGLISH LITERATURE I. Survey of English literature of the sixteenth, seventeenth, and eighteenth centuries. MR. LANSING.
32. SURVEY OF ENGLISH LITERATURE II. Survey of English literature of the nineteenth century. MR. LANSING.

## ROMANCE LANGUAGES

## COLLEGE OF SCIENCE, LITERATURE, AND THE ARTS

Professors EVERETT W. OLMSTED, COLBERT SEARLES; Associate Professors RALPH E. HOUSE, RUTH S. PHELPS; Assistant Professors FRANCIS B. BARTON, JULES T. FRELIN; Professorial Lecturer ANTONIO HERAS; Instructors CHARLES B. DRAKE, MARGUERITE GUINOTTE.

## COURSES

*French*

- 1-2. BEGINNING FRENCH. Pronunciation, grammar, oral exercises, translation. \_\_\_\_\_
- 3-4. INTERMEDIATE FRENCH. Review of grammar, connected prose composition, conversation, and reading of representative authors. \_\_\_\_\_

20. ORAL AND WRITTEN FRENCH. Practical French conversation and composition. \_\_\_\_\_
- 21-22-23. SURVEY OF FRENCH LITERATURE. This course will outline the history of French literature from 1600 to present day, and is prerequisite for the course devoted to special periods. Representative texts will be read. MR. SEARLES, MISS PHELPS, MR. BARTON.
- 50-51-52. FRENCH CONVERSATION. A small amount of outside preparation will be required. MR. FRELIN, MISS GUINOTTE.
- 53-54-55. FRENCH COMPOSITION. MR. FRELIN, MISS GUINOTTE.

### *Spanish*

- 1-2. BEGINNING SPANISH. Pronunciation, grammar, oral exercises, and translation. \_\_\_\_\_
- 3-4. INTERMEDIATE SPANISH. Review of grammar, conversation, connected prose composition, and reading of representative authors.
20. ORAL AND WRITTEN SPANISH. Practical Spanish conversation and composition. MR. DRAKE.
- 50-51-52. SPANISH CONVERSATION. A small amount of outside preparation will be required. MR. HERAS.
- 53-54-55. SPANISH COMPOSITION. MR. HERAS.
- 65-66-67. SURVEY OF SPANISH LITERATURE. An outline of the history of Spanish literature from 1500 to the present day, based upon texts and collateral reading. Prerequisite for courses devoted to special periods. MR. HOUSE.

## SOCIOLOGY AND SOCIAL WORK

### COLLEGE OF SCIENCE, LITERATURE, AND THE ARTS

Professors ARTHUR J. TODD, LUTHER L. BERNARD; Associate Professor MANUEL C. ELMER; Assistant Professors ROSS L. FINNEY, GUSTAV A. LUNDQUIST; Lecturers FRANK J. BRUNO, OTTO W. DAVIS, WILLIAM W. HODSON, ELIZABETH SEEBERG, EDWARD C. WAITE; Instructors LOUIS A. BOETTIGER, CHARLES E. LIVELY; Supervisor of Field Work MILDRED D. MUDGETT.

### COURSES

1. INTRODUCTION TO SOCIOLOGY. Origin and development of human societies; various agencies which have determined the type of social life; social organization, institutions, and progress; bearing of sociology upon other social sciences and arts. MR. BERNARD, MR. ELMER, MR. FINNEY, MR. LUNDQUIST, MR. BOETTIGER, MR. LIVELY.
6. MODERN SOCIAL REFORM MOVEMENTS. A survey of attempts to overcome certain social maladjustments; child labor, the city, bad housing,

- poverty, degeneracy; movements for public health, industrial democracy, social insurance, protection of infancy and youth, public recreation, etc. MR. ELMER, MR. FINNEY, MR. BOETTIGER, MR. LIVELY.
14. RURAL SOCIOLOGY. The background and evolution of country life; rural conveniences, communication, coöperation; rural social institutions, especially the family, school, church, and social center; rural leadership, surveys, organization, social agencies. MR. BERNARD MR. LUNDQUIST, MR. LIVELY.
51. THE BACKGROUND OF DEPENDENCY AND DEFECTIVENESS. This course considers the conditions in contemporary industrial societies out of which the social problems of the dependent and defective arise. MR. BRUNO.
52. TREATMENT OF DEPENDENTS AND DEFECTIVES. This course reviews the methods used or advocated for the prevention and alleviation of poverty and defectiveness with special emphasis upon the method of family case work. MR. BRUNO.
53. TREATMENT OF DELINQUENTS. The causes of crime; nature of the criminal; criminal procedure; methods of treatment (prisons, reformatories, parole, probation); the juvenile offender; juvenile courts; preventive methods. MR. ELMER.
55. HOUSING PROBLEMS. An examination of housing evils and their causes; the various movements for the prevention or improvement of bad housing; town- and city-planning; garden cities. Lectures, readings, field work, and essay. MR. DAVIS.
56. FIELD PRACTICE IN CASE WORK. Designed to give first-hand knowledge of the conditions out of which dependency develops by field work with a social-service agency. MRS. MUDGETT.
57. FIELD PRACTICE IN CASE WORK. Designed for students who have taken 56 and aim to give practice to the methods of treatment outlined in Course 52. MRS. MUDGETT.
60. CHILD WELFARE. Study of social obligations to the child; development of the child-saving movement in the United States; infant and child mortality, recreation, education; courts, institutions, societies, and other public efforts for the child. MR. HOBSON.
- 97-98-99. SUPERVISED FIELD PRACTICE WORK. This is a course in technic open to such students as wish to strengthen their experience in case work. MRS. MUDGETT.
100. SOCIAL PSYCHOLOGY. (Primarily for sociology students.) The social attitudes; their development and modification under social pressures, interactions of individuals and groups. MR. BERNARD.

101. SOCIAL ORGANIZATION. The organization and structure of social groups; the selection of group types and values; the disorganization and reorganization of institutions; purposive social organization. MR. BERNARD.
102. SOCIAL CONTROL. Nature, purpose, and methods of social control; institutional and non-institutional controls; the evolution of sanctions in social control; the revision of the social controls under the influence of modern science. MR. BERNARD.
110. METHODS OF COMMUNITY ORGANIZATION AND SOCIAL WORK IN SMALL TOWNS AND COUNTRY. Concrete problems and methods are emphasized. MR. BERNARD.
114. RURAL SOCIAL INSTITUTIONS. A detailed study of the problems of organization and efficiency of selected rural institutions, especially religious, educational, civic, and recreational. Lectures, discussion, reports. MR. LUNDQUIST.
119. THE FAMILY. The evolution of the family; its various forms and their relation to other social institutions; the service of the family in social evolutions; contemporary problems of the family (standards of living, birth rate, feminism, etc.). MR. ELMER.
120. SOCIAL PROGRESS. A study of the basis for social progress in human nature; analysis of fundamental social institutions with regard to their contributions to human advance; necessary social readjustments to convert drift into progress. MR. TODD.
122. METHODS OF SOCIAL INVESTIGATION. Methods of gathering and presenting community facts; social statistics; social surveys. Lectures, problems, and field work. MR. ELMER.
123. SOCIAL STATISTICS. A study and analysis of social statistics and their bearing upon group life. The course is especially designed to give social workers and public health officials the training necessary to carry on their work successfully. MR. ELMER.
128. CHARITABLE ADMINISTRATION, FINANCE, AND PUBLICITY. A technical study of methods of organizing charitable agencies, of financing them, and of making the public aware of their work. Lectures and practice work. MR. DAVIS.
130. TECHNIC OF FAMILY TREATMENT. An intensive study of social case work as the basis of practical dealing with problems of dependency and defectiveness. Lectures and conferences. MR. BRUNO.
134. LEGAL PROTECTION OF THE CHILD. A study of the relation of law to child welfare. A survey of existing children's protective legislation, of its administration and its future development. MR. HODSON.

- 138-139. MENTAL CASE WORK. A study of mental abnormality and its treatment through case work. Lectures and clinical instruction. (Registration only with consent of the director.) MISS SEEBERG.
140. HISTORY OF SOCIAL THEORY. A rapid survey of the leading social theories from the time of the Greeks, with special reference to the development of sociology in modern times. The theories are related to their social backgrounds. MR. BERNARD.
141. CONTEMPORARY SOCIAL THEORY. An intensive study of developments in the social theory of the late nineteenth and twentieth centuries. MR. BERNARD.
150. SEMINAR. Subject for fall quarter: the literature of social protest. Open to qualified students in either English or sociology. MR. TODD.
- 180-181-182. SEMINAR IN EDUCATIONAL SOCIOLOGY. Problems in the social aspects of educational theory and practice. MR. FINNEY.



**COLLEGE OF AGRICULTURE, FORESTRY, AND  
HOME ECONOMICS**

**TABULAR STATEMENT AND  
PROGRAM OF COURSES**

**1921-1922**

# TABULAR STATEMENT AND PROGRAM OF COURSES

## CLASS HOUR SCHEDULE

	University Farm	Minneapolis Campus
I Hr	7:45- 8:35	8:00- 8:50
II Hr	8:45- 9:35	9:00- 9:50
III Hr	9:45-10:35	10:00-10:50
IV Hr	10:45-11:35	11:00-11:50
V Hr	1:00- 1:50	1:00- 1:50
VI Hr	2:00- 2:50	2:00- 2:50
VII Hr	3:00- 3:50	3:00- 3:50
VIII Hr	4:00- 4:50	4:00- 4:50

Convocation—Thursdays, IV Hour, University Armory

*Final examinations.*—Final examinations will be given during the last four days of the quarter. A detailed schedule will be published in the *Official Daily Bulletin*.

### CLASS SCHEDULE

*Other schools and colleges.*—For programs of classes given in other schools and colleges of the University, not listed below, send to the registrar, University of Minnesota, Minneapolis.

*Abbreviations.*—The following abbreviations are used to indicate names of buildings, those marked with an asterisk (\*) are located on the Minneapolis campus; all others are at University Farm.

A, *Armory	Hr, Horticulture
AB, *Animal Biology	IA, *Institute of Anatomy
Ad, Administration	MA, *Mechanic Arts
BB, Beef Barn	ME, *Main Engineering
C, *Chemistry	MH, *Millard Hall
CB, *Christian Bible School	MS, Meat Shop
Ch, Agricultural Chemistry	Mu, *Music
DB, Dairy Barn	P, *Pillsbury Hall
DH, Dairy Hall	Ph, *Physics
DiH, Dining Hall	PHP, *Public Health and Pathology
Ed, *Education	PP, Plant Pathology
En, Agricultural Engineering	Psy, *Psychology
FH, Farm House	SS, Soil Survey
F, *Folwell Hall	St, Stock Pavilion
G, *Greenhouse	Ve, Veterinary
Gy, Gymnasium	WGm, *Woman's Gymnasium
HE, Home Economics	

*Explanation of course numbers.*—All undergraduate courses are numbered from 1 to 100. All courses open to undergraduates and graduates are numbered from 100 to 200. The letters f (fall), w (winter), and su (summer), indicate the quarters in which the course is offered. For example: 5f,w,s indicates that Course 5 is a one-quarter course given in the fall and repeated in the winter and again in the spring; 10f-11w-12s indicates that Course 10-11-12 is a three-quarter course running through three quarters; 25f,w-26w,s indicates a two-quarter course given in the fall and winter quarters and repeated in the winter and spring quarters.

PROGRAM, 1921-22  
AGRICULTURAL BIOCHEMISTRY

No.	Title	Credits	Offered to	Prerequisite courses
2	Quantitative Methods.....	5	Jr., sr.	Chem. 10 cred.
3	Types of Carbon Compounds	6	Soph., jr., sr.	Chem. 10 cred.
7-8	General Agricultural Biochemistry .....	10	Soph., jr., sr.	Chem. 10 cred.
15	Principles of Animal Nutrition .....	3	Jr., sr.	7-8
101-102	Agricultural Quantitative Analysis .....	6	Jr., sr.	7-8
103	Dairy Chemistry.....	5	Jr., sr.	7-8
106	Chemical Technology of Agricultural Products....	5	Sr.	101-102
108	Chemistry of Wheat and Wheat Products.....	3	Jr., sr.	7-8
110	Flour Laboratory Methods..	5	Jr., sr.	101-102, or Chem. 131-132, parallel 108
111-112	Phytochemistry .....	6	Sr.	Biol. 9 cred., org. chem.
113-114	Biochemical Laboratory Methods .....	4	Si.	Quant. anal., parallel 111-112
116	Chemistry of "Vitamines" and Deficiency Diseases...	3 or 5	Sr.	111-112, 113-114, or Physiol. 101-102, or 7-8 and 15
118	Laboratory Problems in Biochemistry .....	3 or 5	Sr.	111-112, 113-114; or 103 or 110

AGRICULTURAL ECONOMICS

See Economics, page 72.

AGRICULTURAL EDUCATION

COLLEGE OF EDUCATION

No.	Title	Credits	Offered to	Prerequisite courses
11	Principles of Vocational Education .....	3	Jr., sr.‡	None
21	Vocational Education.....	3	Jr., sr.‡	None
41	Apprentice Teaching.....	2	Jr., sr.‡ ††	11, 131

‡ Offered only to those preparing to teach.

†† Students are admitted to this course only when approved by the Division of Agricultural Education.

## AGRICULTURAL BIOCHEMISTRY

No.	Title	Hour	Day	Room	Instructor
2w	Quantitative Methods.....	V, VI, VII, VIII	MWF	7Ch	Mr. Willaman
3f,w† 7f-8w	Types of Carbon Compounds General Agricultural Bio- chemistry .....	I	MTWThFS	201Ch	Mr. Anderson
	Lect.	II	TThS	201Ch	Mr. Anderson
	Lab.	V, VI, VII	MW	203Ch	Mr. Anderson
7w-8s	General Agricultural Bio- chemistry .....				
	Lect.	III	TThS	201Ch	Mr. Anderson
	Lab.	V, VI, VII	MF	203Ch	Mr. Anderson
15f	Principles of Animal Nutri- tion .....	III	MWF	3St	Mr. Palmer
101f†-102w‡	Agricultural Quantitative Analysis .....	V, VI, VII	MWF	105Ch	Mr. Morrow
103s	Dairy Chemistry.....				
	Lect.	V	MWF	251Ch	Mr. Palmer
	Lab.	VI, VII, VIII	MWF	7Ch	Mr. Palmer
106f	Chemical Technology of Agri- cultural Products.....	Ar	Ar	Ar	Mr. Bailey
108s‡	Chemistry of Wheat and Wheat Products.....	I	MWF	201Ch	Mr. Bailey
110s‡	Flour Laboratory Methods..	V, VI, VII, VIII	MWF	7Ch	Mr. Bailey
111f†-112w‡	Phytochemistry .....	III	MWF	201Ch	Mr. Morrow
113f†-114w‡	Biochemical Laboratory Methods .....	V, VI, VII	TTh	7Ch	Mr. Morrow.
116f,w,s‡	Chemistry of "Vitamines" and Deficiency Diseases...	Ar	Ar	Ar	Mr. Sharp, Mr. Palmer, Miss Kennedy
118f,w,s‡	Laboratory Problems in Bio- chemistry .....	Ar	Ar	Ar	Ar

## AGRICULTURAL ECONOMICS

See Economics, page 73.

## AGRICULTURAL EDUCATION

### COLLEGE OF EDUCATION

No.	Title	Hour	Day	Room	Instructor
11f,w	Principles of Vocational Education .....	II	TThS	1PP	Mr. Dyer
11s	Principles of Vocational Education .....	III	MWF	307Ad	Mr. Dyer
21f,w	Vocational Education.....	I	TThS	317Ad	Mr. Mayne
41f	Apprentice Teaching.....				
	Sec. 1	IV	MWF	317Ad	Mr. Field, Mr. Dyer
	2	Ar	Ar	Ar	Mr. Field, Mr. Dyer

† Offered also in the summer session.

‡ Offered also in the summer quarter (eleven weeks).

## COURSES IN HOME ECONOMICS

No.	Title	Credits	Offered to	Prerequisite courses
42	Teaching .....	3	Sr.	41, Agron. 121, 122, 123
53	Consolidated Rural Schools..	3	All†	None
54	Rural Education and Com- munity Life.....	3	All	None
63-64-65	General Agriculture.....	9	All	None
75	Visual Presentation.....	3	Jr., sr.	11
81	Extension Work.....	3	Jr., sr.	6 cred. in farm mgt., 6 cred. in farm crops, 15 cred. in an. ind., 6 cred. in agr. educ.
82	Agricultural Extension Field Course .....	3-10	Jr., sr.	81‡
121	Teachers' Course Home and School Garden Supervision	2	Approval of division	
131	Methods in Teaching High- School Agriculture.....	5	Jr.,† sr.‡	11
151	Organization and Manage- ment .....	5	Sr.‡	11, 21
161-162-163	Fundamentals of Agriculture	9	Jr., sr.‡	None
164	Fundamentals of Agriculture	3	§	None
176	Advanced Visual Presentation	3	Jr., sr.	75
181	Agricultural Statistics and Graphic Representation....	3	Soph., jr., sr.	Farm Eng. 3, 11
191-192-193	Seminar in Agricultural Edu- cation .....	6	Sr.‡	11 cred. in agr. educ.

† Open to juniors on approval of the chief of the division.

‡ Offered only to those preparing to teach.

§ Special reduced courses for consolidated-school principals.

¶ Broad curriculum approved by the Agricultural Education Division and a position approved by the Agricultural Extension Division are also prerequisites to this course.

PROGRAM

No.	Title	Hour	Day	Room	Instructor
41w	Apprentice Teaching..... Sec 1	II	MWF	317Ad	Mr. Field, Mr. Dyer
	2	Ar	Ar	Ar	Mr. Field, Mr. Dyer
41s	Apprentice Teaching.....	Ar	Ar	Ar	Mr. Field
42f,w†	Teaching ..... Sec. 1	I	MWF	317Ad	Mr. Field
	2	Ar	Ar	Ar	Mr. Field
53s‡	Consolidated Rural Schools..	Ar	Ar	Ar	Mr. Dyer
54w‡	Rural Education and Com- munity Life.....	Ar	Ar	Ar	Mr. Dyer
63f-64w-65s	General Agriculture.....	Ar	Ar	Ar	Mr. Storm, Mr. Mayne, Mr. Field
75f,w	Visual Presentation.....	Ar	Ar	Ar	Ar
81s	Extension Work.....	II	TThS	Ar	Mr. Storm
82f,w,s‡	Agricultural Extension Field Course .....	Ar	Ar	Ar	Mr. Storm
121w	Teachers' Course, Home and School Gardening.....	Ar	Ar	Ar	Mr. Field
131f‡	Methods in Teaching High- School Agriculture.....	II	MTWFS	317Ad	Mr. Field
131s‡	Methods in Teaching High- School Agriculture.....	III	MTWFS	317Ad	Mr. Field
151f	Organization and Manage- ment .....	III	MTWThF	317Ad	Mr. Storm, Mr. Dyer
151s	Organization and Manage- ment .....	IV	MTWFS	317Ad	Mr. Storm, Mr. Dyer
161f-162w- 163s	Fundamentals of Agriculture	Ar	Ar	Ar	Mr. Storm
164w ‡	Fundamentals of Agriculture	Ar	Ar	Ar	Mr. Field
176s‡	Advanced Visual Presentation	Ar	Ar	Ar	Ar
181w	Agricultural Statistics and Graphic Representation....	Ar	Ar	Ar	Ar
191f-192w- 193s¶	Seminar in Agricultural Education .....	Ar	Ar	Ar	Mr. Storm

† It may be possible for a limited number to take this course in the spring quarter. Approval of the instructor and chief of division is required before registering.

‡ Offered also during the summer session.

¶ A continuation of this course, (194 su), carrying 2 credits is offered only during the summer session.

## COURSES IN HOME ECONOMICS

## .AGRONOMY AND FARM MANAGEMENT

No.	Title	Credits	Offered to	Prerequisite courses
1	Farm Crops.....	3	All	None
11	Farm Machinery.....	3	Jr., sr.	None
101	Farm Management I.....	3	Jr., sr.	1, Econ. 6
102	Farm Management II: Or- ganization .....	3	Sr.	1, Econ. 6, An. Husb. 6 or 8, Soils 5
103	Farm Management II: Op- eration .....	3	Sr.	102
104	Farm Management III.....	3	Sr.	101, 102
121	Cereal Crops.....	3	Jr., sr.	1, bot. 9 cred.
122	Corn and Potato Crops.....	3	Jr., sr.	1, bot. 9 cred.
123	Forage and Fiber Crops....	3	Jr., sr.	1, bot. 9 cred.
131	Principles • Genetics.....	3	Jr., sr.	Bot. 9 cred., an. biol. 9 cred.
132	Farm Crops Plant-Breeding..	3	Jr., sr	131

## ANIMAL BIOLOGY

## COLLEGE OF SCIENCE, LITERATURE, AND THE ARTS

No.	Title	Credits	Offered to	Prerequisite courses
1-2	General Zoology.....	10†	All	None
9-10	Cytology and Technic.....	10†	Soph., jr., sr.	14-15-16
11	Cytology and Technic.....	5	All	14-15-16
14-15-16	General Zoology (Agr., For., and H. E.).....	9‡	All	None

† The full course must be completed before credit will be allowed.

‡ The full course must be completed before credit will be allowed except that students in home economics may receive credit for the first two quarters work when Botany 8 has also been satisfactorily completed.



AGRONOMY AND FARM MANAGEMENT

No.	Title	Hour	Day	Room	Instructor
1f,w,5†	Farm Crops.....	III, IV	MWF	2Ad	Mr. McGinnis, Mr. Steinmetz
11s	Farm Machinery.....	V, VI, VII	WF	BAd	Mr. Bassett
101s	Farm Management I.....	II	TThS	24Ad	Mr. Pond
102f	Farm Management II: Or- ganization .....	II	MWF	24Ad	Mr. Boss, Mr. Garey
102w†	Farm Management II: Or- ganization .....	I	MWF	24Ad	Mr. Boss, Mr. Garey
103w	Farm Management II: Opera- tion .....	II	MWF	24Ad	Mr. Boss, Mr. Garey
103s†	Farm Management II: Opera- tion .....	I	MWF	24Ad	Mr. Boss, Mr. Garey
104s	Farm Management III.....	II	MWF	24Ad	Mr. Boss
121f	Cereal Crops.....	V, VI, VII	TTh	2Ad	Mr. Arny, Mr. McGinnis
122w	Corn and Potato Crops.....	V, VI, VII	TTh	2Ad	Mr. Arny, Mr. McGinnis
123s	Forage and Fiber Crops.....	V, VI, VII	TTh	2Ad	Mr. Arny, Mr. McGinnis
131f	Principles of Genetics.....	I	TThS	24Ad	Mr. Hayes Mr. Dorsey
132s†	Farm Crops Plant-Breeding..	I	TThS	24Ad	Mr. Hayes, Mr. Griffee

ANIMAL BIOLOGY

COLLEGE OF SCIENCE, LITERATURE, AND THE ARTS

No.	Title	Hour	Day	Room	Instructor
1f-2w*	General Zoology.....				
	Sec. 1 Lab.	III, IV	MWF	101AB	Ar
	Lect.	III	TThS		
		IV	T	313AB	Ar
	2 Lab.	V, VI, VII	TTh	101AB	Ar
	Lect.	V	MWF		
		VI	F	313AB	Ar
	3 Lab.	V, VI	MWF	101AB	Ar
	Lect.	V, VI	TTh	313AB	Ar
1w-2s*	General Zoology.....				
	Lab.	I, II	MWF	101AB	Ar
	Lect.	I	T		
		II	TThS	313AB	Ar
1s-2w*	General Zoology.....				
	Lab.	V, VI, VII	TTh	101AB	Ar
	Lect.	V	MWF		
		VI	F	313AB	Ar
9f-10w*	Cytology and Technic.....	III, IV	MTWFS	201,211AB	Mr. Downey
11s*	Cytology and Technic.....	III, IV	MTWFS	201,211AB	Mr. Nachtrieb
14f-15w-16s	General Zoology, (Agr., For., and H.E.).....	V, VI, VII	TTh	101,313AB	Ar

† Offered also in the summer session.

\* Offered on the Minneapolis campus.

## COURSES IN HOME ECONOMICS

17-18	General Physiology.....	10†	Soph., jr., sr.	14 cred. or 9 cred. and chem. or phys. 10 cred.
23	Principles of Animal Behavior	3	All	14-15-16
37-38-39	General Entomology.....	9†	Soph., jr., sr.	14-15-16
43	Introductory Entomology....	5	All	14-15-16
44	Animal Parasites.....	3	All	14-15-16
46-47	Ornithology .....	6†	Soph., jr., sr.	14-15-16
48	General Ecology.....	5	All	14-15-16
107	Protozoology .....	3	Jr., sr.	14 cred. incl. 14-15-16
109-110	General Physiology.....	10†	Jr., sr.	20 cred.
117-118-119	Ecology of Insects.....	9†	Jr., sr.	43
124	Advanced Ecology.....	5	Jr., sr.	117-118-119
125-126-127	Advanced Entomology.....	9†	Jr., sr.	37-38-39 or 43
130	Biology and Taxonomy of the Aphididae .....	3	Jr., sr.	19 cred. incl. 14-15-16
139-140	Histology and Development of Insects.....	6†	Jr., sr.	37-38-39 or 43
144-145-146	Animal Parasites and Parasitism .....	9	Jr., sr.	37-38-39 or 43
181-182	Embryology .....	6	Jr., sr.	11 or equiv.
183	Genetics and Eugenics.....	3	Jr., sr.	14-15-16, 5 cred. in an. biol. or bot.

For additional courses, see the bulletin of the College of Science, Literature, and the Arts.

## ANTHROPOLOGY AND AMERICANIZATION TRAINING

## COLLEGE OF SCIENCE, LITERATURE, AND THE ARTS

No.	Title	Credits	Offered to	Prerequisite courses
1	Introduction to Anthropology	5	3d qu. fr., Soph., jr., sr.	None
4	Cultural Anthropology.....	3	Soph., jr., sr.	1
5	General Immigration.....	3	Soph., jr., sr.	1
12	Ethnology .....	3	Soph., jr., sr.	1
110	Physical Anthropology and Amalgamation .....	3	Jr., sr.	1, an. biol. 9 cred.
113	The American People, Older Immigrants .....	3	Jr., sr.	3 courses
114	The American People, Newer Immigrants .....	3	Jr., sr.	3 courses
115	The American People, Americanisms and Assimilation..	3	Jr., sr.	3 courses

For additional courses, see the bulletin of the College of Science, Literature, and the Arts.

† The full course must be completed before credit will be allowed.

PROGRAM

17f-18w*	General Physiology.....	V, VI, VII V, VI, VII, VIII	MW			
23s*	Principles of Animal Behavior	V, VI, VII	F	10AB	Mr. Lund	
37f-38w-39s*	General Entomology.....	I, II	TTh	10AB	Mr. Lund	
43s*	Introductory Entomology....	I, II	MWF	208,10AB	Mr. Oestlund	
44f*	Animal Parasites.....	V, VI	MWThFS	208,10AB	Mr. Oestlund	
44s*	Animal Parasites.....	V, VI, VII	MWF	208,10AB	Mr. Riley	
46w-47s*	Ornithology .....	V, VI, VII	WF	208,10AB	Mr. Riley	
48s*	General Ecology.....	V, VI, VII V, VI, VII, VIII	TTh	211,314AB	Mr. Roberts	
107s*	Protozoology .....	I, II	MW			F 208,10AB Mr. Chapman
109f 110w*	General Physiology.....	V, VI, VII V, VI, VII, VIII	MWF	211,213AB	Mr. Sigerfoos	
117f-118w- 119s*	Ecology of Insects.....	V, VI, VII	F	10AB	Mr. Lund	
124†*	Advanced Ecology.....	Ar	TTh	208,10AB	Mr. Chapman	
125f-126w- 127s*	Advanced Entomology.....	III, IV	Ar	Ar	Ar	
130w*	Biology and Taxonomy of the Aphididae .....	III, IV	TThS	208,10AB	Mr. Oestlund	
139f-140w	Histology and Development of Insects.....	II, III, IV	MWF	208,10AB	Mr. Oestlund	
144f-145w- 146s*	Animal Parasites and Para- sitism .....	V, VI, VII	TTh	324Ad	Mr. Riley	
181f-182w*	Embryology .....	V, VI	WF	208,10AB	Mr. Riley	
183s*	Genetics and Eugenics.....	III	MWF	201,211AB	Mr. Nachtrieb	
			MWF	211AB	Mr. Nachtrieb	

ANTHROPOLOGY AND AMERICANIZATION TRAINING

COLLEGE OF SCIENCE, LITERATURE, AND THE ARTS

No.	Title	Hour	Day	Room	Instructor
if*	Introduction to Anthropology				
	Sec. 1	II	MWThFS	15F	Mr. Jenks
	2	V	MTWThF	15F	Mr. Grace
1w*	Introduction to Anthropology	V	MTWThF	15F	Mr. Grace
1s*	Introduction to Anthropology				
	Sec. 1	II	MWThFS	15F	Mr. Grace
	2	V	MTWThF	25F	Mr. Grace
4w*	Cultural Anthropology.....	II	MWF	25F	Mr. Jenks
5f,w s*	General Immigration.....	III	TThS	15F	Mr. Grace
12f*	Ethnology .....	II	TThS	12F	Miss Speaker
12w*	Ethnology .....	III	MWF	25F	Mr. Grace
12s*	Ethnology .....	II	TThS	25F	Miss Speaker
110s*	Physical Anthropology and Amalgamation .....	II	MWF	25F	Mr. Jenks
113f*	The Older Immigrants.....	III	MWF	15F	Mr. Jenks
114w*	The Newer Immigrants.....	III	MWF	15F	Mr. Jenks
115s*	Americanisms and Assimila- tion .....	III	MWF	15F	Mr. Jenks

\* Offered on the Minneapolis campus.

† Offered in the summer session.

## COURSES IN HOME ECONOMICS

## ANIMAL HUSBANDRY

## ANIMAL INDUSTRY GROUP

No.	Title	Credits	Offered to	Prerequisite courses
1	Types and Breeds of Live- stock .....	5	All	None
2	Livestock-Judging .....	3	Soph., jr., sr.	1
3	Market Classes of Livestock	6	Jr., sr.	2†
5	Livestock-Breeding .....	3	Jr., sr.	Agron. 131
6	Livestock-Feeding .....	5	Jr., sr.	Agr. Biochem. 15
7	Meats .....	3	Sr.	2, Agr. Biochem. 15
8	Fundamentals of Feeding....	3	Jr., sr.	Agr. Biochem. 15
9	Pedigrees and Herd Books..	3	Jr., sr.	5
101	Advanced Stock-Judging....	3	Sr.	2, 3-4
102	Horse Husbandry.....	3	Jr., sr.	2, 3-4, 5, 6
103	Beef-Cattle Husbandry.....	3	Jr., sr.	2, 3-4, 5, 6
104	Sheep Husbandry.....	3	Jr., sr.	2, 3-4, 5, 6
105	Swine Husbandry.....	3	Jr., sr.	2, 3-4, 5, 6
106	Advanced Meats.....	3	Jr., sr.	7
107	Meat Problems.....	3	Sr.	106
108	Seminar .....	3	Sr.	5, 6

## ART EDUCATION

## COLLEGE OF EDUCATION

No.	Title	Credits	Offered to	Prerequisite courses
29-30-31††	Fundamental Principles of Design .....	9	All	None
32-33-34	Freehand Drawing and Com- position .....	9‡	All	None
40-41-42	A Still Life, B Composition, and C Sketch Principles of Harmony in Form and Color.....	9	Soph., jr., sr.	29-30-31 or in- structor's per- mission

For additional courses see the bulletin of the College of Education.

‡ Three one-unit courses each term which may be registered for separately.

† No prerequisite except for students who take courses in this division in addition to 1 and 3.

†† Home economics students who have completed H. E. 51 and 53 will be admitted to the last quarter's work.

PROGRAM

ANIMAL HUSBANDRY  
ANIMAL INDUSTRY GROUP

No.	Title	Hour	Day	Room	Instructor
1f,w	Types and Breeds and Live- stock .....	I, II	MTWFS	CSt	Mr. Carnes
2f	Livestock-Judging .....	III, IV	MWF	CSt	Mr. Anderson
3f-4w	Market Classes of Livestock Lect.	I	M	WSt	Mr. Ferrin
	Lab.	I, II	WF	WSt	Mr. Ferrin
5w	Livestock-Breeding .....	IV	MWF	3St	Mr. Peters
6w	Livestock-Feeding .....	III	MTWFS	3St	Mr. Ferrin
7f	Meats .....	V, VI, VII	TTh	MS	Mr. Anderson
8s	Fundamentals of Feeding....	I	TThS	3St	Mr. Harvey, Mr. Rayburn
9s	Pedigrees and Herd Books..	II	TThS	3St	Mr. Ferrin
101f	Advanced Stock-Judging.....	VI, VII	MWF	CSt	Mr. Ferrin
102s	Horse Husbandry.....				
	Lect.	II	TTh	WSt	Mr. Peters
	Lab.	V, VI, VII	F	CSt	Mr. Peters
103s	Beef-Cattle Husbandry.....				
	Lect.	III	MW	3St	Mr. Carnes
	Lab.	V, VI, VII	T	BB	Mr. Carnes
104s	Sheep Husbandry.....				
	Lect.	IV	WF	3St	Mr. Anderson
	Lab.	V, VI, VII	M	CSt	Mr. Anderson
105s	Swine Husbandry.....				
	Lect.	III	TS	3St	Mr. Ferrin
	Lab.	V, VI, VII	Th	CSt	Mr. Ferrin
106w	Advanced Meats.....	V, VI, VII	WF	MS	Mr. Anderson
107s	Meat Problems.....				
	Lect.	IV	TS	MS	Mr. Anderson
	Lab.	V, VI, VII	W	MS	Mr. Anderson
108s	Seminar .....	II	MWF	3St	Mr. Peters

ART EDUCATION

COLLEGE OF EDUCATION

No.	Title	Hour	Day	Room	Instructor
29f-30w-31s*	Fundamental Principles of Design .....				
	Lect.	III	TThS	401,404F	Miss Raymond
	Sec. 1 Lab.	II	TThS	401,404F	Miss Raymond
	2	IV	TThS	401,404F	Miss Raymond
32f-33w-34s*	Freehand Drawing and Composition .....				
	Comp. Sketch	II	W	401,404F	Miss Raymond
	Sec. 1 Lab.	III	F	401,404F	Miss Raymond
	2	I	MWF	401,404F	Miss Raymond
		IV	MWF	401,404F	Miss Raymond
40f-41w-42s*	Principles of Harmony in Form and Color.....				
	Lect.	II	TThS	406F	Miss Raymond
	Sec. 1 Lab.	I	TThS	406F	Miss Raymond
	2	III	TThS	406F	Miss Raymond

\* Offered on the Minneapolis campus.

## COURSES IN HOME ECONOMICS

## BACTERIOLOGY AND IMMUNOLOGY

## MEDICAL SCHOOL

No.	Title	Credits	Offered to	Prerequisite course:
1	General Bacteriology.....	5	Soph., jr., sr.	Chem. 10 cred.
103	Special Bacteriology for Students of Agriculture....	4	Jr., sr.	1
105	Household Bacteriology.....	3	Jr., sr.	1

For additional courses see the bulletin of the Medical School.

## BEE CULTURE

No.	Title	Credits	Offered to	Prerequisite courses
1	Elements of Beekeeping I...	3	All	None
2	Elements of Beekeeping II..	3	All	None
3	Advanced Beekeeping I....	3	Soph., jr., sr.	1, 2
4	Advanced Beekeeping II....	3	Soph., jr., sr.	1, 2
5	Queen-Raising .....	3	Jr., sr.	3, 4

## BOTANY

## COLLEGE OF SCIENCE, LITERATURE, AND THE ARTS

No.	Title	Credits	Offered to	Prerequisite courses
1-2	General Botany.....	10†	All	None

† The full course must be completed before credit will be allowed.

PROGRAM

BACTERIOLOGY AND IMMUNOLOGY

MEDICAL SCHOOL

No.	Title	Hour	Day	Room	Instructor
1f-w-s*† 103w*	General Bacteriology.....	V, VI, VII	MWF	MH	Ar
	Special Bacteriology for Students of Agriculture...	III, IV	TS	MH	Ar
		IV	Th	MH	Ar
105f*	Household Bacteriology.....	VI, VII	TTh	MH	Ar

BEE CULTURE

No.	Title	Hour	Day	Room	Instructor
1f,w,s†	Elements of Beekeeping I..				
	Sec. 1 Lect.	III	TThS	FH	Mr. Jager
	Lab.	Ar	Ar	FH	Mr. Jager
	2 Lect.	III	MWF	FH	Mr. Jager
	Lab.	Ar	Ar	FH	Mr. Jager
2f,w,s†	Elements of Beekeeping II..				
	Sec. 1 Lect.	IV	MW	FH	Mr. Jager
	Lab.	Ar	Ar	FH	Mr. Jager
	2 Lect.	IV	TS	FH	Mr. Jager
	Lab.	Ar	Ar	FH	Mr. Jager
3f w	Advanced Beekeeping I.....				
	Lect.	V	TTh	FH	Mr. Jager
	Lab.	Ar	Ar	FH	Mr. Jager
4w,s	Advanced Beekeeping II.....				
	Lect.	VI	TTh	FH	Mr. Jager
	Lab.	Ar	Ar	FH	Mr. Jager
5‡	Queen-Raising .....				Mr. Jager

BOTANY

COLLEGE OF SCIENCE, LITERATURE, AND THE ARTS

No.	Title	Hour	Day	Room	Instructor
1f-2w*	General Botany.....				Mr. Durand in charge
	Sec. 1 Lab.	I, II	MWF	212-214-220P	
	Quiz	I	T	212-214-220P	
	Lect.	II	TThS	210P	
	2 Lab.	III, IV	MWF	212-214-220P	
	Quiz	IV	T	212-214-220P	
	Lect.	III	TThS	210P	
		III, IV	S	210P	
	3 Lab.	V, VI	MWF	212 214-220P	
	Quiz	V	Th	210P	
	Lect.	V, VI	T	210P	
		VI	Th	210P	

\* Offered on the Minneapolis campus.  
 † Offered also in the summer session.  
 ‡ Offered only in the summer session.

## COURSES IN HOME ECONOMICS

No.	Title	Credits	Offered to	Prerequisite courses
4-5-6	General Botany for Agriculture and Forestry Students	9†	All	None
7	Taxonomy of Flowering Plants .....	5	All	2, 6, or 8
8	General Botany for Home Economics Students.....	5	All	None
11	Algae and Fungi.....	5	Soph., jr., sr.	2, 6, or 8
15	Anatomy of Vascular Plants	5	Soph., jr., sr.	2, 6, or 8
20	Forest Ecology.....	3	Soph., jr., sr.	14 cred., for. cred.
51	Histological Methods.....	3	Jr., sr.	14 cred.
52	Plant Physiology.....	5	Jr., sr.	14 cred.
53	Botany of Economic Plants..	5	Jr., sr.	14 cred.
54	Elementary Ecology.....	5	Jr., sr.	14 cred.
55	Algae .....	5	Jr., sr.	14 cred.
62	Bryophytes and Pteridophytes	5	Jr., sr.	14 cred.
63	Angiosperms and Gymnosperms .....	5	Jr., sr.	7 or 62
107	Bryophytes .....	5	Sr.	7, 62
108	Pteridophytes .....	5	Sr.	7, 62
110	Gymnosperms .....	5	Sr.	7, 63
113-114-115	Advanced Taxonomy.....	9	Jr., sr.	7
118-119	Cytology .....	6†	Jr., sr.	51
131	Field Ecology.....	5	Sr.	54
133	Forest Geography of North America .....	5	St.	54
141	Physical Phases of Plant Physiology .....	5	Sr.	52, org. chem.
142	Plant Metabolism.....	5	Sr.	52, org. chem.
143	Plant Metabolism and Growth .....	5	Sr.	52, org. chem.
144	Plant Microchemistry.....	5	Sr.	52, org. chem.

For additional courses, see the bulletin of the College of Science, Literature, and the Arts.

† The full course must be completed before credit will be allowed.



PROGRAM

No.	Title	Hour	Day	Room	Instructor
1s-2f*	General Botany.....				Mr. Durand in charge
	Lab.	I, II	TThS	212-214-220P	
	Quiz	I	W	210P	
	Lect.	II	MWF	210P	
4f-5w-6s*	General Botany (Agr. and For.) .....				Mr. Durand
	Lect.	VII	TTh	210P	
	Lab.	V, VI	TTh	212-214-220P	
7s*	Taxonomy of Flowering Plants .....				Mr. Rosendahl in charge
	Lab.	V, VI	MWF	212-214P	
	Quiz	VI	Th	210P	
	Lect.	V	TTh	210P	
8s*	General Botany (Home Econ.) .....				Mr. Durand
	Lect.	II	TThS	210P	
	Lab.	I, II	MWF	212-214-220P	
11f*	Algae and Fungi.....	I, II	TWThFS	10AB	Mr. Johnson
15w*	Anatomy of Vascular Plants	III, IV	MTWFS	202AB	Mr. Butters
20f*	Forest Ecology.....	Ar	Ar	Ar	Ar
51f*	Histological Methods.....	I, II	MWF	202AB	Mr. Rosendahl
52f*	Plant Physiology.....	III, IV	MTWFS	G	Mr. Knight
53w*	Botany of Economic Plants..	III, IV	MTWFS	G	Mr. Knight
54s*	Elementary Ecology.....	III, IV	MTWFS	G	Mr. Cooper
55s*	Algae .....	III, IV	MTWFS	10AB	Miss Tilden
62w*	Bryophytes and Pteridophytes .....	I, II	TWThFS	202AB	Mr. Huff
63s*	Gymnosperms and Angiosperms .....	I, II	TWThFS	202AB	Mr. Butters
107w*	Bryophytes .....	Ar	Ar	Ar	Mr. Durand
108w*	Pteridophytes .....	Ar	Ar	Ar	Mr. Butters
110w*	Gymnosperms .....	Ar	Ar	Ar	Mr. Butters
113f-114w-115s*	Advanced Taxonomy.....	V, VI	MWF	202AB	Mr. Rosendahl
118w-119s*	Cytology .....	I, II	MWF	202AB	Mr. Rosendahl
131f*	Field Ecology.....	Ar	Ar	Ar	Mr. Cooper
133s*	Forest Geography of North America .....	V, VI	MWF	G	Mr. Cooper
141f*	Physical Phases of Plant Physiology .....	I, II	TWThFS	G	Mr. Knight, Mr. Harvey
142w*	Plant Metabolism.....	I, II	TWThFS	G	Mr. Knight, Mr. Harvey
143s*	Plant Metabolism and Growth .....	I, II	TWThFS	G	Mr. Knight, Mr. Harvey
144s*	Plant Microchemistry.....	Ar	Ar	G	Mr. Harvey

\* Offered on the Minneapolis campus.

## COURSES IN HOME ECONOMICS

## CHEMISTRY

## SCHOOL OF CHEMISTRY

No.	Title	Credits	Offered to	Prerequisite courses
1-2-3	General Inorganic Chemistry	12†	All	None
9-10	General Inorganic Chemistry	10†	All	H.-s. chem.
11	Qualitative Chemical Analysis	4	Soph., jr., sr.	1-2-3
12-13	Qualitative Chemical Analysis	10†	Soph., jr., sr.	9-10
20-21	Quantitative Analysis.....	10	Soph., jr., sr.	12-13
35-36	Organic Chemistry.....	10†	Jr., sr.	15 cred. in chem.
126	Sanitary Water Analysis....	1 or 2	Jr., sr.	21
140-141‡-142	Physical Chemistry.....	9, 12, or 15	Jr., sr.	2 yrs. chem., 1 yr. phys.

For additional courses see the bulletin of the School of Chemistry.

† The full course must be completed before credit will be allowed.

‡ The first two quarters must be completed before credit is allowed.

PROGRAM

CHEMISTRY

SCHOOL OF CHEMISTRY

No.	Title	Hour	Day	Room	Instructor
1f-2w*	General Inorganic Chemistry				
	Lect.	VI	MWF	100C	Mr. Sneed
	Lab.	VII, VIII	MW	210C	Mr. Sneed
3s*	General Inorganic Chemistry				
	Lect.	VI	MF	100C	Mr. Sneed
	Lab.	VII, VIII	S MF	100C 210C	Mr. Sneed Mr. Sneed
9f-10w*	General Inorganic Chemistry				
	Lect.	VI	MWF	100C	Mr. Sneed
	Lab.	VII, VIII	MWF	210C	Mr. Sneed
11f*	Qualitative Chemical Analysis				
	Lect.	IV	MWF	225C	Miss Cohen
	Lab.	V, VI	MW	210C	Miss Cohen
11s*	Qualitative Chemical Analysis				
	Lect.	V	MWF	100C	Mr. Henderson, Mr. Fosse
	Lab.	V, VI or VII, VIII	TTh TTh	210C 210C	
12s*	Qualitative Chemical Analysis				
	Lect.	II	MWF	100C	Mr. Sneed
	Lab.	I, II, III	ThS	210C	Mr. Sneed
12f-13w*	Qualitative Chemical Analysis				
	Lect.	II	TThS	Ar	Ar
	Lab.	V, VI, VII	MW	Ar	Ar
13f*	Qualitative Chemical Analysis				
	Lect.	II	TThS	325C	Mr. Sneed
	Lab.	V, VI, VII	MW	210C	Mr. Sneed
16w-21s*	Quantitative Analysis				
	Lect.	V	M	325C	Mr. Geiger
	Rec.	V	F	315C	Mr. Geiger
	Lab.	VI-VIII	MF	310C	Mr. Sidener, Mr. Geiger
		V-VIII	W	310C	Mr. Sidener, Mr. Geiger
35f-36w*	Organic Chemistry				
	Lect.	III	MWF	325C	Mr. Hunter
	Lab.	V-VII	TTh	10C	Mr. Hunter, Mr. Lauer
126s*	Sanitary Water Analysis				
	Lect.	V	T	315C	Mr. Sidener
	Lab.	VI-VII	T	310C	Mr. Sidener, Mr. Geiger
	Lab.	V-VII	Th	310C	Mr. Sidener, Mr. Geiger
140f-141w- 142s*	Physical Chemistry				
	Lect.	IV	MWF	325C	Mr. MacDougall
	Lab.	V-VII	F	117C	Mr. MacDougall
	Rec.	IV	S	115C	Ar

\* Offered on the Minneapolis campus.

## COURSES IN HOME ECONOMICS

**DAIRY HUSBANDRY**  
**ANIMAL INDUSTRY GROUP**

No.	Title	Credits	Offered to	Prerequisite courses
1	Elements of Dairying.....	5	All	None
2	Dairy Bacteriology.....	5	Soph., jr., sr.	Bact. 1
3	Dairy Products.....	5	Jr., sr.	1, 2
4	Cheese-Factory Practice.....	3	Jr., sr.	1, 3
5	Creamery Practice.....	3	Jr., sr.	1, 3
101	Milk Production.....	5	Jr., sr.	1
102	Market Milk.....	3	Jr., sr.	1, 2
103	Dairy-Stock Feeding.....	3	Sr.	101, Agr. Biochem. 15
104	Advanced Study of Dairy Breeds .....	3	Jr., sr.	101
105	Seminar I.....	1	St.	3 courses in dy. husb.
106	Seminar II.....	1	Sr.	3 courses in dy. husb.
107	Seminar III.....	1	Sr.	3 courses in dy. husb.

## ECONOMICS

## SCHOOL OF BUSINESS

No.	Title	Credits	Offered to	Prerequisite courses
5	General Economics.....	5	Soph., jr., sr.	None
6	Agricultural Economics.....	3	Soph., jr., sr.	3-4, or 5
13	Agricultural Statistics.....	5	Soph., jr., sr.	3-4, or 5
20	Economic Geography of Agriculture .....	5	All	None
21	Economic History of Agriculture .....	5	All	None

DAIRY HUSBANDRY  
ANIMAL INDUSTRY GROUP

No.	Title	Hour	Day	Room	Instructor
1f,w,s	Elements of Dairying..... (Limited to 30)				
	Lect.	III	TWS	39DH	Mr. Keithley
	Lab.	III, IV	MF	Lab.DH	Mr. Dahle, Mr. Anderson
2w	Dairy Bacteriology..... (Limited to 12)				
	Lect.	IV	TS	40DH	Mr. Macy
	Lab.	V, VI	MWF	30DH	Mr. Macy
3f	Dairy Products.....				
	Lect.	IV	MWF	39DH	Mr. Keithley
	Lab.	V, VI	WF	Lab.DH	Mr. Dahle
4†	Cheese-Factory Practice.....	....	....	....	Mr. Keithley
5†	Creamery Practice.....	....	....	....	Mr. Keithley
101f	Milk Production.....				
	Lect.	IV	MTWF	40DH	Mr. Eckles
	Lab.	V, VI, VII	Th	Ar	Mr. Rayburn
102s	Market Milk.....	VI, VII	MWF	39DH	Mr. Keithley, Mr. Macy
103w	Dairy-Stock Feeding.....	III	MWF	30DH	Mr. Eckles
104s	Advanced Study of Dairy Breeds .....				
	Lect.	III	S	40DH	Mr. Rayburn
	Lab.	V, VI	TTh	40DH	Mr. Rayburn
105f	Seminar I.....	II	S	30DH	Mr. Eckles
106w	Seminar II.....	II	S	30DH	Mr. Eckles
107s	Seminar III.....	II	S	30DH	Mr. Eckles

ECONOMICS  
SCHOOL OF BUSINESS

No.	Title	Hour	Day	Room	Instructor
5f,w,†	General Economics (Agriculture and Forestry).....				
	Sec. 1	I	MWThFS	106En	Ar
	2	III	MTWFS	4PP	Ar
5w,s	General Economics (Home Economics) .....	II	MTWThF	203HE	Ar
6f,w,s,†	Agricultural Economics.....				
	Sec. 1	I	TThS	1PP	Ar
	2	II	TThS	307Ad	Ar
13f	Agricultural Statistics.....				
	Lect.	III	TThS	307Ad	Mr. Working
	Lab.	V, VI	TTh	307Ad	Mr. Working
20f	Economic Geography of Agriculture .....	IV	MTWFS	307Ad	Mr. Holmes
21w	Economic History of Agriculture .....	IV	MTWFS	307Ad	Ar

† Offered only in the summer session.

‡ Offered also in the summer session.

## COURSES IN HOME ECONOMICS

No.	Title	Credits	Offered to	Prerequisite courses
25-26	Principles of Accounting....	8‡	Soph., jr., sr.	3-4, 5, or parallel
28	Principles of Accounting (for Agr., For., and H.E.).....	5	Soph., jr., sr.	3-4, or 5
50	Farm Finance.....	3	Jr., sr.	3-4, or 5 and 6
73	Railway Traffic and Rates..	3	Jr., sr.	3-4, or 5 and 6
85	Principles of Marketing.....	3	Jr., sr.	3-4, or 5 and 6
88	Advertising and Selling.....	3	Jr., sr.	85, Psychol. 156
90	Economics of Consumption..	3	Jr., sr.	3-4, or 5 and 6
91	Principles of Organization and Management.....	3	Soph., jr., sr.	3-4, or 5

‡ The full course must be completed before credit will be allowed.

PROGRAM

No.	Title	Hour	Day	Room	Instructor
25f-26w*	Principles of Accounting....				Mr. Heilman in charge
	Sec. 1	I	MWF	301MA	
	2	II	MWF	301MA	
	3	II	MWF	303MA	
	4	III	MWF	301MA	
	5	IV	MWF	301MA	
	6	V	MWF	301MA	
	7	I	TThS	301MA	
	8	II	TThS	301MA	
	9	III	TThS	301MA	
	10	VI	MWF	209MA	
25f-26w*	Accounting Laboratory (to be given with Principles of Accounting).....				Mr. Heilman in charge
	Sec. 1	V, VI	M	303MA	
	2	VI, VII	M	301MA	
	3	III, IV	T	303MA	
	4	I, II	T	303MA	
	5	VI, VII	T	301MA	
	6	VII, VIII	T	303MA	
	7	V, VI	W	303MA	
	8	VI, VII	W	301MA	
	9	II, III	Th	303MA	
	10	VI, VII	Th	301MA	
	11	V, VI	Th	303MA	
	12	VII, VIII	Th	303MA	
	13	V, VI	F	303MA	
	14	VI, VII	F	301MA	
	15	III, IV	F	303MA	
	16	III, IV	S	303MA	
	17	I, II	S	303MA	
	18	VII, VIII	W	303MA	
25w-26s*	Principles of Accounting....				
	Sec. 1	III	MWF	102MA	Mr. Heilman
25w-26s*	Accounting Laboratory.....	I	TThS	107F	Mr. Heilman Mr. Heilman in charge
	Sec. 1	V, VI	T	303MA	
	2	III, IV	W	303MA	
	3	VII, VIII	M	303MA	
28s	Principles of Accounting.... (Agr., For., and H.E.)				
	Lect.	III MWF and VI Th		24Ad	Mr. Heilman, Mr. Chapman Mr. Chapman
	Lab.	VII, VIII	Th	24Ad	Mr. Dowrie Mr. Cummings
50s	Farm Finance.....	II	MWF	307Ad	Mr. Anderson
73w*	Railway Traffic and Rates...	V	MWF	202MA	Mr. Pelz
85f,s	Principles of Marketing....	II	TThS	4PP	Mr. Garver
88s*	Advertising and Selling....	I	TThS	202MA	
90s	Economics of Consumption..	IV	MWF	307Ad	
91w	Principles of Organization and Management.....	I	TThS	202MA	Mr. Pelz

\* Offered on the Minneapolis campus.

## COURSES IN HOME ECONOMICS

No.	Title	Credits	Offered to	Prerequisite courses
94	Office Management.....	3	Jr., sr.	3-4, or 5 and 6
103-104	Value and Distribution.....	6†	Jr., sr.	3-4, or 5 and 6
106	Land Economics.....	3	Jr., sr.	See footnote†
107	Land Tenure.....	3	Jr., sr.	106
108	Marketing of Farm Products	3	Jr., sr.	85
110-111	Practice Course in Marketing	3	Jr., sr.	85
112	Business Statistics.....	3	Jr., sr.	13 or 14
116	Economics of Agricultural Production .....	3	Jr., sr.	See footnote†
117	Prices of Farm Products....	3	Jr., sr.	See footnote†
126	Principles of Coöperation...	3	Jr., sr.	85 or see footnote†
127-128	Marketing Organization and Management .....	6	Jr., sr.	85, 25-26 or 28
131-132-133	Cost Accounting.....	3	Jr., sr.	25-26
143-144	Money and Banking.....	8‡	Jr., sr.	3-4, or 5 and 6
145	International Exchange.....	3	Jr., sr.	143-144
149	Business Cycles.....	3	Sr.	143-144
176	Commercial Policies.....	3	Jr., sr.	3-4, or 5 and 6
177	Foreign Trade.....	3	Jr., sr.	176
180-181-182	Senior Seminar in Economics	9	Sr.	See footnote†
191-192	Public Finance.....	6‡	Jr., sr.	3-4, or 5 and 6
193	State and Local Taxation...	3	Jr., sr.	191-192

For additional courses, see bulletin of the School of Business

## EDUCATIONAL ADMINISTRATION AND SUPERVISION

## COLLEGE OF EDUCATION

No.	Title	Credits	Offered to	Prerequisite courses
3	Educational Sociology.....	3	Jr., sr.	Psychol. 6 cred.
5	Public Education in the United States.....	3	Jr., sr.	Psychol. 6 cred.
119	The Elementary-School Cur- riculum .....	3	Sr.	1 or 101-102-103, 3

For additional courses see the bulletin of the College of Education.

† Senior rank, or 13 credits in economics and farm management, and 5 credits in other social sciences (political science, sociology, or history).

‡ The full course must be completed before credit will be allowed.



PROGRAM

No.	Title	Hour	Day	Room	Instructor
94f*	Office Management.....				Miss Sykes
	Rec.	V	Th	102MA	
	Lab. Sec. 1	V, VI	M	104,106MA	
	2	V, VI	W	104,106MA	
103f-104w*	Value and Distribution.....	VI	MWF	102MA	Mr. Garver
106w	Land Economics.....	VI	MWF	307Ad	Mr. Black
106s*	Land Economics.....				
	See School of Business program				
107s	Land Tenure.....	VI	MWF	307Ad	Mr. Black
108w	Marketing of Farm Products	VI, VII	T	323Ad	Mr. Black
108-111f	Practice Course in Marketing	Ar	Ar	Ar	Mr. Black, Mr. Anderson
112t*	Business Statistics.....	II	TThS	202MA	Mr. Mudgett
116f,w	Economics of Agricultural Production .....	II	TThS	24Ad	Mr. Holmes
117w	Prices of Farm Products....	II	TThS	4PP	Mr. Working
126f*	Principles of Coöperation...	A	Ar	Ar	Mr. Black, Mr. Miller
127w-128s	Marketing Organization and Management .....	Ar	Ar	Ar	Ar
131f-132w-					
133s*	Cost Accounting.....	II	TThS	109MA	Mr. Noble
143f-144w*	Money and Banking.....				
	Lect.	IV	T		Mr. Dowrie, Mr. Ebersole, Mr. Stehman
	Sec. 1	II	TThS	302D	
	2	III	MWF	209MA	
	3	II	MWF	102MA	
	4	VII	MTW	209MA	
	5	V	MWF	102MA	
	6	III	TThS	209MA	
145s*	International Exchange.....	II	TThS	102MA	Mr. Dowrie
149s*	Business Cycles.....	VIII	MTW	209MA	Mr. Ebersole
176f*	Commercial Policies.....	I	MWF	202MA	Mr. Blakey
177w*	Foreign Trade.....	I	MWF	202MA	Mr. Blakey
180f-181w-					
182s	Senior Seminar in Economics	Ar	Ar	Ar	Ar
191f-192w*	Public Finance.....	III	MWF	209MA	Mr. Blakey
193s*	State and Local Taxation...	III	MWF	209MA	Mr. Blakey

EDUCATIONAL ADMINISTRATION AND SUPERVISION

(COLLEGE OF EDUCATION)

No.	Title	Hour	Day	Room	Instructor
3f*	Educational Sociology.....				
	Sec. 1	II	MWF	205Ed	Mr. Finney
	2	III	MWF	205Ed	Mr. Finney
3w,s*	Educational Sociology.....	III	MWF	205Ed	Mr. Finney
5w*	Public Education in the United States.....	VI	MWF	102Ed	Mr. Swift
5s	Public Education in the United States.....	VI	MWF	317Ad	Miss Alexander
119w*	The Elementary School Cur- riculum .....	VII	MWF	102Ed	

\* Offered on the Minneapolis campus.

## COURSES IN HOME ECONOMICS

## EDUCATIONAL PSYCHOLOGY

## COLLEGE OF EDUCATION

No.	Title	Credits	Offered to	Prerequisite courses
45	Elementary Educational Psychology .....	3	Soph., jr., sr.	Psychol. 6 cred.
106-107-108	Advanced Educational Psychology .....	9	Jr., sr.	45 or equiv.
111	Educational Diagnosis.....	3	Jr., sr.	45 or equiv.

For additional courses see the bulletin of the College of Education.

## ENGLISH

## COLLEGE OF SCIENCE, LITERATURE, AND THE ARTS

No.	Title	Credits	Offered to	Prerequisite courses
1-2-3	General Survey of English Literature .....	9	Soph., jr., sr.	Rhet. 1-2-3
4	Old English.....	4	Soph., jr., sr.	1-2-3 or parallel
6	Chaucer .....	4	Soph., jr., sr.	1-2-3 or parallel
8	Shakespeare .....	4	Soph., jr., sr.	1-2-3 or parallel
27	History of the English Language .....	2	Soph., jr., sr.	4
40	Bible as Literature.....	4	Soph., jr., sr.	1-2-3 or parallel
44-45	American Literature.....	6†	Jr., sr.	1-2-3
51	Spenser .....	3	Jr., sr.	1-2-3
53	Seventeenth-Century Lyrists.	4	Jr., sr.	1-2-3
58-59	Nineteenth-Century Prose...	6†	Soph., jr., sr.	1-2-3
62	Milton .....	4	Jr., sr.	1-2-3
64	Bacon .....	3	Jr., sr.	1-2-3
66	English Novel.....	4	Jr., sr.	1-2-3

For additional courses, see the bulletin of the College of Science, Literature, and the Arts.

## ENTOMOLOGY AND ECONOMIC ZOOLOGY

No.	Title	Credits	Offered to	Prerequisite courses
1	Introductory Entomology....	5	Soph., jr., sr.	An. biol. 9 cred.
2	Economic Entomology.....	5	Soph., jr., sr.	1
3	Elementary Economic Entomology .....	3	Soph., jr., sr.	An. biol. 9 cred.
4	Economic Vertebrate Zoology .....	3	Jr., sr.	An. biol. 9 cred.

† The full course must be completed before credit will be allowed.

EDUCATIONAL PSYCHOLOGY

COLLEGE OF EDUCATION

No.	Title	Hour	Day	Room	Instructor
45f,s*	Elementary Educational Psychology .....	I	MWF	Psy	Miss Dealey
45w*	Elementary Educational Psychology .....	IV	MWF	Psy	Miss Dealey
106f-107w-108s	Advanced Educational Psychology .....	III	MWF	Psy	Mr. Van Wageningen
111s*	Educational Diagnosis.....	II	MWF	Psy	Mr. Van Wageningen

ENGLISH

COLLEGE OF SCIENCE, LITERATURE, AND THE ARTS

No.	Title	Hour	Day	Room	Instructor
1f-2w-3s*	General Survey of English Literature .....				
	Sec. 1 Lect.	II	M	Ar	Ar
	Rec.		WF	114F	Ar
	2 Lect.	VI	T	Ar	Ar
	Rec.	VI	WF	205F	Ar
4w,s*	Old English.....	V	MTThF	204F(w)205F(s)	Ar
6f*	Chaucer .....	VII	MTWThF	204F	Ar
6w*	Chaucer .....	IV	MTWF	205F	Ar
6s*	Chaucer .....	II	TWFS	204F	Ar
8f,w*	Shakespeare .....				
	Sec. 1	I	TWFS	204F	Ar
	2	V	MTThF	204F	Ar
8s*	Shakespeare .....				
	Sec. 1	I	TWFS	204F	Ar
	2	IV	MTWF	204F	Ar
27w*	History of English Language	VIII	TTh	204F	Mr. Klaeber
40f*	Bible as Literature.....	III	MWF	301F	Mr. Burton
44f-45w*	American Literature.....	IV	MWF	204F	Mr. Moore
51f*	Spenser .....	VI	MWF	204F	Ar
53f*	Seventeenth-Century Lyrists.	II	MTWF	205F	Mr. Moore
58w-59s*	Nineteenth-Century Prose...	II	TThS	205F	Mr. Beach
62w*	Milton .....	VI	MTThF	204F	Ar
64s*	Bacon .....	VI	MWF	204F	Ar
66f*	English Novel.....	IV	MTWF	9F	Mr. Burton

ENTOMOLOGY AND ECONOMIC ZOOLOGY

No.	Title	Hour	Day	Room	Instructor
1f,s*†	Introductory Entomology....	V, VI	MTWThF	208-210AB	Mr. Oestlund, Mr. Riley
2w†	Economic Entomology.....	V, VI	MTWThF	306Ad	Mr. Ruggles
3f,w	Elementary Econ. Entomology .....	V, VI, VII	WF	306Ad	Mr. Ruggles
4f	Economic Vertebrate Entomology .....	Ar	Ar	Ar	Mr. Washburn

\* Offered on the Minneapolis campus.

† Offered also during the summer session.

## COURSES IN HOME ECONOMICS

No.	Title	Credits	Offered to	Prerequisite courses
5	Elementary Forest Entomology .....	3	Soph., jr., sr.	An. biol. 9 cred.
6	Insects of Forest Products..	3	Soph., jr., sr.	5
8	Varieties and Habits of Fur-Bearing Animals.....	3	Soph., jr., sr.	An. biol. 9 cred.
12	Forest Zoology.....	3	Jr., sr.	An. biol. 9 cred.
20	Home Economics Entomology	3	Soph., jr., sr.	An. biol. 6 cred.
37-38-39	General Entomology.....	9	Soph., jr., sr.	An. biol. 9 cred.
44	Introductory Course in Animal Parasites and Parasitism .....	3	Soph., jr., sr.	An. biol. 9 cred.
117-118-119	General Ecology of Insects..	9	Jr., sr.	1-2 or 37-38-39
125-126-127	Advanced General Entomology .....	9	Jr., sr.	1-2 or 37-38-39
130	Biology and Taxonomy of the Aphididae .....	5	Sr.	1-2 or 37-38-39
139-140	Histology and Development of Insects.....	6	Jr., sr.	1-2 or 37-38-39
144-145-146	Animal Parasites and Parasitism .....	3-9	Jr., sr.	1-2 or 37-38-39
150	Insecticides and Their Action	3 or 6	Jr., sr.	1-2 or 37-38-39, Agr. Biochem., 7-8 or equiv.
197	Introduction to Research....	5 or more	Sr.	1-2 or 37-38-39 and other work as prescribed by the division

## FARM ENGINEERING

No.	Title	Credits	Offered to	Prerequisite courses
3	Mechanical Drawing.....	2	All	None
4	Blacksmithing .....	2	All	None
5	Carpentry .....	3	All	None
7	Farm Structures.....	3	Jr., sr.	3
8	Farm Engineering.....	5	All	None
11	Applied Mathematics.....	5	All	None
13	Farm Motors I.....	3	All	None
14	Farm Motors II.....	3	All	13
15	Mechanical Laboratory.....	2	All	None
17	Advanced Blacksmithing.....	2	All	4
18	Surveying .....	5	Jr., sr.†	3, 11 or equiv.
23	General Physics.....	5	All	None

† Open also to sophomores in forestry.

PROGRAM

No.	Title	Hour	Day	Room	Instructor
5f	Elementary Forest Entomology .....	V, VI, VII	WF	306Ad	Mr. Graham
6w	Insects of Forest Products..	Ar	Ar	Ar	Mr. Graham
8f	Varieties and Habits of Fur-Bearing Animals.....	Ar	Ar	Ar	Mr. Washburn
12w	Forest Zoology.....	Ar	Ar	Ar	Mr. Riley,
20w	Home Economics Entomology	V, VI, VII	TTh	307Ad	Mr. Ruggles
37f-38w-39s*	General Entomology.....	I, II	MWF	208-210AB	Mr. Oestlund
44f.s	Introductory Course in Animal Parasites and Parasitism .....	V, VI, VII, VIII	MW or TTh	321Ad	Mr. Riley
117f-118w-119s*	General Ecology of Insects..	V, VI, VII	TTh	208-210AB	Mr. Chapman
125f-126w-127s*	Advanced General Entomology .....	III, IV	TThS	208-210AB	Mr. Oestlund
130w*	Biology and Taxonomy of Aphididae .....	Ar	Ar	Ar	Mr. Oestlund
139f-140w*	Histology and Development of Insects.....	III, IV	MWF	208-210AB	Mr. Riley
144f-145w-146s	Animal Parasites and Parasitism .....	V, VI, VII	WF	Ar	Mr. Riley
150f†	Insecticides and Their Action	Ar	Ar	Ar	Mr. Moore
197f,w,s†	Introduction to Research....	Ar	Ar	Ar	Mr. Oestlund, Mr. Ruggles, Mr. Chapman, Mr. Moore, Mr. Riley, Mr. Washburn

FARM ENGINEERING

No.	Title	Hour	Day	Room	Instructor
3f,s	Mechanical Drawing.....	III, IV	MWF	305En	Mr. Jacobson
4s	Blacksmithing .....	V, VI, VII	TTh	20En	Mr. Johnston
5f	Carpentry .....	I, II	TThS	48En	Mr. White
7w	Farm Structures.....	Lect. IV	TS	305En	Mr. White
	Lab.	VI, VII, VIII	M	305En	Mr. White
8f,w	Farm Engineering.....	I	MTWFS	107En	Mr. Boss
11f,w,s	Applied Mathematics.....	III	MTWFS	215En	Mr. Torrance
13f	Farm Motors I.....	I, II	TThS	37En	Mr. Torrance
13s	Farm Motors I.....	V, VI, VII	MF	37En	Mr. Torrance
14s	Farm Motors II.....	V, VI, VII	TTh	37En	Mr. Torrance
15f,s	Mechanical Laboratory.....	I, II	WF	56,101En	Mr. Dent
17s	Advanced Blacksmithing.....	V, VI, VII	WF	20En	Mr. Johnston
18s	Surveying .....	1:15-5:20	MWF	215En	Mr. Roe
23f,s	General Physics.....	Lect. III	TThS	102En	Mr. Stewart
	Sec. 1 Lab.	I, II	TS	103En	Mr. Tyler
	2	V, VI	TTh	103En	Mr. Tyler

\* Offered on the Minneapolis campus.

† Offered also during the summer session.

## COURSES IN HOME ECONOMICS

No.	Title	Credits	Offered to	Prerequisite courses
24	Agricultural Physics I.....	4	All	8, 11, 23 or equiv.
25	Agricultural Physics II.....	4	All	24
28	Land-Clearing .....	3	Jr., sr.	None
31	Farm Surveying and Drainage .....	5	Jr., sr.	3, 11 or equiv.
34	Household Mechanics and Heat .....	4	All	23 or equiv.
35	Household Electricity and Light .....	4	All	34
101	Advanced Drainage.....	3	Sr.	31

## FORESTRY

No.	Title	Credits	Offered to	Prerequisite courses
1	General Forestry.....	4	All	None
2	Elementary Dendrology....	3	All	None
3-4	Dendrology .....	8†	Soph., jr., sr.	Bot. 4
5	Elementary Sylviculture....	3	All	None
9	Elementary Mensuration....	5	All	None
10	Forest Mensuration.....	5	Jr., sr.	3-4
11	Forest Valuation.....	5	Jr., sr.	10, 41
20	Grazing .....	3	Jr., sr.	None
23	Factory Experience.....	3 to 5	Jr., sr.	33-34
26	Tree Crops.....	1	All	None
27	Groves and Windbreaks....	3	All	None
28	Logging .....	3	Sr.	3-4
29	Sawmills and Wood Working Machinery .....	3	Jr., sr.	33-34
30	Wood-Seasoning .....	3	Jr., sr.	33-34
31	Logging Plans.....	3	Sr.	28
32	Lumber Distribution.....	5	Jr., sr.	33-34
33-34	Wood Structure and Identification .....	6	Jr., sr.	3-4, Bot. 4-5-6
35	Seeding and Planting.....	3	Jr., sr.	41
36	Forest Policy and Administration .....	5	Sr.	43, 11, 28 parallel
39	Wood Preservation.....	3	Jr., sr.	33-34
40	Forest By-Products.....	3	All	None

† The full course must be completed before credit will be allowed.

PROGRAM

No.	Title	Hour	Day	Room	Instructor
24w	Agricultural Physics I.....				
	Lect.	III	MWF	102En	Mr. Stewart
	Lab.	V, VI, VII	M	103En	Mr. Tyler
25s	Agricultural Physics II.....				
	Lect.	III	MWF	102En	Mr. Stewart
	Lab.	V, VI, VII	M	103En	Mr. Tyler
28w	Land-Clearing .....	Ar	Ar	Ar	Mr. Thompson
31f	Farm Surveying and Drain- ages .....	1:15-5:20	MWF	215En	Mr. Roe
34w	Household Mechanics and Heat .....				
	Lect.	II	MWF	102En	Mr. Stewart
	Sec. 1 Lab.	V, VI	F	103En	Mr. Stewart
	2	I, II	Th	103En	Mr. Stewart
35s	Household Electricity and Light .....				
	Lect.	II	MWF	102En	Mr. Stewart
	Sec. 1 Lab.	V, VI	F	103En	Mr. Stewart
	2	I, II	Th	103En	Mr. Stewart
101s	Advanced Drainage.....	Ar	Ar	Ar	Mr. Roe

FORESTRY

No.	Title	Hour	Day	Room	Instructor
1f,s	General Forestry.....	II	MTWTF	302Hr	Mr. Cheyney
2†	Elementary Dendrology.....				Mr. Wentling
3f-4w	Dendrology .....				
	Lect.	II	TThS	302Hr	Mr. Wentling
	Lab.	VI, VII, VIII	M	302Hr	Mr. De Flon
3w-4s	Dendrology .....				
	Lect.	I	TThS	302Hr	Mr. Wentling
	Lab.	VI, VII, VIII	F	302Hr	Mr. De Flon
5†	Elementary Sylviculture.....				Mr. Wentling
9†	Elementary Mensuration.....				Mr. Allison
10w	Forest Mensuration.....	IV	MTWFS	302Hr	Mr. Hansen
11f	Forest Valuation.....	I	MTWThF	302Hr	Mr. Allison
20w	Grazing .....	III	TThS	302Hr	Mr. Allison
23††	Factory Experience.....				
26f,w	Tree Crops.....	IV‡	TS	217En	Mr. Cheyney
27w	Groves and Wind Breaks...	I	MWF	302Hr	Mr. Wiggins
28w	Logging .....	III	MWF	302Hr	Mr. Cheyney
29f	Sawmill and Wood-Working Machinery .....	IV	MWF	301Hr	Mr. Cheyney
30s	Wood Seasoning.....	III	MWF	302Hr	Mr. Cheyney
31s	Logging Plans.....	Ar	Ar	Ar	Mr. Cheyney
32w	Lumber Distribution.....	II	MTWThF	302Hr	Mr. Cheyney
33f-34w	Wood Structure and Identifi- cation .....	V, VI, VII	WF	303Hr	Mr. Wentling
35w	Seeding and Planting.....	III	MWF	301Hr	.....
36w	Forest Policy and Adminis- tration .....	I	MTWThF	202Hr	Mr. Allison
39f	Wood Preservation.....	II	TThS	202Hr	Mr. Allison
40s	Forest By-Products.....	I	MWF	302Hr	Mr. Allison

† Offered only during summer session at Itasca Park.

†† Arrangements for this course must be made in advance.

‡ In the fall quarter this course follows hygiene lectures the last six weeks of the quarter. In the winter quarter it will be given the first six weeks of the quarter.

## COURSES IN HOME ECONOMICS

No.	Title	Credits	Offered to	Prerequisite courses
41	Sylvics .....	3	Jr., sr.	3-4, Bot. 4-5-6
43	Sylviculture Laboratory.....	6	Jr., sr.	35
44	Wood Pulp and Paper.....	3	Jr., sr.	33-34 Chem. 3 or 10
45	Forest Regulation.....	3	Sr.	43, 11
46	Forest Regulation Laboratory	3	Jr.	43, 11
101	Advanced Dendrology.....	3	Jr., sr.	3-4, Bot. 4-5-6
106	Research Methods in Sylvi- culture .....	3	Sr.	43
107	Uses of Wood I.....	3	Sr.	33-34 *
108	Uses of Wood II.....	3	Sr.	33-34
109	Uses of Wood III.....	3	Sr.	107, 108
110	Mechanical and Physical Properties of Wood.....	2	Sr.	33-34
111	Advanced Wood Structure..	3	Sr.	33-34
112	Advanced Forest Mensura- tion .....	3	Sr.	10
113	Advanced Forest By-Products	3	Sr.	33-34, Chem. 35-36

## FRESHMAN LECTURES

No.	Title	Credits	Offered to	Prerequisite courses
1	Agriculture and Forestry....	None	Fr.	None
2	Home Economics.....	None	Fr.	None

## GEOLOGY AND MINERALOGY

## COLLEGE OF SCIENCE, LITERATURE, AND THE ARTS

No.	Title	Credits	Offered to	Prerequisite courses
1-2	General Geology.....	10†	Soph., jr., sr.	Chemistry
7-8	Laboratory Work.....	2†	Soph., jr., sr.	Supports 1-2
11-12	Introduction to Geology....	8†	Soph., jr., sr.	None
21-22	Essentials of Mineralogy...	6†	Soph., jr., sr.	Chemistry
29	General Physiography.....	5	Soph., jr., sr.	None
34	Meteorology .....	5	Soph., jr., sr.	None
37	Economic and Commercial Geography .....	5	Soph., jr., sr.	None
51-52	Economic Geology.....	6†	Jr., sr.	1-2

For additional courses see the bulletin of the College of Science, Literature, and the Arts.

† Both quarters must be completed before credit will be given.



PROGRAM

No	Title	Hour	Day	Room	Instructor
41f	Sylvics .....	II			
43s	Sylviculture Laboratory.....	Ar	MWF	301Hr	Mr. Wentling
44s	Wood Pulp and Paper.....	II	Ar	Ar	Mr. Wentling
45s	Forest Regulation.....	IV	MWF	301Hr	Mr. Allison
46s	Forest Regulation Laboratory	Ar	MWF	302Hr	Mr. Allison
101w	Advanced Dendrology.....	Ar	Ar	Ar	Mr. Allison
106w	Research Methods in Sylviculture .....	II	Ar	Ar	Mr. Wentling
107f	Uses of Wood I.....	IV	MWF	301Hr	.....
108w	Uses of Wood II.....	IV	MWF	303Hr	Mr. Wentling
109s	Uses of Wood III.....	IV	MWF	303Hr	Mr. Wentling
110w	Mechanical and Physical Properties of Wood.....	V, VI	MWF	303Hr	Mr. Wentling
111f	Advanced Wood Structures..	V, VI, VII	TTh	303Hr	Mr. Wentling
112w	Advanced Forest Mensuration .....	Ar	TTh	303Hr	Mr. Wentling
113w	Advanced Forest By-Products	Ar	Ar	Ar	Mr. Hansen
			Ar	Ar	Mr. Allison

FRESHMAN LECTURES

No.	Title	Hour	Day	Room	Instructor
1f	Agriculture and Forestry....	III	Th	107En	Mr. Freeman
2f	Home Economics.....	V	F	203HE	Mr. Freeman

GEOLOGY AND MINERALOGY  
COLLEGE OF SCIENCE, LITERATURE, AND THE ARTS

No.	Title	Hour	Day	Room	Instructor
1f-2w*	General Geology.....				
	Sec. 1	I	TWThFS	210P	Mr. Thiel
	2	III	MTThFS	110P	Mr. Emmons
	3	VI	MTWThF	110P	Mr. Allison
1w-2s*	General Geology.....	II	MWThFS	210P	Mr. Werner
1s-2w*	General Geology.....	III	MTThFS	110P	Mr. Emmons
7f-8w*	General Geology Lab.....	Ar	Ar	112P	Mr. Allison
7w-8s*	General Geology Lab.....	Ar	Ar	112P	Mr. Allison
7s*	General Geology Lab.....	Ar	Ar	112P	Mr. Allison
11f-12w*	Introduction to Geology.....	VII	MTWThF	200aP	Mr. Werner
21w-22s*	Essentials of Mineralogy....				
	Lect.	IV	MWF	210P	Mr. Gruner
	Lab.	V-VIII	F	100P	Mr. Gruner
	Lab.	III	MWF	100P	Mr. Gruner
29f*	General Physiography.....	III	MTThFS	210P	.....
34w*	Meteorology .....	III	MTThFS	210P	.....
37s*	Economic and Commercial Geography .....	III	MTThFS	210P	.....
51f-52w*	Economic Geology.....	II	MWF	210P	.....
			MWF	210P	Mr. Schwartz

\* Offered on the Minneapolis campus.

## COURSES IN HOME ECONOMICS

## GERMAN

## COLLEGE OF SCIENCE, LITERATURE, AND THE ARTS

No.	Title	Credits	Offered to	Prerequisite courses
1	Beginning, A.....	5	All	None
2	Beginning, B.....	5	All	1 or 1 yr. prep. German
3	Beginning, C.....	5	All	2
10	Rapid Reading.....	5	All	3 or 2 yrs. prep. German
11	Advanced Rapid Reading....	5	All	10 or 3 yrs. prep. German
14	Nineteenth-Century Prose...	5	All	11 or 4 yrs. prep. German
28-29	Advanced Chemical German	6†	All	15

PROGRAM

GERMAN

COLLEGE OF SCIENCE, LITERATURE, AND THE ARTS

No.	Title	Hour	Day	Room	Instructor
1f*	Beginning A.....				
	Sec. 1	I	TWThFS	207F	Ar
	2	II	MWThFS	207F	Ar
	3	IV	MTWFS	207F	Ar
	4	VI	MTWThF	207F	Ar
1w*	Beginning A.....				
	Sec. 1	I	TWThFS	209½F	Ar
	2	V	MTWThF	209½F	Ar
1s*	Beginning A.....				
	Sec. 1	II	MWThFS	209½F	Ar
	2	V	MTWThF	207F	Ar
2f*	Beginning B.....				
	Sec. 1	II	MWThFS	209F	Ar
	2	VI	MTWThF	209½F	Ar
2w*	Beginning B.....				
	Sec. 1	I	TWThFS	207F	Ar
	2	II	MWThFS	207F	Ar
	3	IV	MTWFS	207F	Ar
	4	VI	MTWThF	207F	Ar
2s*	Beginning B.....				
	Sec. 1	I	TWThFS	209½F	Ar
	2	V	MTWThF	209½F	Ar
3f*	Beginning C.....				
	Sec. 1	IV	MTWFS	209F	Ar
	2	V	MTWThF	207F	Ar
3w*	Beginning C.....				
	Sec. 1	II	MWThFS	209F	Ar
	2	VI	MTWThF	209½F	Ar
3s*	Beginning C.....				
	Sec. 1	I	TWThFS	207F	Ar
	2	II	MWThFS	207F	Ar
	3	IV	MTWFS	207F	Ar
	4	VI	MTWThF	207F	Ar
1of*	Rapid Reading.....				
	Sec. 1	II	MWThFS	212F	Ar
	2	IV	MTWFS	209½F	Ar
	3	VI	MTWThF	212F	Ar
1ow*	Rapid Reading.....				
	Sec. 1	IV	MTWFS	209F	Ar
	2	V	MTWThF	207F	Ar
1os*	Rapid Reading.....				
	Sec. 1	II	MWThFS	209F	Ar
	2	VI	MTWThF	209½F	Ar
11f*	Advanced Rapid Reading....	II	MWThFS	209½F	Ar
11w*	Advanced Rapid Reading....				
	Sec. 1	II	MWThFS	212F	Ar
	2	VI	MTWThF	212F	Ar
11s*	Advanced Rapid Reading....	IV	MTWFS	209F	Ar
14s*	Nineteenth-Century Prose...	II	MTThFS	212F	Ar
28w-29s*	Advanced Chemical German..	III	MWF	209½F	Ar

\* Offered on the Minneapolis campus.

## COURSES IN HOME ECONOMICS

No.	Title	Credits	Offered to	Prerequisite courses
31-32	Medical German.....	6†	All	10 or 15
40	Commercial German.....	5	All	10
50-51-52	Composition .....	3†	Jr., sr.	11, 14 or 4 yrs. prep. German
53-54-55	Conversation .....	3†	Jr., sr.	11, 14 or 4 yrs. prep. German
63	Modern Drama.....	3	Jr., sr.	11 or 14
64	Classic Drama.....	3	Jr., sr.	14 or 63
74	German Poets.....	3	Jr., sr.	63 or 64

For additional courses see the bulletin of the College of Science, Literature, and the Arts.

## HISTORY AND PHILOSOPHY OF EDUCATION

## COLLEGE OF EDUCATION

No.	Title	Credits	Offered to	Prerequisite courses
1	Brief Course in the History of Education.....	5	Jr., sr.	Psychol. 6 cred.
101-102-103	Foundations of Modern Education .....	9	Jr., sr.	Psychol. 6 cred., hist. 6 cred.

For additional courses see the bulletin of the College of Education.

## HOME ECONOMICS

No.	Title	Credits	Offered to	Prerequisite courses
3	Textiles .....	5	All	None
4	Textiles .....	3	All‡	None
5-6	Textiles .....	3	See note ††	None
11	Garment-Making .....	3	All	None

† All quarters must be completed before credit is granted.

‡ Not open to students in home economics.

†† For teachers only.

PROGRAM

No.	Title	Hour	Day	Room	Instructor
31f-32w*	Medical German.....	I	MWF	212F	Ar
31w-32s*	Medical German.....				
	Sec. 1	I	MWF	209F	Ar
	2	I	TThS	209F	Ar
31s*	Medical German.....	I	MWF	212F	Ar
32f*	Medical German.....	I	MWF	209½F	Ar
40w*	Commercial German.....	V	MTWThF	302D	Mr. Laughlin
50f-51w-52s*	Composition .....	III	W	227F	Mr. Laughlin
53f-54w-55s*	Conversation .....	IV	FS	101F	Mr. Laughlin
63f*	Modern Drama.....	IV	MWF	212F	Mr. Davies
63s*	Modern Drama.....	II	MWF	125½	Mr. Downis
64w*	Classic Drama.....	IV	MWF	209½F	Mr. Meyers
74s*	German Poets.....	IV	MWF	212F	Mr. Davies

HISTORY AND PHILOSOPHY OF EDUCATION

COLLEGE OF EDUCATION

No.	Title	Hour	Day	Room	Instructor
if*	Brief Course in the History of Education.....				
	Sec. 1	II	MWThFS	102Ed	Miss Alexander
	2	IV	MTWFS	205Ed	Miss Alexander
	3	VI	MTWThF	205Ed	Miss Alexander
1w,s*	Brief Course in the History of Education.....	II	MTWThF	205Ed	Miss Alexander
101f-102w-103s*	Historical Foundations of Modern Education.....	VII	MWF	205Ed	Mr. Swift

HOME ECONOMICS

No.	Title	Hour	Day	Room	Instructor
3f,w	Textiles .....	I, II	MTWThF	211,305HE	Miss Weller, Miss Phelps
	(Limited to 20)				
3s	Textiles .....				
	(Limited to 20)				
	Sec. 1	I, II	MTWThF	211,307HE	Miss Weller, Miss Phelps
	2	III, IV	MTWFS	211,307HE	Miss Weller, Miss Phelps
4f,w,s	Textiles (S. L. & A.).....	V, VI	MWF	211,307HE	Miss Phelps
	(Limited to 20)				
5f-6w	Textiles (Teachers).....	II, III, IV	S	211,307HE	Miss Weller
	(Limited to 20)				
11f,w,s	Garment-Making .....				
	(Limited to 20)				
	Sec. 1	I, II	MWF	304HE	Miss McDowell, Miss Ebersole
	2	I, II	TThS	304HE	Miss McDowell, Miss Ebersole
	3	V, VI, VII	TTh	304HE	Miss McDowell, Miss Ebersole

\* Offered on the Minneapolis campus.

## COURSES IN HOME ECONOMICS

No.	Title	Credits	Offered to	Prerequisite courses
13	Dressmaking .....	5	Soph., jr., sr.	3, 11, 51, Home Pract. in Garment-Making
17	Advanced Clothing Construction .....	3	Jr., sr.	13, 52, 53
18	Commercial Clothing Manufacture .....	4	Sr.	17 or parallel
21	Foods and Cookery.....	5	Soph., jr., sr.	Chem. 5 cred., Physiol. 4 parallel
22	Food Economics.....	5	Soph., jr., sr.	21
23	Nutrition I.....	5	Jr., sr.	22, Agr. Biochem 3, Bact. 1
24	Camp Cookery.....	4	All†	None
34	Home Management: Operation and Maintenance, Lectures .....	3	Jr.,† sr.	22, 35, parallel, Econ. 5 or parallel
35	Home Management: Operation and Maintenance, Laboratory .....	6	Jr.,† sr.	22, 37 and H. E. Educ. 40 or parallel, 34 parallel Home Pract. in Foods and Cookery advised
37	Home Care of the Sick.....	3	Jr., sr.	Chem. 5 cred., Bact. 1
45	Home Economics Survey....	2	Sr.	None
51	Drawing and Design.....	3	All	None

† Open to juniors only in their third quarter.

PROGRAM

No.	Title	Hour	Day	Room	Instructor
13f,w	Dressmaking ..... (Limited to 20)	III, IV	MTWFS	304HE	Miss McDowell, Miss Patchin
13s	Dressmaking ..... (Limited to 20) Sec. 1	III, IV	MTWFS	304HE	Miss McDowell, Miss Patchin
	2	I, II	TWThFS	112HE	Miss McDowell, Miss Patchin
17f,w,†	Advanced Clothing Construc- tion ..... (Limited to 20)	III, IV	MWF	305HE	Miss McDowell, Miss Patchin, Miss Carlotta Brown
18w,s	Commercial Clothing Manu- facture .....	V, VI, VII, VIII	MWF	305HE	Miss Patchin
21f,w	Foods and Cookery..... (Limited to 20) Sec. 1	V, VI	MTWThF	209HE	Miss Child
	2	III, IV	MTWFS	209HE	Miss Child
21s	Foods and Cookery..... (Limited to 20) Sec. 1	I, II	TWThFS	209HE	Miss Child
	2	III, IV	MTWFS	209HE	Miss Child
22f,w	Food Economics..... (Limited to 20)	III, IV	MTWFS	205,207HE	Miss Child
22s	Food Economics..... (Limited to 20) Sec. 1	III, IV	MTWFS	205,207HE	Miss Child
	2	V, VI	MTWThF	104,105,106HE	Ar
23f,w	Nutrition I..... (Limited to 25)	V, VI, VII, VIII	MWF	211,213HE	Miss Anderson
24s	Camp Cookery.....	VII, VIII	MWF	105,106HE	Miss Child
34f,w,†	Home Management: Opera- tion and Maintenance, Lectures .....	III	TThS	203HE	Miss Studley
35f,w,†	Home Management; Opera- tion and Maintenance, Laboratory .....	Ar	Ar	Ar	Miss Lindquist, Miss Studley
37f,†	Home Care of the Sick..... Lect.	I	S	213HE	Miss Moorhead
	Lab.	V, VI	TTh	WH	Miss Fisher
45w	Home Economics Survey....	IV	TS	203HE	Miss Weigley
51f,w,s	Drawing and Design..... (Limited to 20) Sec. 1	I, II	MWF	401HE	Miss Bacon, Miss V. Goldstein
	2	I, II	TThS	401HE	Miss Bacon, Miss V. Goldstein

† Offered also in the summer session.

## COURSES IN HOME ECONOMICS

No.	Title	Credits	Offered to	Prerequisite courses
52	Art History and Appreciation	3	Jr., sr.	51
53	Advanced Design.....	4	Jr., sr.	51
54	Interior Design.....	3	Sr.	52, 53, 131
55	Decorative Needlework and Other Crafts.....	3	Jr., sr.	51, 53 or parallel
57	Weaving and Other Crafts..	3	Jr., sr.	3, 51, 53
58	Costume Design.....	3	Jr., sr.	55
61	Large Quantity Cookery and Marketing .....	4	Jr., sr.	22
63	Institutional Experience....	3	Jr., sr.	22
69	Institution-Management Prac- tice .....	3	Sr.	151
70	Food Preparation in Rela- tion to Social Work.....	3	Soph.,† jr., sr.	An. Biol. 1-2, chem. 10 cred. advised
71	Elementary Dietetics for the Social Workers.....	3	Soph.,† jr., sr.	70, Physiol. 4 or parallel
72	Home-Management Problems	3	Soph.,† jr., sr.	71, Econ. 5 or parallel
103	Dietetics .....	5	Sr.	108
105	Experimental Cookery.....	3	Jr., sr.	108
108	Nutrition II.....	5	Jr., sr.	23

† Open to sophomores only in their third quarter. Not open to students in home economics except by special permission of the head of the division.



PROGRAM

No.	Title	Hour	Day	Room	Instructor
	Sec. 3	V, VI, VII	TTh	402HE	Miss Bacon, Miss V. Goldstein
52f,s	Art History and Appreciation (Limited to 20)				
	Sec. 1	II	MWF	309HE	Miss V. Goldstein
	2	VII	MWF	309HE	Miss V. Goldstein
52w	Art History and Appreciation (Limited to 20)	VII	MWF	309HE	Miss H. Goldstein
53f	Advanced Design..... (Limited to 20)				
	Sec. 1	V, VI, VII	MWF	402HE	Miss H. Goldstein, Miss V. Goldstein
	2	I, II	MWThF	402HE	Miss H. Goldstein, Miss V. Goldstein
53w,s	Advanced Design..... (Limited to 20)	I, II	MWThF	402HE	Miss H. Goldstein, Miss Patchin, Miss V. Goldstein
54s	Interior Design.....	V, VI	MWF	401HE	Miss Morse
55f,s	Decorative Needlework and other Crafts..... (Limited to 12)	V, VI, VII	TTh	401HE	Miss Morse
57w	Weaving and Other Crafts.. (Limited to 12)	V, VI, VII	TTh	401HE	Miss Morse
58w	Costume Design.....	V, VI	MWF	402HE	Miss H. Goldstein
61f,s	Large Quantity Cookery and Marketing .....				
	(Limited to 10)				
	Lect.	I	S	309HE	Miss Richards, Miss Farmer
	Lab.	I, II, III	TTh	DiH	Miss Richards
63f,w	Institutional Experience.....				
	Lect.	I	T	309HE	Miss Treat, Miss Richards
	Lab.	Three fourth hour periods to be arranged			
69s	Institution-Management Prac- tice .....	Two 8 hour days	Ar	Ar	Miss Treat, Miss Richards
70w	Food Preparation in Relation to Social Work.....	V, VI	MWF	107HE	Miss Lindquist
71s	Elementary Dietetics for So- cial Workers.....	V, VI	MWF	107HE	Miss Mumford
72f	Home-Management Problems.	V	MWF	106HE	Miss Lindquist
103f,w,s	Dietetics .....	V, VI	MTWThF	207-203HE	Miss Biester, Miss Mumford
	(Limited to 20)				
105w,s†	Experimental Cookery..... (Limited to 12)	I, II	MWF	207HE	Miss Weigley, Miss Child
108f,w,s†	Nutrition II..... (Limited to 25)	III, IV	MTWFS	211-213HE	Miss Anderson, Miss Mumford

† Offered also in the summer session.

## COURSES IN HOME ECONOMICS

No.	Title	Credits	Offered to	Prerequisite courses
109	Advanced Nutrition.....	5	Jr., sr.	108, Agr. Biochem. 2
110	Special Problems in Dietetics	3	Sr.	103
111	Special Food Problems.....	3	Sr.	105, Agr. Biochem. 2
122	Advanced Textiles.....	3	Jr., sr.	3, Agr. Biochem. 2
123	Clothing Economics.....	2	Jr., sr.	13, Econ. 5
131	Home Management: House- Planning and Equipment..	5	Jr., sr.	52, 53
151	Institution Management.....	4	Sr.	61, 63

## HOME ECONOMICS EDUCATION

## COLLEGE OF EDUCATION

No.	Title	Credits	Offered to	Prerequisite courses
40	Child-Training .....	3	Jr., sr.	H. E. 37, Psychol. 1-2
42	Special Methods of Teaching Home Economics.....	5	Jr., sr.	H.E. 13, 22, Psychol. 1-2
43	Organization and Methods for Related Art Teaching.	3	Sr.	42, H. E. 52, 53, 131
44	Methods in Home Economics Extension Work.....	3	Sr.	42
46	Observation and Teaching: Related Art.....	8	Sr.	42, H. E. 13, 52, 53, Educ. 45 or Agr. Educ. 11, see course de- scription
47	Observation and Teaching: Foods and Home Manage- ment .....	8	Sr.	42, Educ. 45 or Agr. Educ. 11, see course de- scription
48	Observation and Teaching: Textiles and Clothing.....	8	Sr.	42, Educ. 45 or Agr. Educ. 11, see course de- scription
49	Observation and Teaching: General Home Economics.	8	Sr.	42, Educ. 45 or Agr. Educ. 11, see course de- scription
141	Problems in Home Economics Education .....	3	Sr.	42, Educ. Psychol

PROGRAM

No.	Title	Hour	Day	Room	Instructor
109s	Advanced Nutrition..... (Limited to 15) Lect. Lab.	III V, VI, VII, VII	TS TTh	106HE 311HE	Miss Biester, Miss Anderson
110s	Special Problems in Dietetics (Limited to 20) Lect. Lab.	VII One full afternoon	MW	213HE Ar	Miss Biester Miss Mumford
111s†	Special Food Problems.....	V, VI, VII	TTh	107HE	Miss Child
122f,w	Advanced Textiles..... (Limited to 16)	V, VI, VII	TTh	307-311HE	Miss Phelps, Miss Weller
123w,s	Clothing Economics.....	III	TTh	313HE	Miss Weller
131f,w,s	Home Management: House- Planning and Equipment..	III, IV	MTWFS	401HE	Miss Morse
151w	Institution Management.....	III III, IV	TS M	106HE 106HE	Miss Treat Miss Treat

HOME ECONOMICS EDUCATION  
COLLEGE OF EDUCATION

No.	Title	Hour	Day	Room	Instructor
40f	Child-Training .....	IV	MWF	203HE	Miss Binzel
42f,s†	Special Methods of Teaching Home Economics.....	VII	MTWThF	313HE	Miss Miller, Miss Clara Brown
43w	Organization and Methods for Related Art Teaching.....	IV	MWF	309HE	Miss H. Goldstein
44s	Methods in Home-Economics Extension Work.....	IV	MWF	309HE	Miss Lombard, Miss Newton
46f,w	Observation and Teaching: Related Art..... Lect. Teaching	VIII Ar	TTh Ar	213HE Ar	Miss Brown, Miss Bacon
47f,w	Observation and Teaching: Foods and Home Manage- ment .....	VIII	TTh	213HE	Miss Miller, Mrs. Dorsey, Miss Lombard, Miss Rider
48f,w	Teaching Observation and Teaching: Textiles and Clothing..... Lect.	Ar VIII	Ar TTh	Ar 213HE	Miss Clara Brown
49f,w	Teaching Observation and Teaching: General Home Economics. Lect.	Ar VIII	Ar TTh	Ar 213HE	Miss Ebersole, Mrs. MacComber Miss Miller, Miss Brown
141s†	Teaching Problems in Home Economics Education .....	Ar Ar	Ar Ar	Ar Ar	.....

† Offered also in the summer session.

## COURSES IN HOME ECONOMICS

## HORTICULTURE

No.	Title	Credits	Offered to	Prerequisite courses
6	Fruit-Growing .....	3	All	None
21	Small-Fruit Culture.....	3	Soph., jr., sr.	6 or 32, bot. 9 cred.
32	Vegetable-Growing .....	3	All	None
33	Vegetable-Forcing .....	3	Soph., jr., sr.	32, bot. 9 cred.
50	Floriculture .....	3	All	None
56	Propagation and Nursery Practice .....	3	Soph., jr., sr.	None
71	Landscape-Gardening .....	3	All	None
91	Advanced General Horticulture .....	3	Jr., sr., in agr. educ.	Bot. 9 cred.
93	Judging Horticultural Crops	2	Soph., jr., sr.	6 or 32
107	Orchard Management.....	3	Jr., sr.	6
109	Principles of Genetics.....	3	Jr., sr.	Bot. 9 cred., an. biol. 9 cred.
110	Horticultural Crop-Breeding.	3	Jr., sr.	109
111	Systematic Pomology.....	3	Jr., sr.	6
131	Advanced Vegetable Production .....	3	Sr.	32
132	Systematic Olericulture.....	3	Jr., sr.	32
133	Commercial Truck-Growing..	3	Jr., sr.	32
135	Potato Production.....	3	Jr., sr.	6 or 32, bot. 9 cred.
151	Advanced Floriculture.....	3	Jr., sr.	50, bot. 9 cred.
191-192	Special Problems.....	6	Jr., sr.	Special permission
193-194-195	Horticultural Seminar.....	3	Jr., sr.	9 cred.

## HORTICULTURE

No.	Title	Hour	Day	Room	Instructor
6f	Fruit-Growing .....				
	Sec. 1 Lect.	II	MW	102Hr	Mr. Alderman
	Lab.	I, II	T or F	8Hr	Mr. Alderman
	2 Lect.	IV	TS	102Hr	Mr. Alderman
	Lab.	VI, VII	M	8Hr	Mr. Alderman
21W	Small-Fruit Culture.....	IV	MWF	210Hr	Mr. Brierley
32S	Vegetable-Growing .....				
	Sec. 1 Lect.	II	MW	102Hr	Mr. Tapley
	Lab.	I, II	T or F	8Hr	Mr. Bushnell
	2 Lect.	IV	TS	102Hr	Mr. Tapley
	Lab.	VI, VII	M	8Hr	Mr. Bushnell
33W	Vegetable-Forcing .....				
	Lect.	I	TTh	210Hr	Mr. Tapley
	Lab.	V, VI	F	8Hr	Mr. Tapley
50S	Floriculture .....	III	MWF	102Hr	Mr. Cady
56S	Propagation and Nursery Practice .....				
	Lect.	III	TS	102Hr	Mr. Cady
	Lab.	V, VI	T	8Hr	Mr. Cady
71S	Landscape-Gardening .....	II	TThS	102Hr	Mr. Cady
91S	Advanced General Horticul- ture .....	Ar	Ar	Ar	Mr. Alderman
93f	Judging Horticultural Crops	V, VI, VII	T	8Hr	Mr. Alderman
107f	Orchard Management.....				
	Lect.	III	TTh	106Hr	Mr. Brierley
	Lab.	I, II	Th	8Hr	Mr. Brierley
109f	Principles of Genetics (See Agronomy 131)				
110W	Horticultural Crops-Breeding	I	TThS	212Hr	Mr. Dorsey
111f	Systematic Pomology.....	IV, V, VI, VII	W	8Hr	Mr. Alderman, Mr. Brierley
131f	Advanced Vegetable Produc- tion .....				
	Lect.	III	MW	210Hr	Mr. Tapley
	Lab.	I, II	S	8Hr	Mr. Tapley
132f	Systematic Olericulture.....				
	Lect.	II	TTh	210Hr	Mr. Tapley
	Lab.	V, VI	F	8Hr	Mr. Tapley
133W	Commercial Truck-Growing..	Ar	Ar	Ar	Mr. Tapley
135W	Potato Production.....				
	Lect.	III	MW	210Hr	Mr. Krantz
	Lab.	V, VI	Th	8Hr	Mr. Krantz
151f	Advanced Floriculture.....	Ar	Ar	Ar	Mr. Cady
191W-192S	Special Problems.....	Ar	Ar	Ar	Mr. Alderman
193f-194- 195S	Horticultural Seminar.....	Ar	Ar	Ar	Horticultural Staff

## COURSES IN HOME ECONOMICS

## MILITARY SCIENCE AND TACTICS

No.	Title	Credits	Offered to	Prerequisite courses
1-2-3	First-Year Basic Course R. O. T. C. ....	None	Fr.	See note††
4-5-6	Second-Year Basic Course R. O. T. C. ....	None	Soph.	1-2-3
51-52-53	First-Year Advanced Course R. O. T. C. ....	9	Jr.	4-5-6
54-55-56	Second-Year Advanced Course R. O. T. C. ....	9	Sr.	51-52-53

## MUSIC

## COLLEGE OF SCIENCE, LITERATURE, AND THE ARTS

No.	Title	Credits	Offered to	Prerequisite courses
1-2-3	Harmony .....	9†	Jr., sr.	None
16-17-18	Pianoforte .....	6 or 12†	Jr., sr.	None
22-23-24	Violin .....	6-12†	Jr., sr.	None
40-41-42	Orchestra .....	3†	Jr., sr.	See statement
43-44-45	Choir .....	3	Jr., sr.	None
46-47-48	Appreciation of Music.....	3†	Jr., sr.	None

For additional courses see the bulletin of the College of Science, Literature, and the Arts.

## PHYSICAL EDUCATION

## FOR MEN

No.	Title	Credits	Offered to	Prerequisite courses
1	Personal Hygiene.....	None	Fr.	None
2-3-4	Gymnasium and Swimming..	None	Fr.	None
5-6-7	Advanced Leaders.....	3†	Soph., jr., sr.	Instr. permission
8-9-10	Corrective Gymnastics.....	None	All	None
11-12†	Wrestling .....	None	All	Instr. permission
13-14-15†	Intermediate Swimming.....	None	All	Instr. permission
16-17-18†	Advanced Swimming.....	None	All	Instr. permission
19-20†	Boxing .....	None	All	Instr. permission
21-22-23†	Intramural Athletics.....	None	All	Instr. permission

† The full course must be completed before credit will be allowed.

‡ Students who meet all the requirements of Course 2-3-4 and show special ability may elect these courses instead of Course 2-3-4.

†† Must be legally eligible for enrolment in Reserve Officers' Training Corps. Consult commandant.

PROGRAM

MILITARY SCIENCE AND TACTICS

No.	Title	Hour	Day	Room	Instructor
1f-2w*	First-Year Basic Course.....	V	MWF	A	Ar
3s*	First-Year Basic Course.....	VI, VII, VIII	W	A	Ar
4f-5w*	Second-Year Basic Course...	I	MWF	A	Ar
		III	MWF	A	Ar
		VII	MWF	A	Ar
6s*	Second-Year Basic Course...	VI, VII, VIII	W	A	Ar
51-52-53*	First-Year Advanced Course	Ar	Ar	Ar	Ar
54-55-56*	Second-Year Advanced Course .....	Ar	Ar	Ar	Ar

MUSIC

COLLEGE OF SCIENCE, LITERATURE, AND THE ARTS

No.	Title	Hour	Day	Room	Instructor
1f-2w-3s*	Harmony .....	II	MWF	Mu	Ar
		V	MWF	Mu	Ar
16f-17w-18s*	First-Year Piano.....	Ar	Ar	Mu	Ar
22f-23w-24s*	Violin .....	Ar	Ar	Mu	Ar
40f-41w-42s*	Orchestra .....	VIII	TF	A	Mr. Pepinsky
43f-44w-45s*	Choir .....	VIII	M	Mu	Mr. Scott
46f-47w-48s*	Appreciation of Music.....	V	M	Mu	Miss Reeves

PHYSICAL EDUCATION

FOR MEN

No.	Title	Hour	Day	Room	Instructor
1f,w,s*	Personal Hygiene.....				
	Sec. 1	II	TTh	A	Dr. Cooke, Mr. Roemer, Mr. Glidden
	2	III	TTh	A	Dr. Cooke, Mr. Roemer, Mr. Glidden
	3	IV	TS	A	Dr. Brown, Mr. Roemer, Mr. Glidden
	4	VI	TTh	A	Dr. Brown, Mr. Roemer, Mr. Glidden
	5	VII	TTh	A	Mr. Foster, Mr. Roemer, Mr. Glidden
2f-3w-4s*	Gymnasium .....				
	(Same schedule as Course 1, Hygiene)				
5f-6w-7s	Advanced Leaders.....	Ar	TThS	A	Mr. Foster, Mr. Roemer
8f-9w-10s*	Corrective Gymnastics.....	Ar	Ar	A	Dr. Brown
11w-12s*	Wrestling .....	Ar	Ar	A	Mr. Gilman
13f-14w-15s*	Intermediate Swimming.....	Ar	Ar	A	Mr. Glidden
16f-17w-18s*	Advanced Swimming.....	Ar	Ar	A	Mr. Foster, Mr. Glidden
19w-20s*	Boxing .....	Ar	Ar	A	Mr. Goldie
21f-22w-23s*	Intramural Athletics.....	Ar	Ar	A	Mr. Foster, Mr. Roemer

\*Offered on the Minneapolis campus.

## COURSES IN HOME ECONOMICS

## PHYSICAL EDUCATION

## FOR WOMEN

No.	Title	Credits	Offered to	Frerequisite courses
1-2-3†	Elem. Phys. Training.....	0	Required of all new students	None
4	Preliminary Hygiene.....	0	Required of all new students	None
7-8-9‡	Sophomore Physical Training	0	Soph.	1-2-3
10-11-12	Soph. Orthopedic Gymnastics	0	Soph.	1-2-3
13-14-15	Soph. Interpretive Dancing	0	Soph.	1-2-3
16-17-18§	Soph. Organized Games and Folk-Dancing .....	0	Soph.	1-2-3
19-20-21§	Sophomore Major Sports....	0	Soph.	1-2-3
22-23	Sophomore Elementary Swimming .....	0	Soph.	1-2-3
28-29	Sophomore Advanced Swimming .....	0	Soph.	1-2-3, swimming test
32	Personal Hygiene.....	3	Soph., jr., sr.	An. Biol. 1-2
33	Hygiene of the Family.....	3	Jr., sr.	An. Biol. 1-2
34-35-36‡	Intermed. Physical Training	3†	Jr., sr.	6 qtrs. of phys. tr. Permission of director
40-41-42	Interpretive Dancing.....	3†	Jr., sr.	6 qtrs. of phys. tr.
43-44-45§	Folk-Dancing and Organized Games .....	3	Jr., sr.	6 qtrs. of phys. tr.
46-47-48‡	Hockey, Basket-Ball and Baseball. No registration necessary .....	0	Fr., jr., sr.	Permission of director
49	General Swimming. No registration necessary.....	0	All	None

† The entire course must be completed before credit is received for any quarter.

‡ The third quarter of this course is open to students who have not had the first two quarters.

§ Students may enter any quarter.



PROGRAM

PHYSICAL EDUCATION

FOR WOMEN

No.	Title	Hour	Day	Room	Instructor
1f-2w-3s*‡	Elem. Physical Train.....	IV	MWF	3,151,153WGm	Ar
		V	MWF	3,151,153WGm	Ar
		VI	MWF	3,151,153WGm	Ar
		VII	MWF	3,151,153WGm	Ar
		III	TThS	3,151,153WGm	Ar
4f*	Preliminary Hygiene.....	I	M	201WGm	Dr. Norris
		II	T	201WGm	Dr. Norris
		IV	T	201WGm	Dr. Norris
		VII	T	201WGm	Dr. Norris
		III	W	201WGm	Dr. Norris
7f-8w-9s*‡	Sophomore Physical Train..	IV	TS	3,153WGm	
		V	TTh	3,153WGm	
10f-11w-12s*	Soph Orth. Gymnastics....	IV	TS	3,153WGm	
		V	TTh	3,153WGm	
13f-14w-15s*	Soph. Interpretive Dancing..	VII	TTh	151WGm	Miss Baker
		VIII	TTh	151WGm	Miss Baker
16f-17w-18s*§	Soph. Org. Games and Folk-Dancing .....	III	MF	151WGm	Ar
19f-20w-21s*§	Soph. Major Sports.....	VIII	MW	151WGm	Ar
22f-23w-24s* ¶	Soph. Elem. Swimming.....	IV	MW	51WGm	Ar
		VI	MW	51WGm	Ar
		II	TTh	51WGm	Ar
		III	MTh	51WGm	Ar
		III	TF	51WGm	Ar
		IV	TS	51WGm	Ar
		VI	TTh	51WGm	Ar
		VII	TTh	51WGm	Ar
		VII	MW	51WGm	Ar
		III	WS	51WGm	Ar
32w*	Personal Hygiene.....	III	TThS	201WGm	Ar
33s*	Hygiene of the Family.....	II	MWF	201WGm	Dr. Norris
34f-35w-36s*‡	Intermed. Phys. Train.....	VI	TTh	153WGm	Ar
40f-41w-42s*	Interpretive Dancing.....	IV	TS	151WGm	Miss Baker
43f-44w-45s*§	Folk-Dancing and Organized Games .....	V	TThF	151WGm	Miss Kissock
		VIII	TTh	151WGm	Ar
46f-47w-48s*‡	Hockey, Basket-Ball, Base-ball .....	VIII	TTh	151WGm	Ar
4f,w,s*	General Swimming.....	VIII	MTWTh	51WGm	No instr.

\*Offered on the Minneapolis campus.

‡ The third quarter is open to students who have not taken the preceding quarters.

§ The second or third quarter of this course is open to students who have not had the first two quarters.

¶ No student may register for more than two quarters of swimming without permission.

## COURSES IN HOME ECONOMICS

## PHYSICS

## COLLEGE OF SCIENCE, LITERATURE, AND THE ARTS

No.	Title	Credits	Offered to	Prerequisite courses
1	Elements of Mechanics and Sound .....	3	All	Trigonometry
2	Elements of Mechanics Lab- oratory .....	1	All	1 or parallel
9	Acoustics .....	3	All	None
21	Heat .....	3	All	1
22	Heat Laboratory.....	1	All	2, 21 or parallel
31	Optics .....	3	All	1
32	Optics Laboratory.....	1	All	2, 31 or parallel
41	Magnetism and Electricity...	3	All	1
42	Magnetism and Electricity Laboratory .....	1	All	2, 41 or parallel

For additional courses see the bulletin of the College of Science, Literature, and the Arts.

## PHYSICS

## COLLEGE OF SCIENCE, LITERATURE, AND THE ARTS

No.	Title	Hour	Day	Room	Instructor
1f,w*	Elements of Mechanics and Sound .....				
	Lect.	VII	MWF	30Ph	Mr. Erikson
	Quiz	VIII	W	100C	Mr. Erikson
1s*	Elements of Mechanics and Sound .....				
	Lect.	III	TThS	30Ph	Mr. Erikson
	Quiz	VIII	W	100C	Mr. Erikson
2f,w,s*	Elements of Mechanics Laboratory .....				
	Sec. 1	V, VI	T	16Ph	Mr. Erikson
	2	VII, VIII	T	16Ph	Mr. Erikson
	3	V, VI	Th	16Ph	Mr. Erikson
	4	VII, VIII	Th	16Ph	Mr. Erikson
9s*	Acoustics .....	Ar	Ar	30Ph	Mr. Erikson
21f,w*	Heat .....				
	Lect.	III	TThS	30Ph	Mr. Miller
	Quiz	VIII	W	100C	Mr. Miller
22f,w*	Heat Laboratory.....				
	Sec. 1	V, VI	M	23Ph	Mr. Miller
	2	VII, VIII	M	23Ph	Mr. Miller
	3	V, VI	T	23Ph	Mr. Miller
	4	VII, VIII	T	23Ph	Mr. Miller
31f,s*	Optics .....				
	Lect.	I	TThS	30Ph	Mr. Valasek
	Quiz	VIII	W	100C	Mr. Valasek
32f,s*	Optics Laboratory.....				
	Sec. 1	V, VI	Th	23Ph	Mr. Valasek
	2	VII, VIII	Th	23Ph	Mr. Valasek
	3	V, VI	F	23Ph	Mr. Valasek
	4	VII, VIII	F	23Ph	Mr. Valasek
41w,s*	Magnetism and Electricity...				
	Lect.	III	TThS	30Ph	Mr. Zeleny
	Quiz	VIII	W	100C	Mr. Zeleny
42w,s*	Electrical Laboratory.....				
	Sec. 1	V, VI	T	31Ph	Mr. Zeleny
	2	VII, VIII	T	31Ph	Mr. Zeleny
	3	V, VI	Th	31Ph	Mr. Zeleny
	4	VII, VIII	Th	31Ph	Mr. Zeleny
	5	V, VI	W	31Ph	Mr. Zeleny
	6	VII, VIII	W	31Ph	Mr. Zeleny

\*Offered on the Minneapolis campus.

## COURSES IN HOME ECONOMICS

 PHYSIOLOGY  
 MEDICAL SCHOOL

No.	Title	Credits	Offered to	Prerequisite courses
4	Human Physiology.....	5	All	Chem. 10 cred., biol. 8 cred.
100-101	Physiologic Chemistry.....	12	Jr., sr.	Org. chem., physics, an. biol.
103	Physiology of Muscle, Nerve, Blood, Circulation, and Di- gestion .....	8	Jr., sr.	Org. chem., an. biol., physics
104	Physiology of the Nervous System and Special Senses	8	Jr., sr.	Org. chem., an. biol., physics
150	Some Newer Aspects of Nu- trition .....	3	Sr.	101
153	Advanced Physiologic Chem- istry .....	3	Sr.	101
163	Metabolism .....	2 or 3	Sr.	101

For additional courses see the bulletin of the Medical School.

## PLANT PATHOLOGY AND BOTANY

No.	Title	Credits	Offered to	Prerequisite courses
1	Plant Pathology.....	5	Jr., sr.	Bot. 9 cred.
7	Weeds and Grasses.....	3	Soph., jr., sr.	Bot. 9 cred.
9	Weeds and Seed-Testing....	3	Soph., jr., sr.	Bot. 9 cred.
10	Forest Pathology.....	5	Soph., jr., sr.	Bot. 9 cred.
12	Seed Problems.....	3	Jr., sr.	9
14	Plant-Disease Control.....	5	Jr., sr.	1, Ent. 1 or 3
105-106-107	Mycology .....	9	Jr., sr.	Bot. 7, 11 or equiv.
108-109	Methods .....	6	Jr., sr.	1, Bact. 1
110	Principles of Pathology....	3	Jr., sr.	1, Bact. 1
111	Diseases of Field Crops....	3	Jr., sr.	1
112	Diseases of Fruit and Vege- table Crops.....	3	Jr., sr.	

PROGRAM

PHYSIOLOGY  
MEDICAL SCHOOL

No.	Title	Hour	Day	Room	Instructor
4f,w,s*	Human Physiology.....				
	Lab.	I, II, III	Th	315MH	Miss Greisheimer
	Lect.	I	MTWFS	301MH	Miss Greisheimer
100f-101w*	Physiologic Chemistry.....	I, II, III	TThS	310MH	Mr. Pettibone, Mr. Kingsbury
103f*	Physiology of Muscles, etc..	IV, V, VI, VII	MWF	301MH	Mr. Scott
104w*	Physiology of Nervous System, etc.....	IV, V, VI, VII	MWF	301MH	Mr. Scott
150f*	Some Newer Aspects of Nutrition .....	Ar	Ar	Ar	Mr. Pettibone
153f,w,s*	Advanced Physiologic Chemistry .....	Ar	Ar	310MH	Mr. Pettibone or Mr. Kingsbury
163s*	Metabolism .....	VI, VII, VIII	TTh	310MH	Mr. Pettibone

PLANT PATHOLOGY AND BOTANY

No.	Title	Hour	Day	Room	Instructor
1f†	Plant Pathology.....	V, VI, VII, VIII	MWF	1,2PP	Mr. Stakman, Mr. Leach, Mr. Seal
7w	Weeds and Grasses I.....	V, VI, VII	WF	3PP	Mr. Larson
9f†	Weeds and Seed-Testing....	V, VI, VII	WF	3,4PP	Mr. Larson
10f	Forest Pathology.....	V, VI, VII, VIII	MWF	1,2PP	Mr. Stakman, Mr. Leach, Mr. Seal
12w	Seed Problems.....	Ar	Ar	Ar	Mr. Larson
14†	Plant-Disease Control.....	..	..	..	.....
105f-106w-107s	Mycology .....	III, IV	MWF	1,3,2PP	Mr. Freeman, Mr. Stakman, Miss Dossdall
108f-109w	Methods .....	I, II	MWF	1,30PP	Mr. Stakman, Mr. Leach
110s	Principles of Pathology.....	I, II	MWF	1,30PP	Mr. Stakman, Mr. Barker
111w†	Diseases of Field Crops.....	V, VI	MWF	1,2PP	Mr. Stakman, Mr. Barker
112s†	Diseases of Fruit and Vegetable Crops.....	V, VI	MWF	1,2PP	.....

\*Offered on the Minneapolis campus.  
† Offered also in the summer session.  
‡ Not offered in 1921-22.

## COURSES IN HOME ECONOMICS

## POLITICAL SCIENCE

## COLLEGE OF SCIENCE, LITERATURE, AND THE ARTS

No.	Title	Credits	Offered to	Prerequisite courses
1	American Government.....	5	Soph., jr., sr.	None
7	State and Local Government	5	Soph., jr., sr.	1

For additional courses see the bulletin of the College of Science, Literature, and the Arts.

## POULTRY HUSBANDRY

## ANIMAL INDUSTRY GROUP

No.	Title	Credits	Offered to	Prerequisite courses
1	Poultry .....	3	All	None
2	Poultry-Judging .....	3	All	None
4	Incubating and Brooding...	3	All	None
5	Advanced Poultry-Judging...	3	All	2

## PSYCHOLOGY

## COLLEGE OF SCIENCE, LITERATURE, AND THE ARTS

No.	Title	Credits	Offered to	Prerequisite courses
1-2-3	General Psychology.....	9†	Soph., jr., sr.	None
4-5	Introductory Laboratory Psychology .....	4†	Soph., jr., sr.	1-2 or parallel
7	Introductory Laboratory Psychology .....	4	Soph., jr., sr.	1-2 or parallel
101-102	Experimental Psychology....	6†	Jr., sr.	1-2, 4-5, or 7

† The full course must be completed before credit will be allowed.

‡ Six credits will be allowed for the first two quarters.

PROGRAM

POLITICAL SCIENCE

COLLEGE OF SCIENCE, LITERATURE, AND THE ARTS

No.	Title	Hour	Day	Room	Instructor
if*	American Government.....				
	Sec. 1	IV	MTWFS	LitTh	Ar
	2	VI	MTWThF	306D	Ar
1w*	American Government.....				
	Sec. 1	IV	MTWFS	LitTh	Ar
	2	VI	MTWThF	306D	Ar
1s*	American Government.....				
	Sec. 1	IV	MTWFS	LitTh	Ar
	2	VI	MTWThF	LitTh	Ar
7f*	State and Local Government	VI	MTWThF	308D	Mr. Cushman
7w*	State and Local Government	VI	MTWThF	109MA	Mr. Cushman
7s*	State and Local Government	VI	MTWThF	209MA	Mr. Cushman

POULTRY HUSBANDRY

No.	Title	Hour	Day	Room	Instructor
1f,w	Poultry .....	V	MWF	104Ve	Mr. Smith
2w	Poultry-Judging .....	Ar	Ar	Ar	Mr. Smith
4s	Incubating and Brooding....	V	MWF	104Ve	Mr. Smith
5s	Advanced Poultry-Judging...	Ar	Ar	Ar	Mr. Smith

PSYCHOLOGY

COLLEGE OF SCIENCE, LITERATURE, AND THE ARTS

No.	Title	Hour	Day	Room	Instructor
1f-2w*	General Psychology.....				
	Lect. Sec. 1	I	MW	LitTh	Mr. Elliott, Mr. Foster
	2	VII	MW	LitTh	Mr. Elliott, Mr. Foster
	Rec. Sec. 1	III	S	Psy	
	2, 3	VII	Th or F	Psy	
3s*	General Psychology (cont.)..				
	Lect.	I	MW	LitTh	Mr. Elliott
	Rec. Sec. 1	I	Th or F or S	Psy	
	2	III	Th or F or S	Psy	
	3	V	Th or F	Psy	
	4	VII	Th or F	Psy	
4f-5w*	Introductory Laboratory Psychology .....				
	Sec. 1	I, II	TTh	211Psy	Mr. Foster
	2	III, IV	TS	211Psy	
	3	V, VI	TTh	211Psy	
	4	VII, VIII	TTh	211Psy	
7s*	Introductory Laboratory Psychology .....				
	Sec. 1	V, VI	MTWF	211Psy	
	2	III, IV	MTWF	211Psy	
101f-102w*	Experimental Psychology....	VI	MWF		
		VII	WF	116Psy	Miss Fernald

\*Offered on the Minneapolis campus.

## COURSES IN HOME ECONOMICS

108-109	Advanced General Psychology .....	6†	Sr.	101-102 or by permission
114-115	Human Behavior.....	6†	Jr., sr.	1-2, 4-5 or 7, 9 cr. an. biol., or by permission
119-120	Animal Behavior.....	6†	Jr., sr.	1-2, 4-5 or 7, 9 cr. an. biol., or by permission
121	Neuro-Psychology .....	3	Jr., sr.	1-2, 4-5 or 7, 9 cr. an. biol., or by permission
125-126	Differential Psychology.....	6†	Jr., sr.	1-2, 4-5 or 7
127	Social Psychology.....	5	Jr., sr.	1-2, 4-5 or 7
135-136	Dynamic Psychology.....	6†	Jr., sr.	1-2, 4-5 or 7
144-145	Abnormal Psychology.....	6†	Jr., sr.	1-2, 4-5 or 7

For additional courses see the bulletin of the College of Science, Literature, and the Arts.

## PUBLICATIONS AND RURAL JOURNALISM

No.	Title	Credits	Offered to	Prerequisite courses
10-11-12	Agricultural Journalism.....	9	Jr., sr.	13-14-15, 16-17
19	Agricultural Publicity.....	3	Jr., sr.	Rhet. 19 cred. or rhet. 9 cred., Eng. 9 cred.

## RHETORIC

No.	Title	Credits	Required of	Prerequisite courses
1	Rhetoric I.....	3	All	None
2	Rhetoric II.....	3	All	1
3	Rhetoric III.....	3	All	2
4	Elementary Rhetoric.....	3	All	None

† The full course must be completed before credit will be allowed.



PROGRAM

No.	Title	Hour	Day	Room	Instructor
108w-109s*	Advanced General Psychology	II	MWF	109Psy	.....
114w-115s*	Human Behavior.....	II	TThS	109Psy	Mr. Elliott
119f-120w*	Animal Behavior.....	VI	MWF		Mr. Lashley
121s*	Neuropsychology .....	VII	WF	109Psy	Mr. Lashley
		VI	MWF		Mr. Lashley
		VII	WF	109Psy	Mr. Lashley
125f-126w*	Differential Psychology.....	III	MWF	109Psy	Miss Fernald
127s*	Social Psychology.....	IV	MTWFS	115Psy	Mr. Bird
135w-136s*	Dynamic Psychology.....	III	TThS	115Psy	Mr. Woodrow
144f-145w*	Abnormal Psychology.....	IV	MWF	109Psy	Mr. Lashley

PUBLICATIONS AND RURAL JOURNALISM

No.	Title	Hour	Day	Room	Instructor
10f-11w-12s	Agricultural Journalism.....	V	MWF	317Ad	Mr. Kirkwood
19f	Agricultural Publicity.....	I	TThS	41P	Mr. Kirkwood

RHETORIC

No.	Title	Hour	Day	Room	Instructor
1f	Rhetoric I.....				
	Sec. 1	I	MWF	310En	Miss Jenkins
	2	II	MWF	310En	Miss Jenkins
	3	III	MWF	310En	Miss Clausen
	4	IV	MWF	310En	Miss Clausen
1w,s	Rhetoric I.....	VI	TThS	310En	Miss Jenkins
	Rhetoric II.....	II	MWF	308En	Miss Clausen
2f,s	Rhetoric II.....				
	Sec. 1	II	MWF	310En	Miss Jenkins
	2	IV	MWF	310En	Miss Jenkins
	3	IV	MWF	217En	Miss Clausen
	4	I	TThS	310En	Miss Clausen
3f	Rhetoric I.....	II	TThS	310En	Miss Jenkins
	Rhetoric III.....	III	TThS	310En	Miss Jenkins
3w	Rhetoric III.....				
	Sec. 1	II	MWF	310En	Miss Jenkins
	2	IV	MWF	310En	Miss Clausen
	3	IV	MWF	307En	Miss Jenkins
	4	I	TThS	310En	Miss Jenkins
4f,w,s	Rhetoric III.....				
	Sec. 1	II	MWF	307En	Miss Clausen
4f,w,s	Elementary Rhetoric.....	Ar	Ar	Ar	Miss Jenkins

\*Offered on the Minneapolis campus.

## COURSES IN HOME ECONOMICS

No.	Title	Credits	Offered to	Prerequisite courses
11	Argumentation .....	3	Soph., jr., sr.	3
22	Public Speaking.....	3	Soph., jr., sr.	3
24	Advanced Public Speaking..	3	Soph., jr., sr.	22
31	Survey of English Literature			
	I .....	5	Soph., jr., sr.	3
32	Survey of English Literature			
	II .....	3	Soph., jr., sr.	31

## ROMANCE LANGUAGES

## COLLEGE OF SCIENCE, LITERATURE, AND THE ARTS

*French*

No.	Title	Credits	Offered to	Prerequisite courses
1-2	Beginning French.....	10†	All	None
3-4	Intermediate French.....	10	All	1-2 or 2 yrs. h. s.

† The full course must be completed before credit will be allowed.

PROGRAM

No.	Title	Hour	Day	Room	Instructor
11f	Argumentation .....				
	Sec. 1	I	MWThFS	311En	Mr. Lansing
	2	IV	MTWFS	311En	Mr. Burtis
11w	Argumentation .....	III	MTWFS	311En	Mr. Burtis
11s	Argumentation .....	III	MTWFS	307En	Mr. Lansing
22f	Public Speaking.....	III	MTWFS	311En	Mr. Burtis
22w	Public Speaking.....				
	Sec. 1	I	MTWFS	311En	Mr. Burtis
	2	IV	MTWFS	311En	Mr. Burtis
22s	Public Speaking.....				
	Sec. 1	III	MTWFS	311En	Mr. Burtis
	2	IV	MTWFS	311En	Mr. Burtis
24f,w,s	Advanced Public Speaking..	II	TThS	311En	Mr. Burtis
31f,w,s	Survey of English Literature				
	I .....	II	MWThFS	306En	Mr. Lansing
32w,s	Survey of English Literature				
	II .....	I	MWF	310En	Mr. Lansing

ROMANCE LANGUAGES

COLLEGE OF SCIENCE, LITERATURE, AND THE ARTS

No.	Title	<i>French</i>			Instructor
		Hour	Day	Room	
1f-2w*	Beginning French.....				
	Sec. 1	I	TWThFS	213F	Ar
	2	II	MWThFS	227F	Ar
	3	III	MTThFS	226F	Ar
	4	IV	MTWFS	201F	Ar
	5	V	MTWThF	226F	Ar
	6	VI	MTWThF	202F	Ar
1w-2s*	Beginning French.....				
	Sec. 1	I	TWThFS	227F	Ar
	2	V	MTWThF	202F	Ar
1s*	Beginning French.....				
	Sec. 1	Ar	Ar	Ar	Ar
	2	Ar	Ar	Ar	Ar
2f*	Beginning French.....				
	Sec. 1	I	TWThFS	202F	Ar
	2	V	MTWThF	213F	Ar
3f-4w*	Intermediate French.....				
	Sec. 1	I	TWThFS	205F	Ar
	2	II	MWThFS	204F	Ar
	3	III	MTThFS	213F	Ar
	4	VI	MTWThF	213F	Ar
3w-4s*	Intermediate French.....				
	Sec. 1	I	TWThFS	202F	Ar
	2	V	MTWThF	213F	Ar
3s*	Intermediate French.....				
	Sec. 1	I	TWThFS	213F	Ar
	2	II	MWThFS	227F	Ar
	3	III	MTThFS	226F	Ar
	4	IV	MTWFS	201F	Ar
	5	V	MTWThF	226F	Ar
	6	VI	MTWThF	202F	Ar

\*Offered on the Minneapolis campus

## COURSES IN HOME ECONOMICS

No.	Title	Credits	Offered to	Prerequisite courses
20	Oral and Written French...	5	All	3-4 or 3 yrs. h. s.
21-22-23	Survey of French Literature	9†	All	3-4 or 3 yrs. h. s.
50-51-52	French Conversation.....	3†	Jr., † sr.	3-4 or 3 yrs. h. s., 53-54-55 or parallel
53-54-55	French Composition.....	3†	Jr., † sr.	3-4 or 3 yrs. h. s.

For additional courses see the bulletin of the College of Science, Literature, and the Arts.

*Spanish*

No.	Title	Credits	Offered to	Prerequisite courses
1-2	Beginning Spanish.....	10†	All	None

† The full course must be completed before credit will be allowed.

‡ Open without petition to sophomores who can satisfy the requirements.

PROGRAM

113

No.	Title	Hour	Day	Room	Instructor
1f*	Intermediate French.....				
	Sec. 1	I	TWThFS	227F	Ar
	2	II	MWThFS	213F	Ar
	3	III	MTThFS	124F	Ar
	4	IV	MTWFS	125F	Ar
20f*	Oral and Written French....				
	Sec. 1	III	MTThFS	205F	Mr. Frelin
20s*	Oral and Written French....				
	Sec. 1	VI	MTWThF	206F	Ar
21f-22w-23s*	Survey of French Literature				
	Sec. 1	I	TWThFS	15F	Ar
	2	II	MWThFS	213F	Ar
50f-51w-52s*	French Conversation.....				
	Sec. 1	VI	MTWThF	213F	Ar
	2	III	TThS	107F	Mr. Barton
53f-54w-55s*	French Composition.....				
	Sec. 1	III	TThS	301F	Mr. Sirich
	2	V	MWF	107F	Mr. Scarles
50f-51w-52s*	French Conversation.....				
	Sec. 1	III	MW	201F	Miss Guinotte
53f-54w-55s*	French Composition.....				
	Sec. 1	V	MW	107F	Mr. Frelin
53f-54w-55s*	French Composition.....				
	Sec. 1	III	F	201F	Miss Guinotte
53f-54w-55s*	French Composition.....				
	2	V	F	107F	Mr. Frelin

ROMANCE LANGUAGES

COLLEGE OF SCIENCE, LITERATURE, AND THE ARTS

No.	Title	<i>Spanish</i>		Room	Instructor
		Hour	Day		
1f-2w*	Beginning Spanish.....				
	Sec. 1	I	TWThFS	15F	Ar
	2	II	MWThFS	226F	Ar
	3	III	MTThFS	227F	Ar
	4	IV	MTWFS	226F	Ar
	5	V	MTWThF	201F	Ar
1w-2s*	Beginning Spanish.....				
	Sec. 1	VI	MTWThF	226F	Ar
1s*	Beginning Spanish.....				
	Sec. 1	II	TWThFS	202F	Ar
2f*	Beginning Spanish.....				
	Sec. 1	VI	MTWThF	125F	Ar
2f*	Beginning Spanish.....				
	Sec. 1	II	TWThFS	201F	Ar
3f-4w*	Beginning Spanish.....				
	Sec. 1	VI	MTWThF	226F	Ar
3f-4w*	Intermediate Spanish.....				
	Sec. 1	I	TWThFS	201F	Ar
	2	VI	MTWThF	201F	Ar
3f-4w*	Intermediate Spanish.....				
	Sec. 1	II	MWThFS	201F	Ar
	2	III	MTThFS	202F	Ar
3w-4s*	Intermediate Spanish.....				
	Sec. 1	V	MTWThF	109F	Ar
	2	I	TWThFS	201F	Ar
3w-4s*	Intermediate Spanish.....				
	Sec. 1	VI	MTWThF	201F	Ar

\*Offered on the Minneapolis campus.

## COURSES IN HOME ECONOMICS

No.	Title	Credits	Offered to	Prerequisite courses
3-4	Intermediate Spanish.....	10	All	1-2 or 2 yrs. h. s.
20	Oral and Written Spanish..	5	All	3-4 or 3 yrs. h. s.
50-51-52	Spanish Conversation.....	3†	Jr., ‡ sr.	3-4 or 3 yrs. h. s., 53-54-55 or parallel
53-54-55	Spanish Composition.....	3†	Jr., ‡ sr.	3-4 or 3 yrs. h. s.
65-66-67	Survey of Spanish Literature	9†	Jr., ‡ sr.	3-4

For additional courses see the bulletin of the College of Science, Literature, and the Arts.

## SOCIOLOGY AND SOCIAL WORK

## COLLEGE OF SCIENCE, LITERATURE, AND THE ARTS

No.	Title	Credits	Offered to	Prerequisite courses
1	Introduction to Sociology....	3†† or 5	3d qu. fr., soph., jr., sr.	None
6	Modern Social Reform: Move- ments .....	3	Soph., jr., sr.	1

† The full course must be completed before credit will be allowed.

‡ Open without petition to sophomores who can satisfy the requirements.

†† A 3-credit course, open only to students in Agriculture, Forestry, and Home Economics will be offered at University Farm in the fall and spring quarters.

PROGRAM

No.	Title	Hour	Day	Room	Instructor
3s*	Intermediate Spanish.....				
	Sec. 1	I	TWThFS	226F	Ar
	2	II	MWThFS	226F	Ar
	3	III	MTThFS	227F	Ar
	4	IV	MTWFS	226F	Ar
	5	V	MTWThF	201F	Ar
	6	VI	MTWThF	227F	Ar
(3s)-4f*	Intermediate Spanish.....				
	Sec. 1	I	TWThFS	301F	Ar
	2	II	MWThFS	202F	Ar
	3	III	MTThFS	308D	Ar
	4	IV	MTWFS	202F	Ar
	5	V	MTWThF	227F	Ar
20s*	Oral and Written Spanish...	III	MTThFS	202F	Ar
50f-51w-52s*	Spanish Conversation.....	II	MW	302D	Mr. House
53f-54w-55s*	Spanish Composition.....	II	F	302D	Mr. House
65f-66w-67s*	Survey of Spanish Literature	II	TThS	306F	Mr. House

SOCIOLOGY AND SOCIAL WORK

COLLEGE OF SCIENCE, LITERATURE, AND THE ARTS

No.	Title	Hour	Day	Room	Instructor
if	Introduction to Sociology....				
	Sec. 1*	I	TWThFS	9F	
	2*	III	MTThFS	5F	
	3*	IV	MTWFS	301F	
	4, 5*	V	MTWThF	5F,9F	
	6*	VI	MTWThF	9F	
	7 (3 cred.)	IV	MWF	105En	Mr. Lundquist
1w	Introduction to Sociology....				
	Sec. 1*	I	TWThFS	9F	
	2*	III	MTThFS	5F	
	3*	IV	MTWFS	301F	
	4, 5*	V	MTWThF	5F,9F	
	6*	VI	MTWThF	9F	
	7*	VII	MTWThF	110F	
	8 (3 cred.)	IV	MWF	105En	Mr. Lundquist
1s	Introduction to Sociology....				
	Sec. 1*	I	TWThFS	9F	
	2*	II	MWThFS	5F	
	3*	III	MTThFS	5F	
	4*	IV	MTWFS	301F	
	5, 6*	V	MTWThF	5F,9F	
	7*	VI	MTWThF	9F	
	8*	VII	MTWThF	110F	
	9 (3 cred.)	IV	MWF	105En	Mr. Lundquist
6f*	Modern Social Reform Move- ments .....				
	Sec. 1	II	TThS	102F	Ar
	2	IV	MWF	5F	Ar
	3	V	MWF	110F	Ar
	4	VI	MWF	5F	

\*Offered on the Minneapolis campus.

## COURSES IN HOME ECONOMICS

No.	Title	Credits	Offered to	Prerequisite courses
14	Rural Sociology.....	3	Soph., jr., sr.	1‡
51	Background of Dependency and Defectiveness.....	3	Jr., sr.	10 cred. in sociol.; or 10 cred. in sociol. and pol. sci.; econ. or psychol.
52	Treatment of Dependents and Defectives .....	3	Jr., sr.	51
53	Treatment of Delinquents...	3	Jr., sr.	Same as for 51
55	Housing Problems.....	3	Jr., sr.	Same as for 51
56	Field Practice in Case Work	2	Jr., sr.	51 parallel

‡ No prerequisite for seniors in the College of Agriculture, Forestry, and Home Economics.



PROGRAM

117

No.	Title	Hour	Day	Room	Instructor
6w*	Modern Social Reform Movements .....				
	Sec. 1	II	TThS	301F	Ar
	2	IV	MWF	5F	Ar
	3	V	MWF	110F	Ar
	4	VI	MWF	5F	
6s*	Modern Social Reform Movements .....				
	Sec. 1	II	TThS	301F	Ar
	3	IV	MWF	5F	Ar
	4	V	MWF	110F	Ar
	5	VI	MWF	5F	
14f	Rural Sociology.....				
	Sec. 1*	III	MWF	25F	Ar
	2*	V	MWF	25F	Ar
	3	I	MWF	105En	Mr. Lundquist
14w	Rural Sociology.....				
	Sec. 1*	III	MWF	9F	Ar
	2*	V	MWF	25F	Ar
	3	I	MWF	105En	Mr. Lundquist
14s	Rural Sociology.....				
	Sec. 1*	III	MWF	25F	Ar
	2*	V	MWF	15F	Ar
51f*	Background of Dependents and Defectives.....	I	TThS	5F	Mr. Bruno
51w*	Background of Dependents and Defectives.....	I	MWF	5F	Mr. Bruno
51s*	Background of Dependents and Defectives.....	I	TThS	5F	Mr. Bruno
52w*	Treatment of Dependents and Defectives.....	I	TThS	5F	Mr. Bruno
52s*	Treatment of Dependents and Defectives.....	I	MWF	5F	Mr. Bruno
53f*	Treatment of Delinquents...	III	MWF	9F	
53w*	Treatment of Delinquents...	III	MWF	101F	
53s*	Treatment of Delinquents...	III	MWF	101F	
55w*	Housing Problems.....	I	MWF	101F	Mr. Davis
56f*	Field Practice in Case Work				
	Sec. 1	I, II, III	MW		Mrs. Mudgett
	2	I, II, III	WF		
	3	V, VI, VII	MW		
	4	V, VI, VII	TTh		
	5	V, VI, VII	WF		
56w*	Field Practice in Case Work				
	Sec. 1	II, III, IV	MW		Mrs. Mudgett
	2	II, III, IV	WF		
	3	V, VI, VII	MW		
	4	V, VI, VII	WF		
	5	V, VI, VII	TTh		
56s*	Field Practice in Case Work				
	Sec. 1	V, VI, VII	MW		Mrs. Mudgett
	2	V, VI, VII	WF		
	3	II, III, IV	TTh		
	4	V, VI, VII	TTh		

\*Offered on the Minneapolis campus.

## COURSES IN HOME ECONOMICS

No.	Title	Credits	Offered to	Prerequisite courses
57	Field Practice in Case Work	2	Jr., sr.	52 parallel
60	Child Welfare.....	3	Jr., sr.	52
97-98-99	Supervised Field Practice Work .....	3, 6 or		
100	Social Psychology.....	3	Jr., sr.	Director's consent 1 and 15 cred. in sociol.; anthro.; econ.; educ.; hist.; philos.; pol. sci.; or psychol. includ- ing Psychol. 1-2
101	Social Organization.....	3	Jr., sr.	4 courses in sociol. or 1 and 15 cred. in sociol.; anth.; econ.; educ.; hist.; philos.; pol. sci.; or psychol.
102	Social Control.....	3	Jr., sr.	Same as for 101
110	Community Organization and Social Work in Small Towns and Country.....	2	Jr., sr.	Same as for 101
114	Rural Social Institutions....	3	Jr., sr.	Same as for 101
119	The Family.....	3	Jr., sr.	Same as for 101
120	Social Progress.....	3	Jr., sr.	Same as for 101
122	Methods of Social Investiga- tion .....	3	Jr., sr.	Same as for 101
123	Social Statistics.....	3	Jr., sr.	122
128	Charitable Administration, Finance, and Publicity....	2	Jr., sr.	Same as for 101
130	Technic of Family Treatment	2	Jr., sr.	Same as for 101 including 52
134	Legal Protection of the Child	3	Jr., sr.	Same as for 101 including 60
138-139	Mental Case Work.....	6	Jr., sr.	Same as for 130
140	History of Social Theory...	3	Jr., sr.	Same as for 101
141	Contemporary Social Theory	3	Jr., sr.	Same as for 101
150	Seminar: The Literature of Social Protest.....		Sr.	Consent of director
180-181-182	Seminar in Educational Soci- ology .....	6	Jr., sr.	1, 6, 120

For additional courses see the bulletin of the College of Science, Literature, and the Arts.

PROGRAM

No.	Title	Hour	Day	Room	Instructor
57w*	Field Practice in Case Work				
	Sec. 1	II, III, IV	MW		Mrs. Mudgett
	2	II, III, IV	WF		
	3	V, VI, VII	MW		
	4	V, VI, VII	WF		
	5	V, VI, VII	TTh		
57s*	Field Practice in Case Work				
	Sec. 1	V, VI, VII	MW		Mrs. Mudgett
	2	V, VI, VII	WF		
	3	II, III, IV	TTh		
	4	V, VI, VII	TTh		
60w*	Child Welfare.....	VIII	MWF	9F	Mr. Hodson
97f-98w-99s*	Supervised Field Practice				
	Work .....	Ar*	Ar	Ar	Mrs. Mudgett
100f*	Social Psychology.....	II	TThS	9F	Mr. Bernard
101w*	Social Organization.....	II	TThS	9F	Mr. Bernard
102s*	Social Control.....	II	TThS	9F	Mr. Bernard
110w*	Community Organ. and So-				
	cial Work in Small Towns				
	and Country.....	VII-VIII	Th	9F	Mr. Bernard
114s	Rural Social Institutions....	I	MWF	105En	Mr. Lundquist
119f*	The Family.....	III	TThS	9F	
120f*	Social Progress.....	II	MWF	9F	
122w*	Methods of Social Investiga-				
	tion .....	VII	MWF	9F	Mr. Elmer
123s*	Social Statistics.....	VII	MWF	9F	Mr. Elmer
128s*	Charitable Administration,				
	Finance, and Publicity....	VII-VIII	Th	9F	Mr. Davis
130s*	Technic of Family Treat-				
	ment .....	VII-VIII	T	9F	Mr. Bruno
134s*	Legal Protection of the Child	VIII	MWF	9F	Mr. Hodson
138w*	Mental Case Work.....	VII, VIII	T and Ar	5F	Miss Seeberg
139s*	Mental Case Work.....	VIII	Th and Ar	5F	Miss Seeberg
140w*	History of Social Theory....	II	MWF	9F	Mr. Bernard
141s*	Contemp. Social Theory.....	II	MWF	9F	Mr. Bernard
180f-181w-		VIII-IX	M	Ed	Mr. Finney
182s*	Seminar in Educ. Sociol....				

\*Offered on the Minneapolis campus.

## COURSES IN HOME ECONOMICS

## SOILS

No.	Title	Credits	Offered to	Prerequisite courses
4	Soils .....	3	Soph., jr., sr.	Chem. 10 cred.
5	Soil Fertility.....	3	Soph., jr., sr.	4
101	Chemical Analysis of Soils..	3-5	Jr., sr.	5, quant. anal.
102	Special Problems in Soils....	*	Jr., sr.	101 or 108
104	Soil-Surveying .....	3	Jr., sr.	108
105	Minnesota Soils.....	3	Jr., sr.	5
106	Peat Soils.....	2	Jr., sr.	5
107	Fertilizers and Manures....	2	Jr., sr.	5
108	Physical Properties of Soils..	3	Jr., sr.	5

## VETERINARY MEDICINE

## ANIMAL INDUSTRY GROUP

No.	Title	Credits	Offered to	Prerequisite courses
2	Anatomy of Domestic Animals .....	5	Soph., jr., sr.	None
3-4	Comparative Physiology.....	6	Soph., jr., sr.	2
6	Physiology and Hygiene of Breeding .....	3	Jr., sr.	3-4
8	Veterinary Studies.....	5	Soph., jr., sr.	None
12	Infectious Diseases.....	3	Jr., sr.	3-4, Bact. 1
13	Non-Infectious Diseases....	3	Jr., sr.	3-4
101-102	Advanced Anatomy of Domestic Animals.....	6	Jr., sr.	2 or equiv.
103-104	Advanced Comparative Physi- ology .....	6	Jr., sr.	3-4 or equiv.

\* Credit according to the amount of work.

PROGRAM

SOILS

No.	Title	Hour	Day	Room	Instructor
4f	Soils .....				
	Lect.	III	TTh	251Ch	Mr. Rost
	Lab.	III, IV	S	253Ch	
5s	Soil Fertility.....				
	Lect.	III	TTh	251Ch	Mr. Alway,
	Lab.	III, IV	S	253Ch	Mr. Rost
101f	Chemical Analysis of Soils..	Ar	Ar	Ar	Mr. Rost
102w,s	Special Problems in Soils...	Ar	Ar	Ar	Mr. Alway
104s	Soil-Surveying .....	Ar	Ar	Ar	Mr. McMiller
105w	Minnesota Soils.....	Ar	Ar	Ar	Mr. Alway
106w	Peat Soils.....	Ar	Ar	Ar	Mr. Alway
107w	Fertilizers and Manures.....	Ar	Ar	Ar	Mr. Rost
108w	Physical Properties of Soils	Ar	Ar	Ar	Mr. McMiller

VETERINARY MEDICINE

No.	Title	Hour	Day	Room	Instructor
2f	Anatomy of Domestic Animals .....	V	MTWF	2Ve	
		II	MWThFS	2Ve	Mr. Kernkamp
3w-4s	Comparative Physiology.....	I	TThS	2Ve	Mr. Hewitt
6f	Physiology and Hygiene of Breeding .....	IV	MWF	9Ve	Mr. Boyd
8s	Veterinary Studies.....	III	MTWFS	9Ve	Mr. Reynolds
12w	Infectious Diseases.....	I	MWF	2Ve	Mr. Fitch, Mr. Billings
13s	Non-Infectious Diseases.....	I	MWF	2Ve	Mr. Boyd
101w-102s	Advanced Anatomy of Domestic Animals.....	Ar	Ar	Ar	Mr. Kernkamp
	(Limited to 9)				
103f-104w	Advanced Comparative Physi- ology .....				
	Lect.	II	TTh	9Ve	Mr. Hewitt
	Lab.	V, VI	Th	9Ve	Mr. Hewitt

# *The Bulletin* *of the University of* **Minnesota**

*General Extension Division*  
*Evening Collegiate Courses*  
**1921-1922**



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## CALENDAR

1921-1922

1921

September	19-24	Week	Registration week
September	26	Monday	Regular class work begins
November	24	Thursday	Thanksgiving Day; a holiday
December	24	Saturday	Christmas recess begins

1922

January	2	Monday	Class work resumed
January	23-27	Week	Examination week, first semester
January	27	Friday	First semester ends
January	30	Monday	Second semester begins
May	22-26	Week	Examination week, second semester
May	26	Friday	Second semester ends
May	29	Monday	Annual dinner and closing exercises

## EVENING COLLEGIATE COURSES

### FACULTY

LOTUS DELTA COFFMAN, Ph.D., President  
WILLIAM WATTS FOLWELL, LL.D., President Emeritus  
CYRUS NORTROP, LL.D., President Emeritus  
\*RICHARD REES PRICE, M.A., Director of University Extension  
J. J. PETTIJOHN, B.A., Acting Director of University Extension  
REUEL R. BARLOW, B.A., Instructor in Journalism  
FRANCIS B. BARTON, Docteur de L'Université de Paris, Assistant Professor  
of Romance Languages  
JOSEPH W. BEACH, Ph.D., Associate Professor of English  
LUTHER L. BERNARD, Ph.D., Professor of Sociology  
GISLE C. BOTHNE, M.A., Professor of Scandinavian Languages and  
Literatures  
OSCAR C. BURKHARD, Ph.D., Assistant Professor of German  
GEORGE P. CONGER, B.A., B.D., Assistant Professor of Philosophy  
ROBERT V. CRAM, Ph.D., Instructor in Latin  
JOSEPH E. CUMMINGS, M.A., Instructor in Economics  
JAMES DAVIES, Ph.D., Assistant Professor of German  
LYNWOOD G. DOWNS, M.A., Instructor in German  
J. FRANKLIN EBERSOLE, M.A., Professorial Lecturer in Economics  
MANUEL C. ELMER, Ph.D., Associate Professor of Sociology  
ROSS L. FINNEY, Ph.D., Assistant Professor of Educational Sociology  
WILLIAM S. FOSTER, Ph.D., Associate Professor of Psychology  
JOHN S. GARN, B.A., Instructor in Public Speaking, General Extension  
Division  
ISAAC W. GEIGER, Ph.D., Assistant Professor of Chemistry  
GEORGE G. GLICK, B.A., LL.B., Instructor in Business Law  
WILLIAM L. HART, Ph.D., Associate Professor of Mathematics  
SIGURD B. HUSTVEDT, Ph.D., Assistant Professor of Rhetoric  
ALBERT E. JENKS, Ph.D., Professor of Anthropology  
AUGUST C. KREY, Ph.D., Associate Professor of History  
SAMUEL KROESCH, Ph.D., Assistant Professor of German  
IRVILLE C. Lecompte, Ph.D., Professor of Romance Languages  
CHARLES F. LINDSLEY, M.A., Instructor in Public Speaking  
ARIEL MACNAUGHTON, M.A., Instructor in Public Speaking  
WILFORD S. MILLER, Ph.D., Professor of Educational Psychology  
CECIL A. MOORE, Ph.D., Associate Professor of English  
WALTER R. MYERS, Ph.D., Instructor in Economics  
CHARLES W. NICHOLS, Ph.D., Assistant Professor of Rhetoric  
EVERETT W. OLMSTED, Ph.D., Lit.D., Professor of Romance Languages  
E. MAUD PATCHIN, B.S., Assistant Professor of Textiles and Clothing

\* Absent on leave, 1921-1922.



ARTHUR F. PAYNE, M.A., Assistant Professor of Trade and Industrial  
Education

FRANK M. RARIG, M.A., Associate Professor of Public Speaking

MARTIN B. RUUD, Ph.D., Assistant Professor of Rhetoric

CHARLES A. SAVAGE, Ph.D., Professor of Greek

COLBERT SEARLES, Ph.D., Professor of Romance Languages

LESTER B. SHIPPEE, Ph.D., Assistant Professor of History

EDWARD H. SIRICH, Ph.D., Assistant Professor of Romance Languages

J. WARREN STEHMAN, M.A., Assistant Professor of Economics

ANDREW A. STOMBERG, M.S., Professor of Scandinavian Languages and  
Literatures

MASON W. TYLER, Ph.D., Assistant Professor of History

MARION WELLER, B.A., Associate Professor of Textiles and Clothing

NORMAN WILDE, Ph.D., Professor of Philosophy

JEREMIAH S. YOUNG, Ph.D., Professor of Political Science

## EXTENSION SERVICE

The Extension Service of the University of Minnesota is organized to include:

- A. Evening classes, in Minneapolis, St. Paul, Duluth, and other cities.
  - 1. Courses leading to credit in the College of Science, Literature, and the Arts, in the College of Education, and in the School of Business.
  - 2. Courses in business administration, accountancy, and finance.
  - 3. Practical courses in engineering and in industrial subjects.
- B. Correspondence courses,
- C. Extension lectures, singly or in groups, and lyceum lectures, concerts, and entertainments.
- D. The Municipal Reference Bureau, which compiles and furnishes to city officials information pertaining to municipal government and administration.
- E. The Bureau of Visual Instruction, through which loan collections of lantern slides and films are furnished to schools and clubs.
- F. Drama Service, through which dramatic clubs and school societies are given advice about the production of amateur theatricals, and copies of plays are lent for reading and selection.
- G. Community Service, through which the elements making up a community and its trading fringe are given advice and assistance for bringing together all the social forces into an organization whose purpose shall be to make the people healthy and wealthy and wise.
- H. Agricultural Extension, including lectures, demonstrations, institutes, and short courses under the direction of the College of Agriculture, Forestry, and Home Economics.

# EVENING EXTENSION COURSES

## GENERAL INFORMATION

### ADMISSION TO COURSES

It is not intended that any regulation should debar from the privileges of these courses any person who can pursue them profitably. Those persons desiring credit toward a university degree must of course comply with the regulations laid down by the college in which credit is desired. Those not desiring such credit may be admitted, provided they are sufficiently mature (more than eighteen years of age) and can satisfy the departments in which they wish to study that they are able to carry the work profitably to themselves and without hindrance to the classes.

### CREDIT FOR EXTENSION COURSES

Credit toward a degree will be given students who satisfy the entrance requirements of the college in which credit is desired and who successfully complete any of the extension courses of university grade. This applies to all the courses listed under academic or collegiate courses, unless otherwise specified. It also applies to nearly all the business courses. No courses listed under engineering carry credits. Credit in any extension course will be awarded only to those students who pass the final examinations of that course. Such credits will be recorded upon matriculation in the University. Courses requiring one evening (two hours) a week for recitation normally carry 2 semester credits. Those requiring more time usually carry correspondingly more credits. In the Extension Division credits are still reckoned on the semester, not the quarter, basis. The school year is divided into two semesters of sixteen weeks each, with an extra week devoted to examinations. Normally each class meets one night a week for two hours.

The statement concerning credit for the Certificates in Accountancy, in Finance, and General Business will be found on pages 27, 28, and 29 in the Announcement of Evening Classes.

Students *must indicate at the time of registration whether or not they desire university credit in the courses pursued.*

#### *Regulations Concerning Credit in the College of Science, Literature, and the Arts*

1. All courses for which credit is given in the College of Science, Literature, and the Arts must be authorized with the credits by the Advisory Committee. But credit shall be given only to those extension courses which are conducted in essentially the same manner as the corresponding courses in the University and which are carried on under similar conditions as to attendance, term's work, quizzes, and examinations.

2. Each credit course shall be directly in charge of a member of the faculty.

3. Any regularly enrolled University student successfully completing an approved course shall receive an appropriate credit.

4. Any person shall receive a certificate upon satisfactorily completing an approved course. The certificates entitle the holder to the corresponding University credits whenever he has earned 30 credits in residence. The University examiner shall in all cases pass upon the qualifications of the student.

5. The maximum credit towards a degree for work done in extension courses shall not exceed one half the unit hours required for graduation.

6. Credit for an amount not exceeding one quarter of the unit hours required for graduation may be given at the University of Minnesota to students of such other extension schools or departments as may be approved by the advisory committee, provided that such credit shall be subject to the same provisions as govern credits in the General Extension Division of the University of Minnesota.

#### RESIDENT STUDENTS

1. No University student may enroll for extension courses for the purpose of removing a condition or failure.

2. No University student may enroll for an extension course if this would increase his credit hours beyond what the rules allow.

3. Any University student who wishes to enroll for an extension course must first obtain the approval of the dean of his college.

#### FEEES

Collegiate courses meeting one evening a week require a fee of from \$5 to \$7.50 a semester of sixteen weeks. For collegiate courses meeting two evenings a week, the fee is from \$10 to \$15 a semester.

The fee for the business and engineering courses for a single subject is \$7.50 a semester, with the exception of a few advanced or technical courses for which the fee is \$10 a semester. Each class is a separate unit. The grouping of subjects into courses does not affect the unit fee for each subject.

The fee does not include the cost of texts or materials. The cost of these items varies from \$1 to \$3 a course.

All fees are payable at the time of registration, and registration should not be deferred longer than the second meeting of class. Checks should be made payable to the University of Minnesota.

Special arrangements are made with organizations, clubs, and business concerns, whereby instruction may be given to groups of students within the organization at a sum which will somewhat reduce the individual rate per member. However, such classes can not be restricted to that group alone but must be open to the general public.

#### REFUNDS

No fee will be refunded on account of withdrawal from any course. Exceptions to this rule will be made only in case of (a) removal from the city or (b) illness or physical disability as attested by the certificate of a reputable physician. Application for pro rata refund under the above conditions *will not be considered later than fifteen days after registration.*

## LENGTH OF COURSE

A semester consists of sixteen weeks of instruction with an additional week for the final examination.

## PLACES FOR CONDUCTING CLASSES

Most of the classes in engineering will be held in the Main Engineering Building, Electrical Engineering Building, the Mechanical Engineering, or the Experimental Engineering Building.

Other classes in Minneapolis are conducted at the University, at the Public Library, at the City Hall, and in some of the public schoolhouses. Definite locations for each class will be announced in a circular to be published about September 15.

In St. Paul the work will be carried on at the City Hall and the Public Library. Additional accommodations will be provided for in some cases.

In Duluth the work will be carried on in the St. Louis County Court-house.

## NUMBER FOR WHOM CLASSES WILL BE ORGANIZED

Classes will not be organized for a smaller enrolment than fifteen and in some courses a larger registration will be required.

## TIME OF MEETING

Classes ordinarily meet at 7:30 and dismiss at 9:30. Classes in business subjects frequently meet at 6:30.

## ENROLMENT

Registration for the first semester takes place during the week preceding the organization of classes (September 19-24). Students are advised to register with the instructor at the first meeting of the class.

## RULE REGARDING ABSENCES

The attention of students and faculty is called to the following rule regarding absences:

"No student whose absences exceed three (3) of the regular scheduled sessions of the course for a semester shall be admitted to the final examination of the course without special permission of the director of University Extension."

## PROGRAM OF CLASSES

Folders will be issued about September 15, giving the program of classes and schedules of meeting places. It should be understood that *not all the courses listed in this bulletin are given in any one year*. Final announcement may be found in the special folder. Folders will be issued for the collegiate courses, the business courses, and the engineering courses. Separate bulletins are also issued for each of these groups of courses.

## LOCATION OF EXTENSION OFFICES

The offices of the General Extension Division may be found on the ground floor of the Main Engineering Building, on Washington Avenue and Church Street Southeast. To telephone the office call N. W. Dinsmore 2760 and ask the University central for the General Extension Division

## DEPARTMENT OF COLLEGIATE INSTRUCTION

The following courses are offered extension students with two purposes in view: First, an opportunity is afforded those who are candidates for degrees, but who are unable to pursue their entire college course in regular residence, to complete a part of their work while otherwise occupied during the day.

Second, the advantage of university training in cultural subjects is offered those who can devote one or more evenings a week to such work, regardless of any desire for university credit.

The General Extension Division is now prepared to offer the following evening courses. Others will be given provided a sufficient registration is assured, usually fifteen. Those interested in forming such classes are advised to correspond with the director.

A special folder announcing specific dates and places for holding classes will be issued early in September. This folder, containing the class program, will be sent to all requesting it.

### FEES

Each course listed as a collegiate course requires a fee of \$5 for the semester of sixteen weeks, the class meeting one evening a week for two hours. A few advanced courses require a fee of \$7.50. For collegiate courses meeting two evenings a week the fee is \$10 a semester, with the exception already noted.

### TEXT MATERIAL

When text material is furnished in mimeographed or printed form the student is required to reimburse the University for its cost. This cost varies from \$1 to \$3 per course.

### RULE REGARDING ABSENCES

The attention of students and faculty is called to the following rule regarding absences:

"No student whose absences exceed three (3) of the regular scheduled sessions of the course for a semester shall be admitted to the final examination of the course without special permission of the director of University Extension."

### CREDIT

Credit in any extension course will be awarded only to those students who pass the final examination of the course.

## LENGTH OF COURSE

A semester consists of sixteen weeks of instruction with an additional week for a final examination.

## AMERICANIZATION TRAINING AND ANTHROPOLOGY

### THE AMERICAN PEOPLE

- 1 (113). OLDER IMMIGRANTS. Characteristics, contributions, and distribution of the older immigrant peoples in America, their modification and importance to us. Two credits (one evening a week); first semester. MR. JENKS.
- 2 (114). NEWER IMMIGRANTS. Characteristics, contributions, and distribution of the newer immigrant peoples in America, their modification and importance to us. Two credits (one evening a week); second semester. MR. JENKS.
- 3 (115). AMERICANISMS AND ASSIMILATION. Essential and unique historical Americanisms and their value and virility for the future in America. Conditions and facts of assimilation. Two credits (one evening a week); second semester. MR. JENKS.

## ART

1. ART APPRECIATION—ANCIENT AND MEDIEVAL. This is a cultural rather than a technical course, leading to the appreciation of architecture, sculpture, and painting as an expression of the civic and intellectual activities of the time in which the artist lived. Sixteen two-hour lectures illustrated with lantern slides. One hour required reading to supplement each lecture. Two College of Education credits (one evening a week); first semester.
2. ART APPRECIATION—RENAISSANCE AND MODERN. This is a cultural rather than a technical course, leading to the appreciation of architecture, sculpture, and painting as an expression of the civic and intellectual activities of the modern period. Sixteen two-hour lectures, illustrated with lantern slides. One hour required reading to supplement each lecture. Two College of Education credits (one evening a week); second semester.
3. FREEHAND DRAWING. Drawing and painting from life and from casts, with lectures on the construction of the human figure and its application to decoration. Students completing both semesters will be taught how to make etchings. (One evening a week); both semesters. MR. BURTON.

## CHEMISTRY

1. GENERAL INORGANIC CHEMISTRY—THE NON-METALS. A study of the common non-metallic elements and their principal compounds, with discussions of the laws and theories of chemistry. One lecture, one recitation, and three hours laboratory work per week. TTh; 7:30-10:00. First semester. MR. GEIGER.
2. GENERAL INORGANIC CHEMISTRY AND QUALITATIVE ANALYSIS—THE METALS AND QUALITATIVE ANALYSIS. A study of the common metallic elements and their principal compounds, with a further discussion of the laws and theories of chemistry, and systematic qualitative analysis. One lecture, one recitation, and three hours laboratory work per week. Open to students who have completed Course 1 or its equivalent. Second semester. MR. GEIGER.

NOTE: The work of both semesters is equivalent to 6 semester or 9 quarter credits. Students desiring credit in the College of Science, Literature, and the Arts can earn 10 quarter credits by doing extra work by assignment.

## ECONOMICS

1. ELEMENTS OF ECONOMICS. For description see Department of Business Instruction. (One evening a week); first semester.
2. ECONOMIC PROBLEMS. For description see Department of Business Instruction. (One evening a week); second semester.

## EDUCATION

- 1 (3a). SOCIAL ASPECTS OF EDUCATION. This course deals with conditions within the school itself,—such as the socialized recitation and the social activities of students. It also discusses educational activities outside the school, including the various institutions which influence society. It treats of the necessity of coördinating the social activities within and without the school so that each may become more effective. Two credits (one evening a week); first semester.
- 2 (119). THE SCHOOL CURRICULA. An attempt is made to discover fundamental principles governing the material and methods of education in a democracy. To this end it discusses the nature of what we mean by a democratic society. The aims and methods of the enterprise of education are considered from this point of view. Two credits (one evening a week); second semester.
3. ADMINISTRATION OF VILLAGE AND CONSOLIDATED SCHOOLS. A course designed for the principals of small schools. The technic of school administration and supervision is specifically applied to the small system. An effort is made not only to acquaint the student with progressive



movements in education, but also to help him adjust himself to conditions as he actually finds them. Two credits (one evening a week); second semester. MR. FINNEY.

#### VOCATIONAL AND INDUSTRIAL

1. METHODS OF ESTABLISHING TRAINING DEPARTMENTS IN FACTORIES AND STORES. This is a course for foremen, superintendents, and other executives in the organization and establishment of training departments and "vestibule schools" as a part of scientific management and the employment system. This course will be so arranged that each member of the class will at the end of the course be in possession of the complete data necessary for the establishment of such courses in his own organization. No credit (one evening a week); first semester. MR. PAYNE.
2. SHEET-METAL PATTERN-DRAFTING FOR TINSMITHS AND SHEET-METAL WORKERS. This is a practical course of real problems and development of patterns and of forms and types of sheet-metal work. For boiler-makers, coppersmiths, tinsmiths, and automobile-body men. The course is divided into the following progressive units: (1) development of patterns by orthographic projection; (2) by the use of parallel lines; (3) by means of radial lines; (4) by triangulation; (5) approximation; (6) templates. Students will be encouraged to bring in practical problems from their every-day work. No credit (one evening a week); first semester. MR. PAYNE.
3. SCIENTIFIC METHODS OF HANDLING AND TESTING LABOR. This is a practical course covering the development of scientific methods in handling and testing labor. A complete study will be made of the three groups of tests used. Practical illustrations from plants using these tests. The students of this class will be encouraged to apply the class work to their own particular situations. No credit (one evening a week); second semester. MR. PAYNE.
4. CAUSES OF AND CURES FOR INDUSTRIAL UNREST. An analytical study is made of the fundamental causes of various types of industrial unrest and the remedial measures that have been taken by various organizations. The work of this class will be from the standpoint of the administrator and executive. No political panaceas will be discussed. No credit (one evening a week); second semester. MR. PAYNE.
5. BUSINESS AND FACTORY MANAGEMENT I. The first part of this course deals with the origins of present practices in management, the underlying principles of efficiency in management, the several forms of organization. Part I is prerequisite to Part II. No credit (one evening a week); first semester. MR. PAYNE.
6. BUSINESS AND FACTORY MANAGEMENT II. The second part deals with the more specific details of management, such as scientific management, business cycles, methods of control, selection of personal incentives and rewards, labor problems, etc. No credit (one evening a week); second semester. MR. PAYNE.

7. FOREMAN'S COURSE IN METHODS OF HANDLING LABOR. The aim of this course is to develop in the foreman the scientific point of view in regard to the various problems of handling labor of various kinds as related to production. Some of the detailed lessons are: Evolution of the factory system, functional foremanship, testing of trade knowledge and skill, psychology of the worker, job analysis, personnel analysis and the foreman as an instructor. No credit (one evening a week); both semesters. MR. PAYNE.
8. EMPLOYMENT MANAGEMENT I. The first part of this course deals with the significance of employment management as a part of our evolving industrial civilization, its relation to scientific management, and the organization and functions of an employment department. Part I is prerequisite to Part II. No credit (one evening a week); first semester. MR. PAYNE.
9. EMPLOYMENT MANAGEMENT II. The second part deals in detail with the several functions of the employment department, such as: sources of labor supply, interviewing, scientific selection of men, wage systems, training the worker, labor audits, labor turnover, psychology of the worker, and modern industrial movements. No credit (one evening a week); second semester. MR. PAYNE.

#### ENGLISH

- 1 (I-2-3). GENERAL SURVEY OF ENGLISH LITERATURE. Lectures, recitations, and assigned readings. Designed to prepare for more minute study of special periods. Two credits (one evening a week); first semester.
- 2 (I-2-3). GENERAL SURVEY OF ENGLISH LITERATURE. A continuation of Course 1. Two credits (one evening a week); second semester.
- 3 (8). SHAKESPEARE. An introductory study of Shakespeare's development as a poet and dramatist up to *King Lear*, with readings of representative plays. Two credits (one evening a week); second semester. MR. RARIG.
- 4 (44). AMERICAN LITERATURE. Lectures on American literature with extensive readings from the principal poets and prose writers of the United States. Two credits (one evening a week); second semester. MR. NICHOLS.
- 5 (109-110). THE ROMANTIC POETS. A study of the Romantic School of poets from Wordsworth to Keats, and the influence of the French Revolution upon them. Two credits (one evening a week); first semester. MR. RUUD.
- 6 (151). RECENT POETRY. Poetry in England and America since the death of Queen Victoria. The main tradition and tendencies now prevailing. Two credits (one evening a week); second semester. MR. BEACH.

7. MODERN FRENCH AUTHORS. A study of the French authors of the nineteenth century in English. No credit (one evening a week); first semester. MR. SEARLES.

## GERMAN

1. BEGINNING GERMAN. Pronunciation, grammar, conversation, and composition; selected reading in easy prose and verse. Eight credits (two evenings a week); both semesters. Open to all who have had no German. Both semesters must be completed before credit is given for the first semester. MR. KROESCH.
2. ELEMENTARY CONVERSATION. Conversation on topics of every-day life, aiming at fluency in the use of idiom. Not a course in composition. Organized on the laboratory basis—one hour credit with two hours recitation and at least one hour of outside preparation. Intended for those who have had at least one year of German. Two credits (one evening a week); both semesters. MR. DAVIES.
3. RAPID READING. Short stories and dramas by Storm, Heyse, Baumbach, Lessing, Goethe, Schiller, Hebbel, and Sudermann. Class work and discussions are conducted in German. Open to all who have had at least one year of German. Four credits (one evening a week); both semesters. MR. DOWNS.
4. COMMERCIAL GERMAN. Oral use of the language. Practical vocabulary. In the second semester attention will be given to business correspondence. Open to all with two years German. Both semesters must be completed before credit is given for the first semester. Eight credits (two evenings a week); both semesters. MR. BURKHARD.

## GREEK IN ENGLISH

1. GREEK MYTHOLOGY. No knowledge of Greek is required for this course. A course of lectures and readings dealing with the legends and myths which appear in the literature and art of ancient Greece. The quaint and beautiful stories of Greek gods and heroes found in Homer and in the tragic and lyric poets will be presented and interpreted, and the whole course will be richly illustrated with the stereopticon. The origin and evolution of the myth, its relations to Greek literature, philosophy, and religion, and its influence upon later literature, will also be touched upon. Two credits (one evening a week); first semester. MR. SAVAGE
2. GREEK LITERATURE AND LIFE. This is a course dealing with the literature, life, and art of the ancient Greeks, for which no knowledge of Greek is required. The course consists of lectures and illustrative readings by the instructor and assigned readings in translation and

textbook work by the class; conferences and informal discussions will also be held. The character and influence of Greek culture, especially along the lines of literature, philosophy, and art, will be discussed; and the whole course will be richly illustrated with the stereopticon. Especially designed for those interested in language and literature. Two credits (one evening a week); second semester. MR. SAVAGE.

## HISTORY

1. (1). EUROPEAN HISTORY I. The development of Europe from 800 to about 1500 A. D. with special emphasis upon the political, social, and economic institutions of the period. Open to all. Two credits (one evening a week); first semester. MR. KREY.
2. (2). EUROPEAN HISTORY II. The development of Europe from c. 1500 to 1789. In this period are treated the Reformation, religious wars, and the causes of the French Revolution. The political growth of the nations of Europe is especially emphasized. Two credits (one evening a week); second semester. MR. KREY.
3. EUROPEAN HISTORY III. The development of Europe from 1789 to the present time. Political history especially emphasized. Social and economic problems are treated in their international aspects. Two credits (one evening a week); second semester. MR. KREY.
4. RECENT AMERICAN HISTORY. A study of the political, social, and economic movements in the United States beginning with the later years of the nineteenth century. Considerable attention will be paid to international relations during this period. Two credits (one evening a week); first semester. MR. SHIPPEE.
5. THE FOUNDATIONS OF THE MODERN WORLD. A study of the history of the last half century, and especially of the historical development of the greater international problems of to-day. The course will be primarily historical in scope, studying such questions as the Near East, the conflict of imperialism in the Far East, the development of the present situation in Russia. Emphasis will however be laid on the factors that are especially important at the present moment. Two credits (one evening a week); first semester. MR. TYLER.
6. ROMAN HISTORY. A history of Rome to the death of Constantine in 337 A. D., with special emphasis on its political, social, and economic development. Lectures and assigned readings. Two credits (one evening a week); first semester. MR. CRAM.

## HOME ECONOMICS

- 1 (H.E.3). TEXTILES. This course will include a discussion of those points in fabric study that are of value to both the purchaser and seller of fabrics,—fabric structure, fibers employed in their manufacture, methods

of substitution and adulteration, tests for quality, art and economic considerations in their purchase for clothing and household purposes. Two credits (one evening a week); first semester. MISS WELLER.

- 2 (H.E.13). DRESSMAKING. A course in the technic of clothing construction that will give practice in the use of commercial patterns, modeling on the dress form, and application of construction processes. Problems: preparation of a dress form, and the making of a wool dress and tailored silk waist. Two credits (one evening a week); second semester. MISS PATCHIN.

## JOURNALISM

1. NEWS-WRITING. Practice in writing types of stories covered by reporters for metropolitan newspapers. Study of style, structure, news value, and news-gathering methods, with practice in getting news. Analyses of American newspapers. Four credits (one evening a week); both semesters. MR. BARLOW.

## LATIN IN ENGLISH

1. LATIN LITERATURE IN ENGLISH. No knowledge of Latin is necessary for this course. It is designed primarily for students of literature who desire an acquaintance with those great Roman figures who have exerted such a profound influence on the modern literatures, especially the English, but it is also hoped that it may prove of value to those students and teachers of the Latin language who desire a comprehensive view of its literature. The work will consist of lectures by the instructor on the history of Latin literature to the close of the Silver Age with some account of its influence on modern literature. Illustrative passages from the authors discussed will be read in class and there will be assigned reading in standard translations and histories of Latin literature. Two credits (one evening a week); first semester. MR. CRAM.

## PHILOSOPHY

- 1 (20). PRESENT-DAY PHILOSOPHY. A popular discussion of the most important types of contemporary philosophy. Among the men and movements included are: Haeckel, Eucken, Bergson, Nietzsche, pragmatism, idealism, and neo-realism. Two credits (one evening a week); first semester. MR. CONGER.
- 2 (124). POLITICAL AND SOCIAL ETHICS. A study of the ethical basis of society and the state and a consideration of some of the unsettled problems of politics and economics from the ethical point of view. Two credits (one evening a week); first semester. MR. WILDE.

- 3 (129). MODERN POLITICAL THOUGHT. A study of the development of modern theories of the nature, basis, and authority of the state. Beginning with a preliminary sketch of the ideas of Plato and Aristotle, the course will include the most important political theories from the Renaissance to the present. Two credits (one evening a week); second semester. MR. WILDE.

## POLITICAL SCIENCE

1. AMERICAN FEDERAL GOVERNMENT. An elementary course in American government and politics designed for those studying the problems of citizenship, and for teachers. The course treats of the origin and nature of the federal system of government; of the political party system; the federal constitution; structure and organization of the national government; powers and functions of Congress; the executive and the judiciary; the civil service; the regulatory commissions; national finance; the conduct of foreign affairs; war powers of the government. Texts, *American Government and Politics*, by C. A. Beard, and *The New American Government and Its Work* by J. T. Young. Two credits (one evening a week); first semester.
2. STATE GOVERNMENT. A complementary course to 1 preceding. The constitutional basis of state government; relation of the states to the national and local governments, and to the citizen; organization, functions, and actual workings of state governments, and of county, township, and city governments; public opinion and popular control in state governments; nominations and elections, initiative, referendum, and recall; taxation and finance; social and regulatory legislation. Texts, Beard's *American Government and Politics* and *The New American Government and Its Work* by J. T. Young. Two credits (one evening a week); second semester.
- 3 (158). GOVERNMENT AND BUSINESS. Governmental powers; laissez faire versus regulation; protection against fraud and oppression; restraint of trade and manipulation of prices; protection of debtors; business affected by public interest; qualified property; compulsory benefits; conservation of natural wealth; vested rights; confiscatory legislation; administration of business legislation; reaction of war emergency measures on permanent policy. Two credits (one evening a week); second semester. MR. YOUNG.

## PSYCHOLOGY

- 1 (1-2). GENERAL PSYCHOLOGY. An introduction to the scientific study of the human mind. Two credits (one evening a week); first semester.
2. APPLIED PSYCHOLOGY. The practical application of psychology, especially in the field of business. Prerequisite: Psychology 1. Two credits (one evening a week); second semester. MR. FOSTER.

3. ELEMENTARY EDUCATIONAL PSYCHOLOGY. A survey of fundamental facts of human behavior involved in educational activities. Open to qualified students. Two credits (one evening a week); first semester. MR. MILLER.

### RHETORIC AND PUBLIC SPEAKING

- 1 (1). RHETORIC I. Practical training in writing; exposition, narration, and description. Analysis of prose selections and of compositions written by the class. Two credits (one evening a week); first semester.
- 2 (2). RHETORIC II. A continuation of the preceding course, open to those who have had a one-half year course in freshman rhetoric, or its equivalent. Two credits (one evening a week); second semester.
- 3 (11-12). DESCRIPTION AND NARRATION. Principles and practice; analysis of specimens; short themes and fortnightly essays, with emphasis on planning and amplification. Open to those who have completed the equivalent of Course 1-2 in college composition and rhetoric. Two credits (one evening a week); first semester.
- 4 (13). EXPOSITION. Literary criticism. A continuation of Course 3. Open to those who have completed the equivalent of three half years of college rhetoric. Two credits (one evening a week); second semester.
- 5 (41-42). A GENERAL COURSE IN PUBLIC SPEAKING. The principles of analysis and organization. Extemporaneous speaking based on outlines. Study of model speeches. Attention is given to correctness and effectiveness in delivery. Open to ministers, lawyers, teachers, and others who are able to carry the work. Four credits (one evening a week); both semesters. MR. LINDSLEY.
- 6 (81-82). INTERPRETATIVE READING. Interpretation and oral expression of the various forms of literature, the essay, the short story, lyric, and narrative poetry, and the drama. Open to those who have credit for Course 1-2, college composition and rhetoric, and Public Speaking 5 (41-42). Four credits (one evening a week); both semesters. MR. RARIG, MR. GARNES.
- 7 (83). ADVANCED PUBLIC SPEAKING. The distinctive characteristics of oratorical style: analysis of the styles of representative orators. Written and extemporaneous speeches. Individual criticism and direction. Two credits (one evening a week); first semester. MR. RARIG.
- 8 (110). SHORT-STORY WRITING. An advanced course in writing for those who have had experience in writing for publication or have had preliminary training in the technic of writing. Open for credit only to those who have had at least two years of college courses in writing or the equivalent. Four credits (one evening a week); both semesters.

9. STORY-TELLING TO CHILDREN. (1) Story-telling; its place and value; (2) choice of the story; qualities, desirable and undesirable; (3) preparation of the story; application of the short-story ideals of "singleness of impression" and "dramatic struggle"; reconstruction of the story from the child's viewpoint; (4) the problem of delivery: the group, consciousness, holding attention, self-effacement, vocal and verbal adaptation. No university credit (one evening a week); first semester. MR. GARNES.
10. PLAY-PRODUCING. Practical work in stagecraft, study of new lighting systems, color schemes, stage sets, examination of new ideals in acting, putting on of one community play; problems in directing discussed. Analysis of play suitable for high-school and college production. Two credits (one evening a week); first semester. MISS MACNAUGHTON.

## ROMANCE LANGUAGES

### FRENCH

- 1 (1-2). BEGINNING FRENCH. Grammar, pronunciation, reading, and practice in speaking. Open to all. Both semesters must be completed before credit is given for the first semester. Four credits (one evening a week); both semesters. MR. Lecompte, MR. BARTON.
- 2 (3). INTERMEDIATE FRENCH I. Reading, grammar, and composition. French grammar review; readings from modern authors. Open to all who enter the University with two years of French. Both semesters must be completed before credit is given for the first semester. Four credits (one evening a week); both semesters. MR. SIRICH.
- 3 (4). INTERMEDIATE FRENCH II. Continuation of Course 2. Practical composition and conversation. Informational readings on contemporary France and selected modern texts. Four credits (one evening a week); both semesters. MR. BARTON.
- 4 (13-14, 16-17). ELEMENTARY FRENCH CONVERSATION AND COMPOSITION. Four credits (one evening a week); both semesters. Prerequisite: French I.
5. MODERN FRENCH AUTHORS. A study of the works of the French authors of the nineteenth century in English. No credit (one evening a week); first semester. MR. SEARLES.

### SPANISH

- 1 (1-2). BEGINNING SPANISH. Grammar, pronunciation, reading, and practice in speaking. Open to all. Both semesters must be completed before credit is given for the first semester. Four credits (one evening a week); both semesters. MR. OLMSTED.
- 2 (3). INTERMEDIATE SPANISH. Readings from modern authors. Grammar review. Composition work devoted chiefly to correspondence and commercial practice. Spanish will be as largely as possible the language of



the classroom. Open to those who have had Spanish I (1-2) and are approved by the teacher. Four credits (one evening a week); both semesters.

- 3 (20). **ELEMENTARY SPANISH CONVERSATION AND COMPOSITION.** Prerequisite, Spanish I. This course is open to students who have completed the course in Intermediate Spanish. Four credits (one evening a week); both semesters.

### SCANDINAVIAN

1. **MODERN NORWEGIAN LITERATURE.** Works in the original of Wergeland, Welhaven, Moe, Björnson, Ibsen, Lie, Kielland will be studied. Also the Landsmaal movement. Two credits (one evening a week); first semester. MR. BOTHNE.
2. **MODERN NORWAY FROM 1814, IN ENGLISH.** Lectures and translated works of modern authors. The aim of the course is to make students familiar with modern Norway. One evening a week; second semester. MR. BOTHNE.
- 3 (104-105). **MODERN SCANDINAVIAN HISTORY.** Religious, political, and economic changes in the North; military enterprises and growth of liberalism. Special attention will be given to later industrial development and social legislation. Knowledge of Scandinavian not required. Four credits (one evening a week); both semesters. MR. STOMBERG.
- 4 (107-108). **MODERN SWEDISH LITERATURE.** The Swedish novel. Works in the original of Frederika Bremer, Almquist, Rydberg, Strindberg, Heidenstam, and Selma Lagerlöf will be studied. Some attention will also be given to Swedish poetry of the last half century. Four credits (one evening a week); both semesters. MR. STOMBERG.

### SOCIOLOGY

- 1 (1). **INTRODUCTION TO SOCIOLOGY.** An examination of the evolution of human society from its earliest beginnings to the present, including a discussion of the fundamental factors involved and the social institutions arising during this process, followed by an analysis of some of the leading social problems of the day and a discussion of the psychic and biologic factors involved in human associations. Lectures, reading, discussion. Prerequisite to all other courses in sociology when taken for university credit. Two credits (one evening a week); first semester. MR. BERNARD.
- 2 (101). **SOCIAL ORGANIZATION.** A study of the social mind and its communication, the problems of democracy, of class and caste, of social conflict and revolution, and of social organization on a rational and scientific basis for social efficiency and progress. Lectures, reading, discussion. Course 1, prerequisite if university credit is desired. Two credits (one evening a week); second semester. MR. BERNARD.

- 3 (6). MODERN SOCIAL REFORM MOVEMENTS. A survey of attempts to overcome certain social maladjustments: child labor, the city, bad housing, poverty, degeneracy; movements for public health, industrial democracy, social insurance, protection of infancy and youth, public recreation, etc. Two credits (one evening a week). MR. ELMER.
- 4 (14). RURAL SOCIOLOGY. The background and evolution of country life; rural conveniences, communication, coöperation; rural social institutions, especially the family, school, church, and social center; rural leadership, surveys, organization, social agencies. Two credits (one evening a week); second semester.
- 5 (3). EDUCATIONAL SOCIOLOGY. The school as a community factor; the present peculiar relation of the school to social problems; the function of the school in these relations. Two credits (one evening a week); first semester. MR. FINNEY.
- 6 (100). SOCIAL PSYCHOLOGY. A study of the method by which character, attitudes, and capacities are built up in the individual. A critical examination of the nature and classifications of instincts and of the methods by which habits are constructed under the influence of the various environmental pressures. Designed as a background for students who are particularly interested in problems of social organization and control. Two credits (one evening a week); first semester. MR. BERNARD.
- 7 (102). SOCIAL CONTROL. A study of the social, psychological, and physical factors which control and direct people in their social relationships. Subjects considered are the origin, evolution, and direction of social control, the means and technic of social control, the growth toward rational and scientific social control under the influence of a developing social science, the limits and purposes of social control. Designed for the same class of students as Course 6. Two credits (one evening a week); first semester. MR. BERNARD.
- 8 (120). SOCIAL PROGRESS. An examination of the nature and conditions of social progress, involving a study of human nature in its relation to social progress, of the physical and social environments as limiting and stimulating factors in social progress, and of the contribution of modern science to social progress. Various theories of social progress are reviewed and criticized with the purpose of arriving at a tenable theory in the light of present knowledge. Two credits (one evening a week); second semester. MR. BERNARD.
- 9 (140). HISTORY OF SOCIAL THOUGHT. Lectures and readings on the main contributions, personalities, and social backgrounds of the leading contributors to social thinking from the times of the Greeks to the middle of the nineteenth century. The main tendencies as well as the individual theories are kept in view and both are related to the circumstances out of which they developed. Such men as Plato, Aristotle, St. August-

tine, Dante, More, Bacon, Hobbes, Vico, Montesquieu, Condorcet, Rousseau, Herder, Godwin, Bentham, Saint-Simon, and Comte are given most attention. Particularly recommended for those who wish to understand how our present social ideas came to be. Two credits (one evening a week); first semester. MR. BERNARD.

- 10 (141). CONTEMPORARY SOCIAL THOUGHT. Lectures and readings on the main lines of social thought developing within the last fifty years, with especial emphasis upon present tendencies. The chief schools considered are the biological, the environmentalist, the anthropological, the anthropogeographical, the statistical, the economic interpretationists, the anarchists, the social psychologists, the group struggle theorists, the classificationists, the theory of the elite, etc. Due consideration will be given to American sociologists. Two credits (one evening a week); second semester. MR. BERNARD.

### SWIMMING

A course of instruction in swimming will be given in the Women's Gymnasium on the University campus. The classes are open to men and women alike. The course continues through the school year, one hour an evening, and those registering in the first semester will go on with the work the second semester without further registration. These courses carry no university credit.

Persons taking the courses are required to conform to the regular University rules in regard to the gymnasium and the pool.

1. SWIMMING. Family class with children. One evening a week; first and second semesters. MR. FOSTER.
2. SWIMMING. Beginning class for women only. One evening a week; first and second semesters. MR. FOSTER.
3. SWIMMING. Family class. No children. One evening a week; first and second semesters. MR. FOSTER.
4. SWIMMING. Advanced class for women only. One evening a week; first and second semesters. MR. FOSTER.

### ADDITIONAL COURSES

Many advanced courses not listed in this bulletin will be given upon the request of any responsible individual or group willing to organize a sufficiently large class to insure the success of the undertaking.

## REGISTRATION 1920-1921

### SIGNIFICANCE OF SYMBOLS

- \*Also in St. Paul Business
- \*\*Also in St. Paul Collegiate
- \*\*\*Also in Engineering
- †Also in Minneapolis Business
- ††Also in Minneapolis Collegiate
- †††Also in Minneapolis Collegiate and Minneapolis Business
- °Also in Minneapolis Business and St. Paul Business
- \*††Also in Minneapolis Collegiate and St. Paul Business
- ‡Also in St. Paul Business and St. Paul Collegiate

#### MINNEAPOLIS—COLLEGIATE

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|--|---|
| <p>Abrams, Belle, 1037 James Ave. N.<br/>         Adams, Laurette E., 1335 Vine Place<br/>         Ainsworth, Alice, 3311 Portland Ave.<br/>         Adolphson, Fredericka H., 1805 2nd Ave. S., Apt. 23<br/>         Akers, Nannie E., 3815 Waveland Terrace<br/>         Albert, Mrs. Emma I., 4255 Pleasant Ave.<br/>         Albert, U. Ruth, 1005 6th Ave. S.<br/>         Alexander, Sara, 2909 43rd Ave. S.<br/>         Afëxis, Tekla I., 2308 McNair Ave. N.<br/>         Allee, Anne M., 453 Aldine Ave., St. Paul<br/>         Allen, Ethel L., 1112 S.E. 8th St.<br/>         Allen, Marjorie F., 1766 Girard Ave. S.<br/>         Allen, Sadie L., 3337 16th Ave. S.<br/>         Alsworth, Ida, 2709 Humboldt Ave. S.<br/>         Altman, George T., 2126 Thomas Ave. N.<br/>         Alton, Howard R., 921 University Ave. S.E.<br/>         Amidon, Isabella M., 718 40th Ave. N.E.<br/>         Amidon, Wm. W., 718 40th Ave. N.E.<br/>         Amonson, Maude, 1800 13th Ave. S.<br/>         Amonson, Nettie, 1800 13th Ave. S.<br/>         Anderson, Albert, 1355 Kestor St., St. Paul<br/>         **Anderson, Mr. and Mrs. A. E., 909 Iglehart Ave., St. Paul<br/>         †Anderson, A. E. L., 4004 Oakland Ave.<br/>         Anderson, Anna H., 1416 Portland Ave.<br/>         Anderson, Bert Geo., 1210 Lowry Bldg. St. Paul<br/>         Anderson, Bessie M., 78 Willow St.<br/>         Anderson, Carl Oscar, 2421 11th Ave. S.<br/>         Anderson, Christian, 3620 E. 42nd St.</p> | <p>Anderson, Florence I., 2620 35th Ave. S.<br/>         Anderson, Hulda F., 32 N. 11th St.<br/>         Anderson, Lillian E., 2444 10th Ave. S.<br/>         Anderson, Mabel, 3007 E. Lake St.<br/>         Anderson, Margaret E., 78 Willow St.<br/>         Anderson, Nora C., 2310 Emerson Ave. S.<br/>         Address, Lulu Page, 71 Melbourne Ave. S.E.<br/>         Andrews, Mel C., 4453 Stevens Ave.<br/>         Angus, Alice, 1313 S.E. 6th St.<br/>         Anneberg, Robert D., 608 S.E. 7th St.<br/>         Anneberg, Ruth A., 2221 Fremont Ave. S.<br/>         Anthony, Maud R., 2620 Hennepin<br/>         Apfeld, Josephine J., 3032 Irving Ave. S.<br/>         †Applebee, Ruby M., 4331 Stevens Ave.<br/>         Armstrong, C. E., 3512 17th Ave. S.<br/>         Arnell, Mabel D., 2812 Grand Ave. S.<br/>         Arosin, Marie A., 905 Hague Ave., St. Paul<br/>         Arver, J. F., 1153 Abell St., St. Paul<br/>         Ash, Ruby M., 93 N. 17th St.<br/>         Ashton, Jennie, 1506 Laurel Ave.<br/>         **Ashton, John B., 65 S. 11th St.<br/>         Atkins, Marion P., Curtis Hotel, 208 C.<br/>         Atkinson, Grace M., 1809 James Ave. S.<br/>         Atwater, Pierce, 1536 Vine Place<br/>         Aufderheide, Bertha, 806 42nd Ave. N.<br/>         Auxer, Caroline C., 806 12th Ave. S.E.<br/>         Avery, R. C., 2507 Nicollet Ave.<br/>         Babcock, Lucile, 3032 Humboldt Ave. S.<br/>         Babcock, Vinette. care Bryant School<br/>         Bach, Ida M., 3100 Stevens Ave.</p> |
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Bach, Lydia H., 3100 Stevens Ave.  
 Backstrom, Myrtle A., 1724 Capitol Ave.  
 Bacon, Eleanor, 3416 2nd Ave. S.  
 Bacon, Myrtle E., 2922 Lyndale Ave. N.  
 Baer, Mrs. A. B., 2010 Marshall St., St. Paul  
 Bailey, Irene M., 1733 Blair St., St. Paul  
 Bailey, Lucille O., 1733 Blair St., St. Paul  
 Bailey, Roscoe M., 6 11th St.  
 †Baillargeon, Jos. Octave, 100 W. 14th St.  
 Baldwin, Fanny E., 2417 Harriet Ave.  
 Baldwin, Louise V., 2219 Dupont Ave. S.  
 Ball, Sarah B., 314 University Ave. S.E.  
 Ballentine, Emma K., 301 3rd Ave. S.E.  
 Ballie, Jean E., 3136 Pillsbury Ave.  
 Banker, May L., 3314 Elliott Ave.  
 Barber, Bertha, 3132 Fremont Ave. S.  
 Barber, Laura, 3409 3rd Ave. S.  
 Bargewell, Myrta, 2903 Humboldt Ave. N.  
 Barker, Mrs. Geo. H., 2403 Lake Pl.  
 Barker, Helen B., 1810 3rd Ave. S.  
 \*Barker, Leland H., 1810 3rd Ave. S.  
 Barker, Nellie I., Curtis Hotel  
 Barnes, Amy, 1500 Chicago Ave.  
 Barnes, Bernice, 2008 Bryant Ave. S.  
 Barney, Edith M., 2118 Cedar Ave.  
 Barnhart, John R., 727 E. 18th St.  
 Barnum, Anna L., 1917 Penn Ave. S.  
 Barrett, Laura M., 3809 Pillsbury Ave.  
 Barron, Nora M., The Buckingham  
 Barry, A. B., Hopkins, Minn.  
 †Bart, Anna N., 620 Dupont Ave. N.  
 Bashefkin, Ida, 630 Iglehart Ave., St. Paul  
 Bassett, Jas. E. H., 822 W. 35th St.  
 Baston, Ethel, St. Louis Park  
 Bather, Mrs. A. E., 1520 N.E. Washington St.  
 Bauman, Helen L., 91 Ash St.  
 Baxter, Bertha B., 427 8th Ave. S.E.  
 Beach, Mr. & Mrs. J. W., 1801 University Ave. S.E.  
 Beach, Rowena E., 2708 Colfax Ave. S.  
 Beare, Florence, 2634 Oliver Ave. N.  
 Beaverson, George, 2425 Lyndale Ave. N.  
 Beck, Eva L., 1322 S.E. 6th St.  
 Becker, Mrs. Gertrude, 1107 Harmon Place  
 Becker, Nelle, 4041 Vincent Ave. S.  
 Beckman, Elsie E., 455 N.E. Pierce St.  
 Beckstrom, Emily, 812 S.E. 4th St.  
 Beisner, Goldie, 1309 Plymouth Ave. N.  
 Belden, Mary Foster, 2951 Penn Ave. N.  
 Belitz, Lillie M., 2635 N.E. Jackson St.  
 Bell, Mrs. E. T., 527 S.E. 7th St.  
 Bell, Freda, 14th St. & 5th Ave. S.  
 Bell, John, Warren, 1001 E. River Rd.  
 Bell, Lois C., 602 E. 15th St.  
 Bell, Mable V., 77 Ash St.  
 Bell, Margaret Merrill, 1001 E. River Road  
 Bellinger, Louise G., 1309 Plymouth Ave. N.  
 Bells, Erma M., 1521 S.E. 6th St.  
 Bells, L. W., 1521 S.E. 6th St.  
 Bennett, Mrs. J. A., 2013 Selby Ave., St. Paul  
 Bennett, Mable, 714 S.E. 4th St.  
 Bennett, Rufus C., 1225 Hawthorne Ave.  
 Benson, Clara, Hamel, Minn.  
 Benson, Florence, 2216 Clinton Ave.  
 Benson, Gudrun, 137 E. Grant  
 Benton, Mrs. Jeannette, 3640 Portland Ave.  
 Ber, Adelaide, 1801 1st Ave. So.  
 †Berg, Jessie, 3243 Grand Ave. S.  
 Berg, Robt. D., 1557 Midway Pkwy., \*St. Paul  
 Berg, Mrs. Zella E., 1557 Midway Pkwy, St. Paul  
 Berglund, Ada G., 116 Groveland Ave.  
 Berglund, Lillian O., 116 Groveland Ave.  
 Berquist, W. I., 3536 Colfax Ave. S.  
 Berkheimer, Effie, 2228 Dayton Ave., St. Paul  
 Berman, Edna, 1115 Bryant Ave. N.  
 Bertels, Ernest H., 885 21st Ave. S.E.  
 Berven, Gay C., Mound, Minn.  
 Beseman, Magdalen, 1800 1st Ave. S.  
 Betts, Laura J., 5604 Blaisdell Ave.  
 Bicknell, E. H., 3446 1st Ave. S.  
 Biever, Ernest, 213 N. 3rd St.  
 Birkenmeyer, Hazel V., 1506 Chicago Ave., Apt. 33  
 Bissell, Blanche S., 2035 Kenwood Pkwy.  
 Bissell, Stanford, 2035 Kenwood Pkwy.  
 †Bjerke, Olaf E., 111 E. 31st St.  
 Bjorklund, Oliva, 3148 10th Ave. S.  
 Blakeley, Addie, 2616 Hennepin Ave.  
 Blakey, Mr. & Mrs. Roy, 424 S.E. Harvard St.  
 Blanchette, A. M. (Miss), Curtis Hotel  
 Bliven, Paul, 2932 7th Ave. S.  
 Blossmo, Mrs. O. J., 504 S.E. Beacon St.

Boehme, Alma E., 1816 Stevens Ave., Apt. 15  
 \*\*\*Boker, Vitus A., 88 Arthur Ave. S.E.  
 Bolter, Leon Maynard, Leamington Hotel  
 Bolton, Grace M., 908 5th Ave. S.  
 Borden, Gertrude C., 2026 Laurel Ave., St. Paul  
 Borden, Mabel C., 2026 Laurel Ave., St. Paul  
 Borden, Margaret E., 4753 Xerxes Ave. S.  
 Bosley, Harriet, 2870 Humboldt Ave. S.  
 Boss, L. C., 802 Franklin Ave. W.  
 Bosserman, Homer L., 3038 39th Ave. S.  
 Botts, Alice L., 4004 Bryant Ave. S.  
 Bowe, A. G., 2145 Carroll Ave., St. Paul  
 Braa, Cecilia, 2712 13th Ave. S.  
 Brackett, Constance E., 516 S.E. 4th St  
 Braden, Elizabeth B., 2300 Hennepin Ave.  
 Brady, Mrs. H. L., 819 S.E. Essex St.  
 Brandsted, Miss, Minneapolis  
 Brask, Herbert C., 2432 15th Ave. S.  
 Breen, Genevieve R., 2223 Russell Ave. N.  
 Brennan, Mrs. Jessie, 1780 Bryant Ave. S.  
 †Brick, P. L., 4315 Harriet Ave.  
 Bridgman, Mrs. G. H., The Leamington  
 Brink, Carol, 55 Williams Ave. S.E.  
 Brink, Frances V., 1708 Brook Ave. S.E.  
 Brinker, Howard C., 3715 Nicollet Av.  
 Brockman, Mrs. Gretta K., 4429 York Ave. S.  
 Brockway, Helen, 1786 Hennepin Ave.  
 †Broderick, Martin J., 603 S.E. Delaware St.  
 †Bronstad, Obert J., 1600 Linden Ave. N.  
 Brooke, Mrs. W. E., 416 S.E. Walnut St.  
 Brooks, Anna Pamela, 1779 James Ave. S.  
 Brooks, Mrs. Edmund D., 1779 James Ave. S.  
 Brooks, Susan A., 2028 Seabury Ave.  
 Brown, Mrs. Blanche, 5714 Pillsbury Ave.  
 Brown, D. Grace, 2720 Pillsbury Ave.  
 Brown, Effie M., 411C Curtis Hotel  
 Brown, Harry L., 175 Iglehart Ave., St. Paul  
 Brown, Helen M., 1609 Hawthorne  
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 Byrnes, Mary S., 325 Franklin Ave.  
 Cady, Katherine Rowell, 317 S.E. Harvard St.  
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 Cap, Frances M., 2628 Aldrich Ave. N.  
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 Christie, Blanche, 3145 James Ave. S.  
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 Fletcher, Frances, 1101 17th Ave. S.E.  
 Fletcher, Miriam, 413 5th Ave. S.E.  
 Fletcher, Pauline, 413 5th Ave. S.E.  
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 Hoy, Roschelen, 3622 E. 50th St.  
 Hoy, V. Grace, 1402 Spruce Place  
 Hubbard E. L., 824 9th Ave. S.E.  
 Hubbard, Gladys, 2204 Grand Ave.  
 Hueffner, Beulah, 1780 Bryant Ave. S.  
 Huefner, Stanley R., 1786 Hennepin Ave.  
 Hughes, C. L., 2418 Ferrant Place  
 Hughes, Ethel M., 2922 Dorman Ave.  
 Hughes, Harriet J., 2433 Colfax Ave. S.  
 Hughes, Margaret, Curtis Hotel  
 Hughson, Florence M., 2300 Nicollet Ave.  
 Hulett, Ethel R., 2012 Hennepin Ave.  
 Hulett, Jessie I., 2012 Hennepin Ave.  
 Hull Maebelle C., 3148 10th Ave. S.  
 Hullis, Mrs. Mabel G., 3914 2nd Ave. S.  
 Hulls, Mrs. F. B., 3914 2nd Ave. S.  
 Hultman, Ida, 1501 Linden Ave.  
 Hunter, Eva M., 2300 Nicollet Ave.  
 Hunter, Mrs. W. H., 629 University Ave. S.E.  
 Hurlburt, Frances, 3541 12th Ave. S.  
 Hussey, Alice, 3124 Portland Ave.  
 Hussey, Martha L., 2012 Park Ave.  
 Hustvedt, S. B., 112 Church St.  
 Hutchinson, Frances, 2612 37th Ave. S.  
 Hynes, Julia, 1731 Park Ave.  
 Ingle, Jeannette, 2708 Colfax Ave. S.  
 Ingraham, Florence, 26 Oak Grove St.  
 Irving, Alice M., 833 Summer St.  
 Irwin, G. W., 3913 Chicago Ave.  
 Isham, Eugene S., 715 Laurel Ave., St. Paul

Jackson, Elizabeth, 820 University Ave. S.E.  
 Jacobs, F. E., 2413 Emerson Ave. S.  
 Jacobson, Jay Arthur, 1059 16th Ave. S.E.  
 James, Mary L., Hampshire Arms  
 Jameson, May, The Leamington  
 Janzig, Alexander C., 504 20th Ave. S.E.  
 Japs, Amelia R., 1786 Hennepin Ave.  
 Jaynes, Mrs. E. L., 147 Orlin Ave. S.E.  
 Jensen, Christina M., 785 Linwood Place, St. Paul  
 Jensen, Louise, 3115 Dupont Ave. S.  
 Jensen, Mildred H., 1419 5th St. S.E.  
 †Jermata, Loring P., 1349 Penn Ave.  
 John, Olga, 3304 Dupont Ave. S.  
 Johns, Muriel O., 3304 Dupont Ave. S.  
 Johnson, Adelia, 2832 Riverside Ave.  
 Johnson, Agnes, 1903 E. 39th St.  
 Johnson, Anna F., 70 S. 12th St.  
 Johnson, Anna M., 3255 14th Ave. S.  
 Johnson, Clara, 2624 30th Ave. S.  
 Johnson, Delia J., 2704 11th Ave. S.  
 Johnson, Dena L., St. Louis Park  
 Johnson, Elsie C., 3932 37th Ave. S.  
 Johnson, Eva C., 2412 4th Ave. S.  
 Johnson, Jennie A., 1308 Harmon Place  
 Johnson, Lillian M., 1423 Vine Place  
 Johnson, Mabel A., 401 S.E. 5th St.  
 Johnson, Mildred, 627 N.E. Pierce St.  
 Johnson, Myrtle H., 3116 10th Ave. S.  
 Johnson, Olga, 926 N.E. Fulton St.  
 Johnson, Thora E., 1015 S.E. 8th St.  
 Johnstone, Mrs. Nelle B., 611 Central Park Place, St. Paul  
 Jones, Vera R., 323 14th Ave. S.  
 Jones, Zola Lucile, 1209 S.E. 7th St.  
 Jordan, Helen, 2321 Dupont Ave. S.  
 Jordet, Orval, 2236 N.E. Pierce St.  
 Joyce, Carolyn, Plaza Hotel  
 Juhl, Anna, 3620 E. 42nd St.  
 Kaldahl, H., 1486 Hythe St., St. Paul  
 Kammarran, Abbie M., 1208 W. Franklin Ave.  
 Kane, Mrs. D., 3612 4th Ave. S.  
 \*Kantor, George J., 1618 Charles St., St. Paul  
 Keating, Anna B., 2020 Fremont Ave. N.  
 Keating, Lillian M., 1315 S.E. 7th St.  
 †Keating, Maurice H., 3136 17th Ave. S.  
 Keeler, Irene M., 1515 Selby Ave., St. Paul  
 Keen, Adeline M., 1918 Chicago Ave.  
 Keenan, Sarah, 3435 Longfellow Ave.  
 Keiser, Laura Jean, 319 W. 25th St.  
 Kellam, Martha T., 1415 Willow St.  
 Keller, Lucia C., 194 Rondo St., St. Paul  
 Kelley, Evie F., 2615 Columbus Ave.  
 Kelley, Gladys R., 2417 Emerson Ave. S.  
 Kelley, Nellie E., 16 S. 12th St.  
 \*\*Kelly, Alice M., 1985 Selby Ave., St. Paul  
 †Kelly, Frederic M., 4100 Queen Ave. S.  
 Kelly, Helen M. V., 2541 N.E. Monroe St.  
 Kelly, Mrs. Hubert, 5104 Colfax Ave. S.  
 Kelsey, Dr. C. W., 3525 Elliott Ave.  
 Kendall, Calla, 1911 Park Ave., Apt. 306  
 Kendall, Eunice A., 701 S.E. 8th St.  
 Kennedy, Agnes M., 2533 Bryant Ave. S.  
 Kennedy, Charlotte, Anoka Minn.  
 Kennedy, Marion, 2533 Bryant Ave. S.  
 †Keogh, M. J., 229 Fremont Ave. N.  
 Kepperlex, Marian L., 2308 Commonwealth Ave., St. Paul  
 Kerlou, Reuben R., 1700 S.E. 4th St.  
 Kerr, Adah L., 1520 N.E. Washington St.  
 Kerr, Maude M., 1416 Portland Ave.  
 Kesler, Emma, 59th & Nicollet Ave.  
 Kirkpatrick, Jessie, 3815 2nd Ave. S.  
 Killeen, Florence M., 1325 Vine Place  
 Killeen, Usula M., 1325 Vine Place  
 Kimball, Florence, 1119 W. Franklin St., Apt. 302  
 King, Cecelia, Glen Lake, Minn.  
 \*\*King, Don L., St. Paul Academy, St. Paul  
 King, Julia E., 1034 19th Ave. S.E.  
 King, L. Louise, 2818 1st Ave. S.  
 Kinney, Elvira, 2319 Irving Ave. N.  
 Kirk, Renie J., 1926 3rd Ave. S.  
 Kirkygaard, J., 3620 E. 42nd St.  
 Kirochstein, Helen I., 220 Oak Grove St.  
 Klase, Austin, Y.M.C.A.  
 Kleffman, Lydia, 1103 S.E. 4th St.  
 Klint, Anna M. S., 3017 23rd Ave. S.  
 Knauss, Cadwell, 1406 Midway Pkwy., St. Paul  
 Knauss, Mr. & Mrs. W. C., 1406 Midway Pkwy., St. Paul  
 Kneeland, Ruth, The Antlers  
 Knight, Bessie P., 3232 Oakland Ave.  
 Knight, Patience, 1420 Russell Ave. N.  
 Knox, Mary L., 3136 Girard Ave. S.  
 Knutson, Mrs., 721 N.E. Madison St.  
 Kocourak, John F., 736 S.E. Superior St.  
 Koefod, Ella, 3439 10th Ave. S.

Koehler, Elsa I., 508 University Ave. S.E.  
 Koehsel, Minnie C., 2417 Dupont Ave. S.  
 Koeneman, Martin E., 1233 Hague Ave., St. Paul  
 Kohler, Katherine M., 320 N.E. Jackson St.  
 †Koll, Gertrude, 1800 1st Ave. S.  
 Kortnem, Catherine, 2401 Portland  
 Kostick, Gertrude, 2415 Colfax Ave. S.  
 Kostick, Mrs. J., 331 13th Ave. N.E.  
 Konrad, Edith L., 716 16th Ave. S.E.  
 Kowalewska, Josepha, 723 2nd St. N.E.  
 Kraemer, Elizabeth, 2029 James Ave. N.  
 Kraemer, Lena, 1529 Hawthorne Ave.  
 Krawczyk, Monica, 2111 University Ave N.E.  
 Krey, A. C., 324 S.E. Walnut St.  
 Krueger, Etta A., 2409 1st Ave. S.  
 Kruger, Isabelle R., 111 Spruce Place  
 Kuehl, Bertha I., 2533 Chicago Ave.  
 Kuehn, Louise M., 1831 Irving Ave. N.  
 Kuenhert, Mrs. Alma J., 6 Oakley Ave., St. Paul  
 Kuhlman, Grace G., 4412 Beard Ave. S.  
 †Kulp, Delmar E., 332 Oak Grove St.  
 Kurth, Henretta L., 317 12th Ave. N.E.  
 Kurtzman, Mrs. Dorothy, 1033 E. River Road.  
 LaBarge, Mrs. Myrtle, 1819 Lyndale Ave. S.  
 Labriche, Olive, 3231 Girard Ave. N.  
 LaDell, Minnie, 1601 1½ Hawthorne Ave.  
 †Lahtinen, Wymen W., 233 Humboldt Ave. N.  
 Lamb, Edna A., 1919 N.E. 6th St.  
 Lambertson, H., 29 Clarence Ave. S.E.  
 Lamont, Harry K., Hotel Hastings  
 †Laney, L. Margaret, 4451 Upton Ave. S.  
 Langberg, Martha, 721 N.E. Madison St.  
 Langvick, Emma M., 2406 Girard Ave. N.  
 Langvick, Huldah, 2406 Girard Ave. N.  
 Lantz, Edwin W., 3809 Elliott Ave.  
 Lantz, Ludwig A., 3809 Elliott Ave.  
 Lapierre, Catherine, 319 University Ave. N.E.  
 Lapierre, Esther, 319 University Ave. N.E.  
 Larawa, Douglas, 485 Carter Ave., St Paul  
 Larpenteur, M. A., 3615 Park Ave.  
 Larson, Mrs. L. P., 5716 Clifton Ave.  
 Larson, Mrs. Winford, 516 9th Ave. S.E.  
 Latourelle, Constance, 1201 E. River Road  
 Laughead, Caecilia V., 736 S.E. Superior St.  
 Lawrence, E. Margaret, 2449 Blaisdell Ave.  
 Lawrence, Hortense, 1817 Vine Place  
 Layden, Genevieve, 640 E. 19th St.  
 Leager, Marc C., 4506 Colfax Ave. S.  
 LeBorious, Mabel, 342 Bates Ave., St. Paul  
 LeCompte, Mrs. I. C., 803 University Ave. S.E.  
 †Lee, Clara, 2101 Minnehaha Ave.  
 Lee, Julia M., 238 Nelson Ave., St. Paul  
 †Lee, Wm. S., Wells Dickey Co., McKnight Bldg.  
 Leerskov, Eleanor, 4404 W. Curve Ave.  
 Leesz, Myrtle, 52 S. 10th St.  
 Leffholm, Elsie M., 1200 Dupont Ave. N.  
 LeMaitre, Rose, 1705 Stevens Ave.  
 Leman, Margaret F., 127 E. 14th St.  
 Lemke, Louise, 2117 22nd Ave. N.E.  
 Lemm, Morley B., 2207 Blake St., St. Paul  
 Lenthold, Dorothy G., 707 Summit Ave.  
 Lenhart, E. M., 4020 Harriet Ave.  
 Lennon, Mary M., 221 N.E. 2nd St.  
 Leonard, Alice E., 2919 Girard Ave. N.  
 Leonard, Lucy A., 310 E. 31st St.  
 Leonard, Marion S., 1213 S.E. 7th St.  
 Lestic, Elizabeth, 4642 Wentworth Ave. S.  
 Lestic, Florence, 4642 Wentworth Ave. S.  
 Leu, Elisabeth, Curtis Hotel  
 Leuthold, Dorothy G., 707 Summit Ave.  
 Leverett, Lilah, 1209 S. 7th St.  
 Lewis, Mrs. Carl H., 3304 48th Ave. S.  
 Lewis, H. Adelaide, 1800 3rd Ave. S.  
 Lewis, Harry M., 3342 Holmes Ave. S.  
 Lewis, Lulu V. (Mrs.), Long Lake, Minn.  
 †Lexcen, John M., 1826 Crystal Lake Ave.  
 Liden, Miss Elin, 1906 N.E. Buchanan St.  
 Liden, Helen, 3520 Columbus Ave.  
 Liedl, Rose M., 718 S.E. 6th St.  
 †Lienan, Clair T., 19 N. 15th St.  
 Liliensfeld, Harry, 1315 S. 7th St.  
 Liljemstrom, William J., 914 W. 36th St.  
 Lindahl, Elizabeth H., 695 Holly Ave. St. Paul  
 Lindberg, Viola G., 2936 43rd Ave. S.  
 Lindberg, Walter F., 2106 Dupont Ave. N.  
 Lindquist, Agnes, 717 N.E. Fillmore St.  
 Lindquist, Mabelle, 717 N.E. Fillmore St.

Linnell, Fern D., 1401 Yale Place, Apt. 5  
 Lobdell, Frances R., 1937 Fremont Ave. S.  
 Lobdell, Marie, 1937 Fremont Ave. S.  
 Locke, Olive A., 625 E. 37th St.  
 Loftus, Katherine M., 2401 Grand Ave.  
 Loker, Grace E., 3420 18th Ave. S.  
 Lommen, Julia A., 1941 Aldrich Ave. S.  
 Lommen, Olga L., 1941 Aldrich Ave. S.  
 Loring, Mildred W., 623 14th Ave. S.  
 Lowen, Maud B., 3240 Oakland Ave.  
 Lucas, Florence C., 3156 Columbus Ave.  
 Luce, Martha J., 2103 Franklin Ave. S.E.  
 Luger, Alvina, 2612 Humboldt Ave. S.  
 Luke, Wm. H., Concordia College, St. Paul  
 Lund, Lillian C., 4017 Elliott Ave.  
 Lundall, Leon N., 3109 Humboldt Ave. S.  
 Lundberg, George Wm., 204 S.E. Harvard St.  
 †Lundberg, Roy Wm., 2808 28th Ave. S.  
 Lundberg, Ruth, 1922 N.E. Pierce St.  
 Lundgren, Magda E., 4143 Girard Ave. N.  
 Lundgren, Paul J., 5129 28th Ave. S.  
 Lynch, Catherine C., 1103 15th Ave. S.E.  
 Lyon, Mrs. J. D., 3617 Pleasant Ave.  
 Lyons, Pearl B., 44 Arthur Ave. S.E.  
 MacCallin, Loretta, 2536 Garfield Ave.  
 MacDonald, Nellie C., 1643 Queen Ave. N.  
 MacEwen, Nora H., 246 N. St. Albans St., St. Paul  
 MacGregor, Effie, The Buckingham  
 MacLaughlin, Cecil, 3239 1st Ave. S.  
 MacMillan, Katherine V., 3016 Portland Ave.  
 McCall, Margaret, 905 W. Franklin Ave.  
 McCarren, Jane, 424 S.E. 5th St.  
 McCarthy, Emma, 1923 Aldrich Ave. S.  
 McCartis, Dorothy, 440 University Ave. N.E.  
 McCauley, Isabel, 2732 3rd Ave. S.  
 McConnell, Daisie C., 5340 Nicollet Ave.  
 McCormack, Katherine B., 2001 Aldrich Ave. S.  
 McCrosan, Esther E., 4227 Pillsbury Ave.  
 McDonald, Marguerite C., 419 N.E. 2nd St.  
 McDowell, Harriett J., 2608 3rd Ave. S.  
 †McElroy, Monica, 2008 E. 22nd St.  
 McElroy, Pauline G., 1619 Logan Ave. S.  
 McEvoy, John J., 205 W. 6th St., St. Paul  
 McFarlane, Mabel J., 2217 Colfax Ave. S.  
 McFetridge, Margaret E., care Central High School, St. Paul  
 McGinty, Catherine A., 2418 Dupont Ave. N.  
 McGrory, Mabel, 1929 3rd Ave. S.  
 McGuane, Anna, 3016 Portland Ave.  
 McGuane, Marcella, 2608 15th Ave. S.  
 McGuane, Marion C., 2608 15th Ave. S.  
 McGuire, Sarah E., 1215 W. 37th St.  
 McIntyre, Alice M., 4424 Upton Ave. S.  
 McIntyre, Ethel, 620 E. 19th St.  
 McKean, George J., 1740 Goodrich Ave. St. Paul  
 McKenzie, Florence, 1910 S.E. 4th St  
 McKusick, Marion, Hotel Maryland  
 McLaughlin, Josephine, 4300 Lyndale Ave. S.  
 McMillan, Clyde H., 3846 Grand Ave S.  
 McMillan, Edith, 20 W. 36th St.  
 McMillan, Margaret, 505 10th Ave. S.E.  
 McNamara, Katherine, 604 11th Ave. S.E.  
 McNie, Mary Bella, The Leamington  
 McQuen, Wm. W., 204 S.E. Harvard St.  
 McShane, Catherine, Hampshire Arms  
 McGibbon, Dr. E. E., 2105 Newton Ave. S.  
 Mackay, Margaret, 510 15th Ave. S.E.  
 Mackey, Laura P., 1706 Stevens Ave.  
 MacLaughlin, Cecil, 3239 1st Ave. S.  
 Madden, Adeline E., 2612 Chicago Ave.  
 Madsen, Mary A., 611 14th Ave. S.E.  
 Madsen, Semina C., 611 14th Ave. S.E.  
 Magnusson, Ingeborg, 2101 10th Ave. S.  
 Maley, Elizabeth, 613 Washington Ave. S.E.  
 \*\*Malone, Anna, 1197 Grand Ave., St. Paul  
 Malone, Mrs. Edw. W., 217 Fairview Ave., S. St. Paul  
 Maloney, Beezie A., 1601 Park Ave.  
 Malthouse, Ellen, The Leamington  
 Mandel, Bessie R., 127 Highland Ave.  
 Mann, Helen G., 766 Iglehart Ave., St. Paul  
 Manning, Evelyn, 271 Selby Ave., St. Paul  
 Mapes, Gailen F., 909 Franklin Ave. W.  
 Marden, Eva, 504 3rd Ave. S.E.  
 Marshall, Marion T., 2917 Fremont Ave. N.

Martin, Maud E., Waverly Hotel  
 Martin, Mildred W., 1780 Bryant Ave. S.  
 Martin, Portia Hazel, 3113 Bloomington Ave.  
 Martineau, Stella L., 3706 Grand Ave.  
 Martinson, Esther, 1801 3rd Ave S., Apt. 203  
 Mason, Adelaide E., 1108 15th Ave. S.E.  
 Mason, Mrs. Walter, 809 S.E. Essex St.  
 Mather, Helen, 3653 Bryant Ave. S.  
 Mathews, Edna C., 417 S.E. Delaware St.  
 Mathewson, Ruby A., 3617 Blaisdell Ave.  
 Mattoon, Hope I., 624 E. 17th St.  
 Mattson, Mabel J., 1320 S.E. 6th St.  
 May, Julia F., 2012 Park Ave.  
 Mayladry, H. I., 2322 Buford Ave., St. Paul  
 Maynes, Mrs. Genevieve, Osseo, Minn.  
 Mealey, Helen C., 2404 Sheridan Ave. N.  
 Mecker, Dean W., 5028 Vincent Ave. S.  
 Meinke, Luella L., 737 E. 27th St.  
 Melcher, Angela, 3217 Park Ave.  
 Mellem, Lulu E., 2201 Scudder Ave., St. Paul  
 Mellerud, Helen, 1500 3rd Ave. S., Apt. 6  
 Mellstrom, Helen, 1415 Portland Ave.  
 Merrill, Blanche L., 214 Oak Grove St.  
 Merrill, Helen B., 2172 Como Ave. W., St. Paul  
 Merten, Mildred W., 1780 Bryant Ave. S.  
 Metcalf, Ruth H., 1621 Ashland Ave., St. Paul  
 Michler, Emma, 2632 Garfield Ave.  
 Miller, Miss, care Powers Mercantile Co.  
 Miller, Howard, 2325 Laurel Ave.  
 Miller, Jane S., 1904 Park Ave.  
 Miller, Jessie A., 1712 E. Lake St.  
 Miller, Mrs. L. F., 417 12th Ave. S.E.  
 Miller, Mary T., 1712 E. Lake St.  
 Miller, Mathilda, 612 E. 15th St.  
 Minten, Esther, 89 Hague Ave., St. Paul  
 Mo, Helen George, 3044 Pleasant Ave.  
 Moen, Cora B., 2018 3rd Ave. S.  
 Moffat, Mabel G., 2165 Ann Arbor St., St. Paul  
 Molan, Kathleen, 415 E. 16th St.  
 Monroe, Elsie W., 3115 Fremont Ave. S.  
 Monseth, Minda, 2939 Colfax Ave. N.  
 Monsos, Rachel, 2000 Portland Ave.  
 Montelius, George A., 2518 Emerson Ave. S.  
 Montgomery, Esther D., 3015 Fremont Ave. N.  
 Moore, George R., 815 S E. 6th St.  
 Moore, May, 3439 10th Ave. S.  
 Moorhead, Amy O., 1421 Vine Place  
 Moorman, Lucile, 610 E. 15th St.  
 Morris, Annie B., 1927 Elliott Ave.  
 Morris, Agatha B., 1530 Vine Place  
 Morris, Calvin W., 1927 Elliott Ave.  
 Morrison, Katherine McLacklan, 1622 Clinton Ave.  
 Morrisey, Winifred E., 1033 Charles St., St. Paul  
 Morrissey, Ethel L., 2622 Chicago Ave.  
 Morse, Anna J., 1420 Portland Ave.  
 Morton, Catherine L., 5122 Washburn Ave. S.  
 Moses, Mary C., 3304 Elliott Ave.  
 Moss, Constance, 1309 W. Franklin Ave.  
 Moynahan, Frances J., 3529 Stevens Ave.  
 Mulle, Olga, 3022 Irving Ave. S.  
 Mullen, Cleo E., 2617 3rd Ave. S.  
 Mullen, Mrs. P., 407 University Ave. S.E.  
 Muller, Katherine J., 1920 2nd Ave. S.  
 Mullin, Jessica L., 1804 1st Ave. S.  
 Mullins, Ella M., 1916 2nd Ave. S.  
 Munns C. E., 2617 W. 40th St.  
 Munson, Harriet, Waverly Hotel  
 Murphy, Anna, Curtis Hotel  
 Murphy, Helen M., 2624 Humboldt Ave. S.  
 Murphy, Mary L., 2885 1/2 Knox Ave. S.  
 Murphy, Mary V., 4109 Sheridan Ave. S.  
 †Murphy, Theresa, 3505 Sheridan Ave. N.  
 Murray, Agnes R., 2445 Aldrich Ave. S.  
 †Myklebust, I. L., 1558 Hillside Ave. N.  
 Myers, Genevieve, 2501 Bryant Ave. S.  
 Myers, Mrs. Walter, 608 S.E. Oak St.  
 Myhre, Emma A., 1819 Lyndale Ave. S.  
 Naion, Effie L., 1407 Clinton Ave.  
 Nalezny, Catherine D., 423 N.E. Jefferson St.  
 Naper, Martha E., 3149 Holmes Ave. S.  
 Nash, Anna, 2018 Hennepin Ave.  
 Nauer, Berta, 3936 12th Ave. S.  
 Niedham, Marie, 3253 Bloomington Ave.  
 Neill, Caroline M., 2705 1st Ave. S.  
 Neilson, Elizabeth, 2908 45th Ave. S.  
 Nelson, Anna J., 3001 Fremont Ave. N.  
 Nelson, Beth, 2108 Western Ave.  
 Nelson, F. Olaf, 3220 16th Ave. S.

Nelson, Pauline A., 5716 Clinton Ave.  
 Nessel, Martha E., 1704 Park Ave.  
 Nessel, Nellie, 1704 Park Ave.  
 Nestor, Edna Macy, 1210 N.E. 2nd St.  
 Nettleton, Flora, 1109 Hawthorne Ave.  
 Newell, Bertha M., 3333 Humboldt Ave.  
 S.  
 Newell, Margaret M., 1103 S.E. 4th St.  
 Newgard, Olaf, 3648 34th Ave. S.  
 Newholm, J. Bernire, 179 N. Kent St.,  
 St. Paul  
 Newkirk, Mrs. Bert, 509 S.E. Essex St.  
 Newkirk, Muriel, 509 S.E. Essex St.  
 Newkirk, Virginia, 509 S.E. Essex St.  
 Newlander, Ruth D., 419 Groveland Ave.  
 Newton, Mrs. Emma, 1502 Raymond  
 Ave., St. Paul  
 Newton, Sadie H., 2623 Harriet Ave.  
 Nickell, Marion F., 500 S.E. 7th St.  
 Niedorf, Katherine E., 237 N. St. Al-  
 bans St., St. Paul  
 Niles, Harriet S., Hotel Maryland  
 Nimis, B. Louise, 290 Cathedral Pl.,  
 St. Paul  
 Nolan, Muriel A., 557 Rondo St., St.  
 Paul  
 Nolander, Austin P., 2876 Humboldt  
 Ave. S.  
 Nooris. Rev. Lester S., 5835 Lyndale  
 Ave. S.  
 Norden, Thos. P. (Mr. & Mrs.), 817  
 Portland Ave., St. Paul  
 Normann, Astrid, 500 S.E. Delaware  
 Northfield, Mrs. Susan M., 1415 19th  
 Ave. N.  
 Nortner, Dr. M. G., 401 Penn Ave N.  
 Norton, Anna C., 4952 Newton Ave. S.  
 Noyes, Wilbur J., Mineral Springs,  
 Minneapolis  
 Nye, Ellen S., 1705 Stevens Ave.  
 Nygaard, Mrs. Mabel G., 4121 W. 45th  
 St.  
 Nystrom, Clara, 513 13th Ave. S.E.  
 Nystrom, Ruth, 37 W. 54th St.  
 \*\*O'Brien, Genevieve, 511 Harrison  
 Ave., St. Paul  
 O'Dell, Thomas E., 21 W. Grant St.  
 O'Farrell, Margaret, 1929 3rd Ave. S.  
 O'Gordon, Melvilene, 808 9th Ave. S.E.  
 O'Hagen, Archie M., 2905 28th Ave. S.  
 O'Hare, Joseph P., 205 W. 6th St., St.  
 Paul  
 O'Reilly, Gertrude, 1608 Hawthorne  
 Ave.  
 Oakford, Frances P., 1788 Hennepin  
 Ave.  
 Oberg, Anna M., 2519 Grand Ave.  
 Odean, G. R., Jr., 3431 Nicollet Ave.  
 Okerblad, Stina A., 1409 Chicago Ave.  
 Okland, Herman J., 29 N.E. 2nd St.  
 †Olmen, Stella L., 1016 W. 28th St.  
 Olson, Chester J., 412 S.E. Walnut St.  
 Olson, Clarence T., 1419 S. 7th St.  
 Olson, Helena, 2115 3rd Ave. S.  
 Olson, Olga E., 2936 43rd Ave. S.  
 Olson, Oscar B., 92 Snelling Ave. N.,  
 St. Paul  
 Opfer, Albert B., 3244 Colfax Ave. S.  
 Opsahl, Josephine M., 1606 22nd Ave.  
 N.  
 Orcott, F. R., 136 W. 56th St.  
 Orcott, Mrs. Frank, 136 W. 56th St.  
 Oren, Ellen, 1111 Russell Ave. N.  
 Oren, Mary L., 1111 Russell Ave. N.  
 Orr, Loretta M., 2509 Emerson Ave. N.  
 Osmundson, Walter E., 204 S.E. Har-  
 vard St.  
 Osterberg, Mathilda, Hotel Curtis  
 Osterberg, May, 1234 Edmund St., St.  
 Paul  
 Overholser, Margaret, 2803 Fremont  
 Ave. N.  
 Owre, Alice, 514 S.E. Essex St.  
 Owre, Frances C., 514 S.E. Essex St.  
 Oyen, Agnes G., 3722 Oakland Ave.  
 Padgett, Florence O., 1710 Stevens Ave.  
 Page, Grace M., 2162 Carroll Ave., St.  
 Paul  
 Palm, Cora R., 4003 Wentworth Ave.  
 Palmer, Mary J., 528 14th Ave. S.E.  
 Parsons, Mrs. Clara D., 4242 Alden  
 Drive  
 Patchen, Georgia A., 1811 1st Ave. S.  
 Patchin, Mrs. Eva, 619 University Ave.  
 S.E.  
 †Patterson, Howard G., 86 Willow St.  
 Paul, Helen, 3315 Holmes Ave. S.  
 Paulson, H. Arthur, 1428 S.E. 6th St.  
 Peacock, Agnes, Hampshire Arms  
 Pearce, James B., 1915 Fremont Ave. S.  
 Pearry, Lynne A., West Hotel  
 Pearson, Carl E., 723 Sims St., St. Paul  
 Pearson, Delia E., 2110 30th Ave. S.  
 Pearson, Elizabeth, 2832 31st Ave. S.  
 Pearson, Julian H., 1415½ Dupont Ave.  
 N.  
 Pease, Cecil, 3307 Emerson Ave. N.  
 Pederson, Mildred, 31 Arthur Ave. S.E.  
 Pederson, Nora L., 619 N.E. Pierce St.  
 Peet, Mrs. Wm., 2018 2nd Ave. S.  
 Penhall, Lillith F., 113 W. Grant St.  
 Perkins, Alice, 1622 W. 31st St.  
 Perkins, Ellen G., 3021 Park Ave.  
 Perry, Georgia, 2717 Pleasant Ave.  
 Perusse, Blanche, 1312 S. 8th St.  
 Perusse, Esther A., 413 S.E. Oak St.



Peters, Leone E., 1915 2nd Ave. S.  
 Peterson, Beatrice E., 617 University Ave. S.E.  
 Peterson, Clara V., 2016 28th Ave. S.  
 Peterson, Claudine, 3400 Bryant Ave. S.  
 Peterson, David N., 3247 Columbus Ave.  
 Peterson, Edna L. T., 2904 41st Ave. S.  
 Peterson, Edwin T., 3301 5th Ave. S.  
 Peterson, Effie A., Portland Ave. & 59th St.  
 Peterson, Emma V. E., 2904 41st Ave. S.  
 Peterson, Eva C., Hotel Harmon  
 Peterson, Hannah M., 2320 S. 7th St.  
 Peterson, H. G., 2816 27th Ave. S.  
 Peterson, J. E., 1708 Como Ave., St. Paul  
 Peterson, Marian L., 3301 5th Ave. S.  
 Peterson, Marie Hanna, 2300 S. 7th St.  
 Peterson, Merle C., 2411 11th Ave. S.  
 Peterson, Minnie, Portland Ave. & 59th St.  
 \*\*Peterson, Richard M., 959 14th Ave. S.E.  
 Phede, Celina, 3817 38th Ave. S.  
 Phillips, Anna T., 1808 Stevens Ave.  
 Phillips, Bertha L., 3208 Humboldt Ave. S.  
 †Phillips, Grace, 1686 Capitol Ave., St. Paul  
 Piemeisel, Robert L., 1615 1st Ave. S.  
 Pierce, Elizabeth, University Hospital  
 Pierce, Mrs. M. Frances, 706 University Ave. S.E.  
 Piltz, Edna M., 2641 15th Ave. S.  
 Pitney, E. H., 2315 Dupont Ave. S.  
 Pittard, Katherine V., 1118 S.E. 7th St.  
 Pitorf, Albert J., 274 E. Annapolis St., St. Paul  
 Pixley, Mary Maude, 3247 Stevens Ave.  
 Platzer, Helen, 3410 Garfield Ave.  
 Plunkett, Mrs. Thos., 2724 Chicago Ave.  
 Plantikow, Lyla G., 2215 Dupont Ave. N.  
 Plantikow, Miranda M., 2215 Dupont Ave. N.  
 Pletke, Dora, 1786 Hennepin Ave.  
 Plummer, Bel, 1111 Hawthorne Ave.  
 Plummer, Mrs. S. H., 414 W. 54th St. S.  
 Polk, Grace E., 516 Hampshire Arms  
 Pomeroy, Lillian C., 2404 Nicollet Ave.  
 Poppe, Eleanora, 2627 Humboldt Ave. S.  
 Poore, Louise, 2871 Humboldt Ave. S.  
 Porter, H. W., 121 11th St. S.  
 Powell, Mrs. Irene, 5600 Nicollet Ave  
 Powell, Mrs. Mary A., Grant-Portland Hotel  
 Powell, Louise M., University Hospital  
 Preston, Catherine, 99 S.E. Bedford St.  
 Price, Cora Belle, 332 1-3 Humboldt Ave. S.  
 Purdy, Beatrice, 413 5th Ave. S.E.  
 Purdy, Daisy I., 123 W. 5th St.  
 Putman, Alice E., 1823 9th Ave. S.  
 Pybus, Emma M., 610 E. 15th St.  
 Pyke, Emily, 1922 Humboldt Ave. S.  
 Quilling, Alice M., 1530 Vine Place  
 Quinby, Thos. F., 2424 Humboldt Ave. S.  
 Quinn, Mary E., 2432 Lyndale Ave. S.  
 Radke, Helen M., 504 2nd Ave. S.E.  
 Radosch, Mina, 75 Melbourne Ave. S.E.  
 Raines, Mary Edith, 3136 Humboldt Ave. S.  
 Randall, Ada M., Hopkins, Minn.  
 Randall, Grace A., 1425 Vine Place  
 Randall, Louise E., 3248 2nd Ave. S.  
 Rankin, Mrs. A. B., 605 E. 17th St.  
 Ranney, Lila Weber, 69 S.E. Bedford St.  
 Rañum, Edna E., care Alfred J. Krank, 140 E. 6th St., St. Paul  
 Rarig, Margaret, 111 Orlin Ave. S.E.  
 Ray, Charlotte D., Hampshire Arms  
 Ray, Rosalie E., 1939 Bryant Ave. S.  
 Reber, Maude, 2416 28th Ave. S.  
 Rehcycl, Mildred, 2402 Hennepin Ave  
 Reed, Carolyn A., The Leamington  
 Reed, Margaret, 2204 Grand Ave. S.  
 Rees, Mrs. Lester, 1000 Franklin Ave. W.  
 Regan, Mrs. Grace H., 609 The Leamington.  
 Rehart, Nell, 3717 Cedar Ave.  
 Rñhfeld, Alice D., St. Louis Park  
 Reichard, Veda, 4541 York Ave. S.  
 Reichert, Ida A., 415 Dupont Ave. N.  
 Reid, Mary D., 604 11th Ave. S.E.  
 Rehrke, Rosetta M., 4544 Zenith Ave. S.  
 Reque, Marie E., 307 W. 15th St.  
 Renfield, Alice D., St. Louis Park  
 Reusch, J. J., 391 Beacon Ave., St. Paul  
 †Rex, Florence, 307 W. 15th St.  
 Rhame, Edith Pope, 209 S.E. State St.  
 Rhoads, Paul H., 538 12th Ave. N., St. Paul  
 Richards, Estelle W., Hotel Maryland  
 Richards, Mary L., 114 W. Grant St.  
 Richards, Nellie, The Leamington  
 Richter, Grace A., 4324 Lyndale Ave. S.  
 Ricketson, Mrs. Francis J., 2931 Oliver Ave. N.

Riedle, Anna M., 738 E. 16th St.  
 Rieff, Florence, The Minnehaha, Apt.  
 28, St. Paul  
 Rien, Earl A., 501 S.E. Beacon St.  
 Righter, V. Mari, 623 14th Ave. S. E.  
 Ristrom, Ruth, 3708 Blaisdell Ave.  
 Ritchie, Lillian, 2687 Lake of Isles Blvd.  
 Ritze, Bertha L., 2549 Bryant Ave. S.  
 Robertson, Katherine H., Hastings Ho-  
 tel  
 Robinson, Harriet M., The Leamington  
 Robinson, Mabel, 500 S.E. 7th St.  
 Robinson, Willis S., 3736 11th Ave. S.  
 Roesler, Pearl, 1119 S.E. 6th St.  
 Rogers, Edna M., 1420 Portland Ave.  
 Rogers, Fay, 1206 18th Ave. N.  
 Rogers, Helen, 4029 Garfield Ave.  
 Rogers, Richard S. (Mr. & Mrs.), 212  
 S.E. Harvard St.  
 Rohann, Alice Eva, 223 W. Diamond  
 Lake Road  
 Rohann, Emma, 223 W. Diamond Lake  
 Road  
 Rohweder, Gertrude, 1821 1st Ave. S.  
 Rollins, Mark P., 1912 Hennepin Ave.  
 Roney, Katherine L., 219 Groveland  
 Ave.  
 Rood, L. C., 2633 Pillsbury Ave.  
 Rood, Mary B., Maryland Hotel  
 Rose, Florence, 2425 Dupont Ave. S.  
 Rose, Mrs. L. V., 325 W. 54th St.  
 Rose, Mollie Mae, Asbury Hospital  
 Rosenquist, Selma E., 3119 Stevens Ave.  
 S.  
 Ross, Mrs. Effie L., 1820 Stevens Ave.  
 Rotering, Anna, 1915 1st Ave. S.  
 Rowan, Margaret, 1700 Portland Ave.  
 Rowe, Dr. A. T., 3345 Grand Ave. S.  
 Rowell, Ora M., 1408 Spruce Place  
 \*\*Rowles, May V., 1958 Selby Ave.,  
 St. Paul  
 Rudoy, Max M., 917 14th Ave. S.  
 Rue, Christ M., 681 Lowry Ave. N.E.  
 Rumbaugh, Mary L., 2406 Nicollet Ave.  
 Rusch, Ella, 1753 Iglehart Ave., St.  
 Paul  
 \*\*Rusch, Gertrude C., 1753 Iglehart  
 Ave., St. Paul  
 \*\*Rusch, Mabel A., 1753 Iglehart Ave.,  
 St. Paul  
 Russell, Clementina R., 2451 Aldrich  
 Ave. S.  
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 St. Paul  
 Russell, Marian E., Anoka, Minn.  
 Rutherford, S. J., 1016 27th Ave. N.E.  
 Rutledge, Jeanette W., 18 W. Rustic  
 Lodge  
 Ruud, M. B., 813 10th Ave. S.E.  
 Ruud, Peter H., 604 20th Ave. S.  
 Ryan, Miss, care Powers Merc. Co.  
 Ryan, Anna M., 416 7th Ave. N.E.  
 Ryan, James L., 820 Nor. Pac. Bldg.,  
 St. Paul  
 Ryan, Joseph M., 416 7th Ave. N.E.  
 †Rye, Carlton D., 1407 Girard Ave. N.  
 Rylander, Crrl E., 705 Sims St., St.  
 Paul  
 Rylander, Lawrence, 705 Sims St., St.  
 Paul  
 Rystrom, Roy, 716 E. Magnolia St.,  
 St. Paul  
 Saam, Selma L., 610 E. 15th St.  
 Sachs, Lena, 568 7th Ave. N.  
 Sachs, Louis, 1903 1st Ave. S.  
 Salpeter, Mrs. J., 579 Carroll Ave., St.  
 Paul  
 Sampson, Frances P., 2428 Portland Ave.  
 Sand, Anna, 800 13th Ave. S.E.  
 Sand, Borghild L., 612 E. 15th St.  
 Sandbo, William E., 1724 S.E. 4th St.  
 Sanden, Bert C., 1292 Dayton Ave., St.  
 Paul  
 Sanderson, James C., 813 S.E. 5th St.  
 Sanderson, Katherine, 679 Lincoln Ave.,  
 St. Paul  
 Sanver, Mary T., 603 River Road S.E.  
 Sarvela, Leonard A., 808 12th Ave. S.E.  
 Sauer, Marion, 3435 Longfellow Ave.  
 Sbenikle, Mrs. M., 3145 Stevens Ave.  
 Scals, Kate M., 2300 Nicollet Ave.  
 Scammon, Mrs. R. E., 33 Arthur Ave.  
 S.E.  
 Schadde, Alva J., 528 S.E. 8th St.  
 Schaefer, Emmel, 2545 Bryant Ave. S.  
 Schain, George A., 2917 31st Ave. S.  
 Schey, Jennie O., 417 S.E. Delaware  
 Schey, Martin J., 1516 11th Ave. S.  
 Schill, Gertrude B., 721 12th Ave. S.E.  
 Schmidt, Martha L., 2200 Sheridan Ave.  
 S.  
 Schmit, Florence M., 539 Brainard Ave.,  
 St. Paul  
 Schmitt, Harold N., 733 Aurora Ave.,  
 St. Paul  
 Schoening, Ida Beth, 2109 Fremont Ave.  
 S.  
 Schoenleben, Leland A., 1825 Emerson  
 Ave. N.  
 Schoettler, Arthur E., 1905 Elliott Ave.  
 Schoof, Bessie J., 1070 17th Ave. S.E.  
 Schow, Mayme J., 224 E. Page St., St.  
 Paul  
 Schroeder, Mrs. J. F., 1324 N.E. Grand  
 St.  
 Schroeder, Neva, 3323 Columbus Ave.

Schubert, Martha, General Hospital  
 Schuhardt, Lena, 6 N. Dale St., St. Paul  
 Schumacher, Gladys M., 2622 4th Ave.  
 S.  
 Schussler, Emma U., 2722 Bloomington Ave.  
 Schwartz, Celia M., 1031 St. Clair St.,  
 St. Paul  
 Scofield, Harriet E., 2609 Columbus Ave.  
 Scott, Walter I., 2608 Pillsbury Ave.  
 Scripture, Elizabeth, Minneapolis  
 Scully, Zita, 2413 Emerson Ave. N.  
 Seamans, Florence R., 910 21st Ave. S.  
 Seavey, Howard L., 2300 Nicollet Ave.  
 Sehey, Emma M., 1301 4th Ave. S.  
 Seiden, A. W., 3228 22nd Ave. S.  
 Seidlitz, Ella, 2541 Harriet Ave.  
 Seigert, Mary, 3912 Aldrich Ave. S.  
 Seitz, Mrs. Adelle K., 1416 W. 34th St.  
 Seitz, Conrad, 1416 W. 34th St.  
 Seitzer, Johanna, 600 Ridgewood  
 Sellhorn, Minnie D., 69 Lyndale Ave. N.  
 Sevaton, Martha, 3900 Minnehaha Ave.  
 Seyller, Blanche L., 1325 Vine Place  
 Shane, William Geo., 3549 Humboldt  
 Ave. S.  
 Shaney, Florence, 1612 Stevens Ave.  
 Shannon, Rose M., 203 W. 5th St., St.  
 Paul  
 Shannon, S. Q., 913 Eustis St., St. Paul  
 Shapiro, Amo, 908 Fremont Ave. N.  
 Shaw, Gertrude J., 2344 Aldrich Ave. S.  
 Shea, Agnes, 20 N. 13th St.  
 Shebat, Esther, 2825 Hennepin Ave.  
 Shebat, Katherin, 2825 Hennepin Ave.  
 Shedorsky, Lena, 204 Western Ave., St.  
 Paul  
 Sheehan, Katherine, 1815 1st Ave. S.  
 Sheldon, Bessie, 1315 S.E. 7th St.  
 Shellhorn, Emma J., 911 Queen Ave. N.  
 Shillock, Anna, 702 S.E. 4th St.  
 Sheppard, Ross I., 1800 S.E. 4th St.  
 Shere, Lewis, 3435 Grand Ave. S.  
 Sheridan, Helen M., 3443 Elliott Ave.  
 Sherin, Mabel, 1819 Lyndale Ave. S.  
 \*\*Shields, Alice, 89 Mackubin St., St.  
 Paul  
 Shippee, Elizabeth, Prospect Park, St.  
 Paul  
 Shirey, Fay D., 729 10th Ave. S.E.  
 Shively, Viola E., 1551 Hillside Ave. N.  
 Sholley, Gertrude B., 3836 Thomas Ave.,  
 S.  
 Shuman, Anne, 914 E. 18th St.  
 Shumway, George G., 3410 Pillsbury  
 Ave.  
 \*\*\*Sidebottom, Radclyffe S., 1907 Or-  
 ange St., St. Paul  
 Siebert, Marie H., 3006 Oliver Ave. N.  
 Siegert, Frances, 3552 3rd Ave. S.  
 Siehl, C. D., 3315 W. 45th St.  
 Sifton, Hattie E., 2015 W. Broadway  
 Siggelkow, Grace R., 2954 Penn Ave. N.  
 Silber, Gertrude G., 127 Highland Ave.  
 Silber, Mary, 127 Highland Ave.  
 Silk, Harry L., 41 27th Ave. S.E.  
 Simon, Selma S., 184 Fillmore Ave. E.,  
 St. Paul  
 Simonson, Adolph C., 2502 N.E. John-  
 son St.  
 Simpson, Myrtle, 1847 E. 31st St.  
 Sims, Mrs. Ralph W., 2644 Aldrich Ave.  
 S.  
 Slattery, Thelma L., 3328 5th Ave. S.  
 Slider, Ethel M., 1226 5th St. S.E.  
 Small, Mary F., 1219 S.E. 4th St.  
 Smart, Mrs. Catherine C., 1418 Port-  
 land Ave., Apt. 19  
 Smith, Agnes C., 4100 Upton Ave. S.  
 Smith, Alice D., Curtis Hotel, Apt. 476  
 Smith, Claribel, 1224 Mary Place  
 Smith, Cleora F., 309 Como & River  
 Blvd., St. Paul  
 Smith, Evelyn F., 1266 Curtis Hotel  
 Smith, Gertrude, 2608 Pillsbury Ave.  
 Smith, Gertrude K., 476 Curtis Hotel  
 Smith, Grace I., 60 Royalston Ave.  
 Smith, Helen E., 1705 Stevens Ave.  
 Smith, Irene A., 3125 16th Ave. S.  
 †Smith, Margaret L., 1958 Carroll Ave.,  
 St. Paul  
 Smith, Samuel E., 1417 W. Lake St.  
 Smith, Winnifred B., 1107 S.E. 6th St.  
 Snyder, Mary, 1325 Vine Place  
 Soare, Edna R., 3125 Penn Ave. N.  
 Solmans, Emma, 515 S.E. Harvard St.  
 Somers, Catherine W., 2111 14th Ave. S.  
 Souba, Amy, Hopkins, Minn.  
 Spaulding, Edith E., 5538 Nicollet Ave.  
 Spear, Florence H., 2317 Humboldt Ave.  
 S.  
 Spencer, Gertrude L., 3112 Fremont  
 Ave. S.  
 Sperry, Ralph M., 705 S.E. 7th St.  
 Springsted, James H., 1807 4th St. S.E.  
 Squire, Anne, 1025 6th Ave. S.  
 Squier, Carrie, 303 S.E. Walnut St.  
 Staehle, Jean (Mrs.), 2738 Portland Ave.  
 Stanley, Elizabeth A., 747 N.E. Mad-  
 ison St.  
 Stayman, Bessie, 156 Gobertson St., St.  
 Paul  
 Steele, Katherine D., 1316 S.E. 7th St.  
 Steele, Robert E., 1930 Girard Ave. S.  
 Steinert, Bessie B., Excelsior, Minn.  
 Steinmetz, Jennie, 914 Logan Ave. N.

Steffanus, Clara, 695 Holly Ave., St. Paul

Stenning, Cliff, 1829 5th Ave. S.

Stephens, Florence G., 116 W. 27th St.

Stephens, Jean P., 3102 W. 44th St.

Stevens, Janet M., The Leamington

Stevenson, Irene, 3201 Colfax Ave. S.

Stewart, Theodosia, 3112 3rd Ave. S.

Stockwell, Mrs. Lynn E., 625 University Ave. S.E.

Stone, Charles W., 911 W. 43rd St.

Strain, Inga, 1402 Emerson Ave. N.

Straub, Lloyd J., 1126 S.E. 5th St.

Strauss, Clara, 911 Newton Ave. N.

Streit, Frank M., 204 S.E. Harvard St.

Stringham, Josephine A., The Leamington

Stromme, W. A., St. Louis Park

Strong, Mrs. Carolyn H., 2445 Aldrich Ave. S.

Suidey, Charles P., 1904 1st Ave. S.

Sullivan, Elizabeth M., 846 Holly Ave., St. Paul

Sumner, Elizabeth L., 84 Spruce Place

Sundberg, Frederick G., 45 N. Dale St., St. Paul

Svenddal, Dagny, 2522 Garfield Ave.

Swanson, Anna E., 3215 Pillsbury Ave.

Swanson, Clarence V., 730 Capitol Heights, St. Paul

Swanson, Edith M., 911 Penn Ave. N.

Swanson, Ellen J., 2323 N.E. Pierce St.

Swanson, Helen A., 5814 Portland Ave.

Swanson, Lucile I., 1918 3rd Ave. S.

Swanson, Mabel M., 911 Penn Ave. N.

Sweet, Earl, 5604 Blaisdell Ave.

Sweet, Mrs. Earl, 5604 Blaisdell Ave.

Swennes, Agnes E., 3818 Chicago Ave.

\*\*\*Swenson, G. A., 2842 31st Ave. S.

Swensrud, Hannah, 2608 S. 8th St.

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Taylor, Beulah, 1915 Portland Ave.

Taylor, Louis A., 3743 22nd Ave. S.

Taylor, Mary E., 1015 3rd Ave. S.

Taylor, Sarah E., 4208 Chicago Ave.

Taylor, Susan E., 4208 Chicago Ave.

Teichroew, Henry W., 2339 Pierce Ave., St. Paul

Telfair, Nellie M., 1422 Portland Ave.

Teuill, Gertrude, 1415 Willow St.

Thom, L. W., 3432 32nd Ave. S.

Thomas, Anna B., 3312 Nicollet Ave.

Thomas, Gertrude T., University Hospital

Thomas, Joseph M., 818 University Ave. S.E.

Thomas, Lucy A., 2420 Harriet Ave.

Thomas, Jessie M., 818 University Ave. S.E.

\*\*\*Thomas, Mabel H., 3032 Irving Ave. S.

Thomas, Mary E., 1786 Hennepin Ave.

Thomas, Mrs. Selma, 2403 Bloomington Ave.

Thompson, Blanche M., 2311 Bryant Ave. N.

Thompson, Dena, 417 S.E. Oak St.

Thompson, Edith, 1521 Spruce Place

Thompson, Faith, 2608 Humboldt Ave. S.

Thompson, Helen, 106 E. 16th St.

Thompson, Vera A., 316 12th Ave. S.E.

Thompson, Vida A., 316 12th Ave. S.E.

Thomson, Margaret M., 2655 Irving Ave. S.

Thomson, Thomas C., 3620 E. 42nd St.

Thor, Christine L., 1216 Sheridan Ave. N.

Thornton, B. Elizabeth, Curtis Hotel

Thornton, Katherine J., Curtis Hotel

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Thorsen, Thea, 406 17th Ave. S.E.

Thyken, Hugh J., 1707 Stevens Ave.

Tierney, M. J., 3015 W. 52nd St.

Tinstrom, Ernest A., 716 Cromwell Ave., St. Paul

Todd, Erma E., 1217 Washburn Ave. N.

Tolbot, Esther B., 901 Summit Ave.

Tollefson, Esther, 3648 17th Ave. S.

Tollifson, Eunice J., 201 S.E. State St.

Tollifson, Hazel, 315 S.E. Harvard St.

Tombler, Marie, 4617 Aldrich Ave. S.

Tombler, Alice, 4617 Aldrich Ave. S.

Tomlinson, Bessie A., 3115 13th Ave. S.

Tote, Mrs. John, 1011 14th Ave. S.E.

Tousignant, Florence, 2326 Bryant Ave. N.

Towey, Agnes M., 2746 Fremont Ave. S.

Towey, Robert E., 2746 Fremont Ave. S.

Towler, May B., Minn. Soldiers Home

Tripp, Eva M., Curtis Hotel

Trueman, Veronica, 1323 E. 25th St.

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Tupper, Emily H., 1902 Park Ave.

Turngren, Ellen M., 4049 5th Ave. S.

Turnquist, Anna L., 2542 Chicago Ave.  
 †Turnquist, Clarence H., 2418 Chicago Ave.  
 Turnquist, Myrtle, 2631 3rd Ave. S.  
 Turrittin, Mary, 3302 Harriet Ave.  
 Tusler, Wilbur H., 4044 Pleasant Ave.  
 Tuttle, Marguerite W., 621 S.E. Beacon St.  
 Twitchell, Mrs. S. D., 1429 Como Ave. W., St. Paul  
 Tyler, Alice F., 619 S.E. Beacon St.  
 Tyra, M. Dorothea, 2009 Lyndale Ave. N.  
 Tyra, Ruth, 2009 Lyndale Ave. N.  
 Ulbricht, Clara, 523 S.E. 7th St.  
 Ulbricht, Emma A., 523 S.E. 7th St.  
 Underdahl, Olive, 328 15th Ave. S.E.  
 Underwood, Elizabeth, care Girl's Vocational High  
 Unngaard, Robert L., 3309 19th Ave. S.  
 Vail, Mrs. R. W. G., 519 S.E. Essex St.  
 Vanderhoof, Clare, 500 S.E. Delaware St.  
 Van Dusen, Sara H. (Mrs.), 601 S.E. 6th St.  
 Van Kleek, Maud, 2010 Park Ave.  
 Vannier, Marion L., University Hospital  
 Van Patten, Mrs. W. E., 120 S.E. 7th St.  
 †Vanstrum, Margaretta, 4508 Lyndale Ave. S.  
 Van Valkenburg, Mabel, 2408 1st Ave. S.  
 Veblen, Gertrude, 2644 Aldrich Ave. S.  
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 Vertz, Mrs. Leila W., 4938 Russell Ave. S.  
 Vievering, William, 2360 Hampden Ave., St. Paul  
 Voight, Walter Edw., 1892 Feronia Ave., St. Paul  
 Von Drak, Lela, 113 S.E. Cecil St.  
 Von Rohe, Lucy E., The Leamington  
 Wadden, Loretta, 4104 Park Ave.  
 Wagner, Ernest, 4419 Pleasant Ave.  
 Wahl, Gertrude, 1800 1st Ave. S.  
 Wajahn, Martha, 324 16th Ave. N.  
 Waldum, Oluf, 3013 James Ave. S.  
 Walker, Eva, 411 16th St. N.  
 Wallar, Beulah H., 1835 Dayton Ave., St. Paul  
 Walsh, William C., 1819 Lyndale Ave. S.  
 Walter, Raymond B., 5216 Upton Ave. S.  
 Wanless, Luceille, 420 S.E. Walnut St.  
 Ward, Susanna R., 4424 Upton Ave. S.  
 Warden, Marion, 2112 Humboldt Ave. S.  
 Warnock, Florence M., 1786 Hennepin Ave.  
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 Warren, Gladys E., 3503 Lyndale Ave. S.  
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 Weeks, Ida M., 3036 Bryant Ave. S.  
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 Welo, Alma H., 3036 Harriet Ave.  
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 Wentland, Ida V., 1325 Vine Place  
 Wentz, Edith N., 1469 Hythe St., St. Anthony Park, St. Paul  
 Wesbrook, Helen F., 702 S.E. 4th St.  
 West, Carleton, care Dayton Co.  
 Westlund, Mary E., 4311 Wentworth Ave.  
 Westlund, Olof N., 2107 Portland Ave.  
 Weston, Carlyle D., 2201 Aldrich Ave. S.  
 Westen, Effie M., 2527 N. 4th St.  
 Wetmone, Mrs. Theodore, The Leamington  
 Wheeler, Eva G., 3336 Irving Ave. S.  
 Wheeler, G. A., 926 Chicago Ave.  
 Wheeler, Mrs. Iris J., 3734 28th Ave. S.  
 Wheeler, Marion L., 315 S.E. Harvard St.  
 Whitaker, John A., 3752 Grand Ave. S.  
 Whitcomb, Anne W., 2205 Lyndale Ave. S.  
 White, Anna M., 1083 15th Ave. S.E.  
 White, Caroline A., 1208 W. 28th St.  
 White, Carrie A., 1208 W. 28th St.  
 Whiteford, Mr. and Mrs. A. W., 2917 Aldrich Ave. S.  
 Whitenack, Miss, care Powers Merc. Co.  
 Whiting, Jennie N., 2208 Western Ave.  
 Whitmer, Marie, 619 Washington Ave. S.E.  
 Whitney, Earl L., 527 S.E. Oak St.  
 Wichman, Edward W., 2421 Girard Ave. S.  
 Wicklund, Hazel E., 4504 Pleasant Ave.  
 Wilcox, Gilbert D., 3119 Girard Ave. S.  
 Wilde, Oliver T., 803 E. 15th St.  
 Wilkinson, Helen F., 4028 Grand Ave. S.  
 Wilkinson, Sarah H., 20 W. 36th St.

Willets, Blaine, St. Louis Park  
 Williams, Belle, 20 15th St. N.  
 Williams, Josephine F., 5625 Stevens Ave.  
 Williams, Maud M., 2010 Park Ave.  
 Williams, Ruth, Curtis Court  
 Williams, Violet, 122 S.E. 4th St.  
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 Wilson, Neva M., Hillcrest, D. 2  
 Wincott, Marguerite, 1013 W. Lake St.  
 Wingblade, Henry, 1392 Almond St., St. Paul  
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 Winter, Winifred, 629 12th Ave. S.E.  
 Winton, Adelaide A., 2705 Bloomington Ave.  
 Winton, Mary F., 2705 Bloomington Ave.  
 Witchie, Hazel M., 1700 Dupont Ave. N.  
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 †Wolfson, Wilfred, 1810 13th Ave. S.  
 Wood, Adelia, 3341 2nd Ave. S.  
 Wood, Genevieve M., 1523 Van Buren St.  
 Woodbury, Jessie E., 3121 Dupont Ave. S.  
 Woodruff, Pearl, 1208 Franklin Ave. W.  
 Woods, Laura, 60 Ash St.  
 Woodworth, H. C., 1662 Capitol Ave., St. Paul  
 Woolever, Raymond G., 312 S.E. Ontario St.  
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 Wright, Quincey, 311 5th Ave. S.E.  
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 Wyland, Elizabeth, 3108 Clinton Ave.  
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 Yeaton, Katherine, 1828 Clinton Ave.  
 Yetter, Margaret C., 2550 Monroe St.  
 Yikl, Ida, 1714 Western Ave.  
 Youatt, L. W., 915 S.E. 6th St.  
 Young, Katherine, 1120 S.E. 6th St.  
 Youngquist, Wilma, 821 25th Ave. S.  
 Zickrick, Theo., 117 W. Grant St.  
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 ††Anderson, August Edward, 909 Iglehart Ave.  
 ††Anderson, Mrs. Florence, 399 Holly Ave., Minneapolis  
 ††Ashton, John Barton, care Dayton Co. Atlas, Maurice, 583 Carroll Ave.  
 Baber, Florence E., 1415 Van Buren St.  
 Bach, Lovena, 627 Cable Ave.  
 Baker, Mrs. E. Dorothy, 642 Ashland Ave.  
 Baldwin, Julia M., 215 S.E. Harvard St., Mpls.  
 \*Barwise, Thos. C., 2064 James St.  
 Bassford, M. Hannah, 441 Iglehart Ave.  
 Battelle, Madeleine F., 1028 Hague Ave.  
 Behrens, Marie, 118 Western Ave. N.  
 Bengtson, J. F., 1388 Albany St.  
 Bergmeier, Clara H., 614 Fountain St.  
 Berry, Mona, 826 Selby Ave.  
 Bigne, Blanche S., 54 N. Delos St.  
 \*Billingsley, Merle, Piedmont, No. 33 E.  
 Birch, Ethel L., 1133 Selby Ave.  
 Birch, Nellie E., 1133 Selby Ave.  
 Birnberg, Mrs. Tobias L., 911 Fairmount Ave.  
 Blair, Chas. W., 500 S. 10th St., Mpls.  
 Blumberg, Carrie, 2064 Summit Ave.  
 Boeke, Henriette, 218 N. Dunlap  
 Bohan, Victoria S., 1859 Roblyn Ave.  
 Boulger, Francis Jas., 1996 Dayton Ave.  
 Boxell, Ethel H., 814 Hague Ave.  
 Bowe, John, Brookside, Mpls.  
 Branch, Peter A., 205 6th St.  
 Brandon, Charles A., 909 Y.M.C.A., Mpls.  
 Brennan, Mary Frances, 760 Carroll Ave.  
 Bresnahan, Katherine, 605 Selby Ave.  
 Brey, Florence, 614 Dayton Ave.  
 Bright, M. Louise, 805 Portland Ave.  
 Brink, Oscar, 717 Lawson  
 \*Broadstone, Erminie, 1662 Capitol Blvd.  
 Brooks, Robert L., 1630 W. 26th St., Mpls.  
 Brown, Mrs. Elsie C., 927 Hastings Ave.  
 Brubacher, Ruford D., 3412 1st Ave S., Mpls.  
 Bryant, Richard, 162 W. Annapolis St.  
 Buckley, Margaret, 226 Nelson Ave.  
 Bucklin, C. A., 201 Macalester Ave.  
 Bucklin, Inez C., 201 Macalester Ave.  
 Burch, Miriam A., Angers Hotel  
 Burke, Margaret W., State Hospital, Phalen Park  
 Burns, Elizabeth, 999 Portland Ave.  
 Burns, Maria, 999 Portland Ave.  
 Burns, Dr. Robert M., 1049 Portland Ave.  
 Burns, Mrs. Wendell T., 1857 Laurel Ave.  
 Butler, Augusta H., 1153 Laurel Ave.  
 Calmenson, Mrs. Bertha, 1985 Portland Ave.  
 Canning, Katherine M., 1662 Capitol Ave.  
 Canon, Winnifred, 1966 Ashland Ave.  
 Carlson, Vinnette, 1145 Jessie St.  
 Carroll, Charles, 393 Stryker Ave.  
 Casady, Gladys, 2019 Lincoln Ave.  
 Caulfield, Mary G., 937 Laurel Ave.  
 Chandler, Mary, 512 Portland Ave.  
 Christofferson, C. H., 885 Hague Ave.  
 Clark, Lauletta, 605 Iglehart Ave.  
 Clark, R. W., 1012 Portland Ave.  
 Cohen, Gertrude, 855 St. Clair St.  
 Colter, Mabel A., 841 Laurel Ave.  
 Conley, Lydia M., 1141 Laurel Ave.  
 Connolly, Mary M., 135 Western Ave.  
 Corcoran, Anna, 245 N. Oxford St.  
 Corrigan, Edna, 41 W. Cook St.  
 Coughlan, Cecilia, 237 Pleasant Ave.  
 Countryman, Alden, 213 S. Avon St.  
 Cuzner, Mary F., 213 S.E. Harvard St., Mpls.  
 Dakin, E. T., 89 N. Oxford St.  
 Daly, Harriet K., 630 Marshall Ave.  
 Daly, M. A., 630 Marshall Ave.  
 Davenport, Florence, The Angers  
 Dearborn, Mollie K., White Bear, Minn.  
 DeVinney, Mrs. Mabel I., 1869 Selby Ave.  
 Dixon, Woodson F., 3016 Portland Ave.  
 Donlin, Mrs. J. E., 1271 Ashland Ave.  
 Dorrman, Paula, 1907 Marshall Ave.  
 Dossall, Bertha, 1332 Dayton Ave.  
 Dougherty, Aurelia M., 620 Park Ave.  
 Dougherty, Hannah T., 620 Park Ave.  
 Doyle, Anastasia, 2057 Grand Ave.  
 Drackert, Grace, 1208 Selby Ave.  
 Drake, Miss L. R., 1429 W. Como Ave.  
 Duffy, Margaret F., 439 N. Cleveland Ave.  
 Egan, Anastasia, 1183 Ashland Ave.  
 Elliott, Mary C., 811 E. 5th St. White Bear Lake  
 Emery, Marion G., No. 3, 293 Dayton Ave.  
 Engstrom, H. E., 1700 Princeton Ave.  
 Engstrom, Theo. A., 694 Sims St.  
 Erickson, Agnes E., 946 Arkwright St.  
 Erickson, Cyrus H., 497 Dayton Ave.  
 Erickson, Jno. A. Jr., 1368 Payne Ave.  
 Ern, H. R., 3617 39th Ave. S., Mpls.

Fanning, Mary G., 757 E. 6th St.  
 Farrell, Bernice, 828 Holly Ave.  
 Fayerweather, Mary, 535 Ashland Ave.  
 Feeley, Mae A., 1144 Dayton Ave.  
 Filysek, Waltef E., 2726 N.E. Fillmore St., Mpls.  
 Finstrom, Ernest A., 716 Cromwell Ave.  
 Fitzpatrick, Mary F., 1183 University Ave.  
 Fligelman, Mrs. Sol, 2116 Fairmount Ave.  
 Foster, J. Maude, 271 Selby Ave.  
 \*Fox, Edward John, 535 Ashland Ave.  
 Fox, Mrs. Joseph L., 1764 Portland Ave.  
 Fraser, Harriet R., 109 W. Summit Ave.  
 Friedl, Mrs. Joseph, 1163 Laurel Ave.  
 \*\*\*Fullerton, Donald C., 416 S.E. 8th Ave., Mpls.  
 Funkel, Irene Pay, Mahtomedi, Minn.  
 Garrels, Gebnardine, 595 Ottawa Ave.  
 Garrett, Thos. H., 1514 Portland Ave.  
 Gaughan, Miss S., The Marlborough  
 Gaynor, Lucy M., 902 Cromwell Ave.  
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 Glasgow, Esther, 1511 W. Minnehaha St.  
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 Goodkind, Mrs. Harold, 567 Lincoln Ave.  
 Gordinier, Lillian A., 109 Bates Ave.  
 Gorman, Alice A., 727 E. 3rd St.  
 \*Greeley, Margaret, 218 Dayton Ave.  
 Green, Anna B., 303 Nelson Ave.  
 Gundlach, Caroline M., 1726 Lincoln Ave.  
 Hauser, C. L., 920 Hennepin Ave., Mpls.  
 Hagerty, Inez Elizabeth, 2004 Portland Ave.  
 Hagen, G. W., 1114 McLean Ave.  
 Hagen, Sylvia, 761 E. 3rd St.  
 Hall, Edith P., 997 Dayton Ave.  
 Hamilton, Winifred C., 642 Ashland Ave.  
 Hand, Richardine, 591 Ashland Ave.  
 Hansen, Nancy E., 475 Laurel Ave.  
 Harmon, Mrs. H. W., 1924 Iglehart Ave.  
 Harris, Dena S., 1854 Portland Ave.  
 Harris, Mrs. Wm., 1458 Lincoln Ave.  
 Hayes, Laura, 881 St. Clair St.  
 Hayward, Della G., 1295 Goodrich Ave.  
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 Heck, Jennie, 418 Rice St.  
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 ††Hedrick, W. L., 519 Asbury Ave.  
 Heieie, O. C., 321 Lowry Bldg.  
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 Holmes, Margaret J., 1156 Summit Ave.  
 Hope, Alice M., 391 Beacon Ave.  
 Horrigan, Mary J., 683 Iglehart Ave.  
 Hosmer, Alice M., 528 Ashland Ave.  
 How, Mary W., 436 Portland Ave.  
 Hubbell, Nellie M., 248 Dayton Ave.  
 Iddings, Clara L., 998 Ashland Ave.  
 Ingersoll, Archibald G., 404 Ashland Ave.  
 Jacobs, Ann, 2117 Commonwealth Ave.  
 Janes, Mrs. A. L., 588 Grand Ave.  
 John, Elsa, 373 Maple St.  
 Johnson, Anna, 333 E. Lawson St.  
 Johnson, Florence A., 788 Fairmount Ave.  
 Johnson, Gertrude, 1005 Lincoln Ave.  
 Johnson, Jennie U., 1685 Capitol Ave.  
 Johnson, Mathilda, 1388 Capitol Ave.  
 Johnson, Nettie, 1780 Wordsworth St.  
 Johnston, Ruth, 33 S. Avon St.  
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 Kellogg, Gertrude, 369 Laurel Ave.  
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 Klein, Elsie, 634 Iglehart Ave.  
 Klein, Elizabeth, 1685 Capitol Ave.  
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 Koeneman, Emma, 1233 Hague Ave.  
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 Kuehne, Minnie, 402 Dayton Ave.  
 Kurtz, Myrtle H., 886 Fairmount Ave.  
 Laramy, Ruth G., St. Paul Park  
 Larkin, Jane V., 1204 Portland Ave.  
 Larkin, Mrs. M. B., 701 Laurel Ave.



Larpenteur, Ethel, 737 Hudson Ave.  
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 LaValle, Mrs. Rose, 178 Summit Ave.  
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 Layton, Edith M., 702 Cedar St.  
 Lealtad, Grace, 465 Mackubin St.  
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 Lee, Mrs. Earle Goodrich, 1787 Dayton Ave.  
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 LeVasseur, Mme. Deluice M., 345 Pleasant Ave.  
 Lindvall, August J., 714 E. Cook St.  
 Little, Mrs. Arthur P., 1656 Wellesley Ave.  
 Loecinger, Millie S., 1699 Portland Ave.  
 Lofgren, Margaret, 599 Case St.  
 Lotter, Josephine Anne, 1128 E. Geranium St.  
 Long, Justine, 589 Summit Ave.  
 Loveland, Carrie E., 2126 Carter Ave.  
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 Lowenthal, Bertha, 277 Prescott  
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 MacAlister, Una F., 658 Holly Ave.  
 MacEwen, Wm. S., 246 N. St. Albans St.  
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 Miller, Ada M., 1789 Iglehart Ave.  
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 Nelson, Mrs. E. N., 1133 Laurel Ave.  
 Nelson, Esther T., 1358 Lafond St.

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 Neuman, Mary, 772 Marshall Ave.  
 Neumann, Minnie M., 947 Cromwell Ave.  
 Newell, Frank J., 923 Edmund St.  
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 Nordgren, Dan J., 1052 Jessie St.  
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 O'Dell, Thomas E., 600 University Ave., Mpls.  
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 Ohl, Mrs. Lawrence, 374 Daly St.  
 Ohr, Frances D., 118 Western Ave.  
 Ohr, Winnifred, 556 Ashland Ave.  
 Olsen, Carolyn, 271 Selby Ave.  
 Olson, Florence E., 750 E. Geranium St.  
 Olson, Mina, 1253 Lafond St.  
 Olson, Ruth I., 1358 Lafond St.  
 Olson, Walfred A., 724 Case St.  
 Orenstein, Mrs. L. F., 806 Linnwood Place  
 Otto, Verne A., 591 Lafond St.  
 Parker, Frances P., 235 Arundel St.  
 Parkinson, Laura D., 1789 Iglehart Ave.  
 Parks, Mabel A., 617 Elfelt St.  
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 ††Peterson, Richard M., 959 14th Ave. S.E., Mpls.  
 Pilger, Celina M., 1680 Capitol Ave.  
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 Podlasky, Fannie, 1400 Summit Ave.  
 Poreau, Germaine, 589 Portland Ave.  
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 Pukrop, Caleria, 916 Jessamine St.  
 Rawlinson, Anna I., 203 S. Chatsworth St.  
 Reier, Martin A., 520 S.E. Delaware St., Mpls.  
 Rice, Catherine, 766 Carroll Ave.  
 Riordan, Gertrude B., 269 Selby Ave.  
 Rodgers, Ethel, 967 Fremont  
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 ††Rusch, Mabel A., 1753 Iglehart Ave.  
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 Schow, Mayme J., 224 E. Page St.  
 Schulz, Erna M., 927 Hastings Ave.  
 Schumman, Carl T., 535 Grand Ave.  
 Schwartz, Anna K., 608 Lincoln Ave.  
 \*Schwartz, Mary, 1031 St. Clair St.  
 Schwartz, Rachel B., 699 Ashland Ave.  
 Selig, Ruth H., 1799 Summit Ave.  
 Sexton, Margaret M., 790 Dayton Ave.  
 \*Shaker, Elias, 1626 Ashland Ave.  
 Shalene, Eunice M., Mounds Park Sanatorium  
 Shedorsky, Sara, 204 Western Ave.  
 ††Shields, Alice, 89 Mackubin St.  
 Silverman, Nancy H., 44 Prior Ave. N.  
 Simos, Tillie, 148 E. Congress St.  
 Simpson, John P., 783½ University Ave.  
 Skinners, Mary, 201 Goodrich Ave.  
 Slaptes, Mrs. C. D., 1656 Wellesley Ave.  
 Slemmons, Antoinette, 235 Arundel St.  
 Slette, Inga, 538 Dayton Ave.  
 Sliney, Elizabeth J., 736 Holly Ave.  
 Soukup, Joseph F., 1180 Portland Ave.  
 Stathan, Oliver C., 657 Grand Ave.  
 Steen, Lulie, 589 Portland Ave.  
 Stickney, Edith P., The Angus Hotel  
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 Stone, Edward J., 610 Holly Ave.  
 Strand, Mary, 296 Duke St.  
 Stroble, Elizabeth, 591 Ashland Ave.  
 Sumerfield, Irene L., 1493 Summit Ave.  
 Sutherland, John E., 1203 E. 6th St.  
 Sweeney, Randall, care Field, Schlick & Co.  
 Thompson, Clara E., 176 Arundel St., Flat I  
 Thuet, Emma, 591 Ashland Ave.  
 Timme, Cora H., 1148 Orange St.  
 Titus, Lucile J., 2187 Dayton Ave.  
 Tolson, Edgar, 856 Albemarle St.  
 Tomczak, Antoinette M., 1217 Lafond St.  
 Towlinson, Geo. H. (Mr. & Mrs.), 1034 Dayton Ave.  
 Tozier, Beatrice K., 216 Ann St.  
 Tschida, Katherine A., 1188 Laurel Ave.  
 Tuff, Jane R., 924 Iglehart Ave.  
 \*Tufnesson, Harold N., Y.M.C.A., Rm. 527  
 Wakefield, Nelle, 1958 Carroll Ave.  
 Walsh, William, 205 W. 6th St.  
 Watson, Florence, Central High School  
 \*Wattles, Fern, Piedmont, Apt 33 E  
 Wedge, Agnes, 805 Portland Ave.  
 Weisz, Hans, 386 Exchange  
 Wentworth, C. D., Y.M.C.A.  
 Williams, Isabel, 554 Holly Ave.  
 Willmer, Mrs. James G., 954 Fairmount Ave.  
 Wilson, Clarence T., 211 S.E. Harvard St., Mpls.  
 ††Wilson, Neva M., Hillcrest, D. 5  
 Wimber, Mrs. L. L., 2170 Lincoln Ave.  
 \*Woodruff, Earl A., 820 Ohio St.  
 Yost, Lena, 260 Iglehart Ave.  
 Zirkin, Daniel E., 1600 Plymouth Ave N., Mpls.

## DULUTH—COLLEGIATE

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St.

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Brun, Wm., 22 E. 1st St.

Daly, Margaret B., 3902 W. 3rd St.

Erickson, Anna E., 403 E. 2nd St.

Hansen, Ruth M., 1414 E. 5th St.

Maki, Enoch, 1007 E. 2nd St.

Maki, John F., 1007 E. 2nd St.

Neipp, John C., 17 W. 5th St.

Pascoe, P. R., 508 E. 5th St.

Stram, S. T., 413 4th Ave. E.

Webb, John, Alexander Hotel

Westlund, Albert, 624 25th Ave. W.

Whelan, E. H., 715 17th Ave. E.

Williams, Thor, 1305 E. 6th St.

BULLETIN OF  
**The University of Minnesota**  
DEPARTMENT OF AGRICULTURE

DAIRY SHORT COURSES  
AT  
UNIVERSITY FARM,  
ST. PAUL, MINN.

1921-22



SHORT COURSE SERIES

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Minneapolis, Minnesota

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# DAIRY SCHOOL STAFF

1921-22

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James Sorenson, Secretary Minnesota Creamery Operators' Association  
A. J. McGuire, B.Agr., Coöperative Creameries  
Dr. R. W. Archibald, State Health Department

## DAIRY SHORT COURSES AT UNIVERSITY FARM

The University of Minnesota will offer the following vocational short courses in dairying in 1921-1922:

Creamery Operators' Short Course, Jan. 2 to Feb. 11, 1922

Advanced Creamery Operators' Short Course, Nov. 14 to 26, 1921

Ice Cream Plant Operators' Short Course, Nov. 28 to Dec. 3, 1921

Cheese Plant Operators' Short Course, Feb. 13 to Mar. 11, 1922

Milk Plant Operators' Short Course, Dec. 5 to Dec. 10, 1921

Creamery Managers' Conference, Jan. 5, 1922.

**Purpose.**—The purpose of these courses is to aid the student in gaining a more thoro understanding of the problems connected with the manufacture of dairy products and to fit them for positions of responsibility in this work. The University of Minnesota Dairy Short Course has assisted in training more than 2,500 young men, many of whom have achieved national distinction in dairy lines. The development of creamery, cheese factory, ice cream, and city milk plants in this and other states makes an ever increasing demand for trained men who are able to fill positions of responsibility. A part of this training is best obtained through experience as helper and assistant in the various kinds of dairy manufacturing plants

and is essential as a background for the theoretical and practical work offered by the University. However, a part of the training every man should have who expects to fill a position of responsibility in the dairy industry can be obtained only by attending a school where the principles and fundamentals of the subject are taught. Here he learns something of the chemistry and bacteriology of milk, bookkeeping, creamery calculations, and the theory and operation of refrigerating machines. He also has the chance to learn the essentials of successful operation of factories from practical men who have been especially successful.

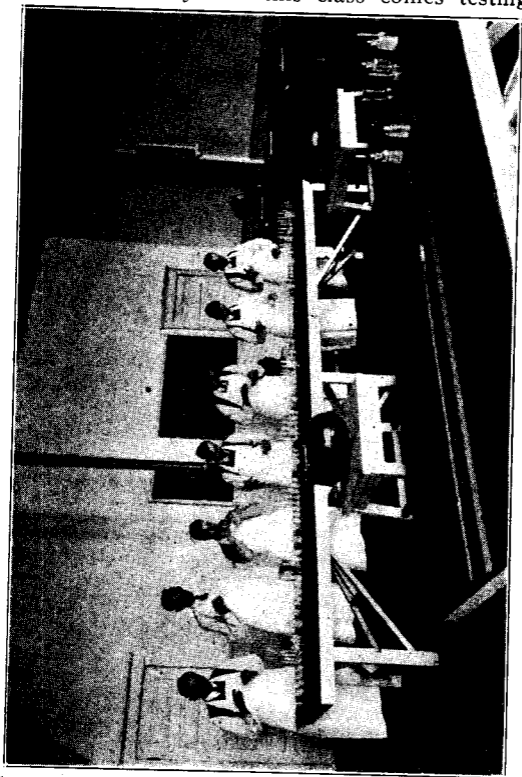
**Demand.**—The demand for men well trained in all these branches is greater than the supply. Several factories in the state have had difficulty during the last year in securing good men even at liberal salaries.

**Location.**—The Dairy Courses are taught at University Farm, between St. Paul and Minneapolis. To reach the School take a Como-Harriet car in either city, and get off at Carter Avenue. The School is about a ten-minute walk east from the car line. It is in the country, yet within half an hour's ride of either city.

### **Advanced Creamery Operators' Short Course**

This course will begin November 14, 1921, and continue for two weeks. It is open only to men who have had at least two years' experience in a creamery, or one year's experience and a term in the Dairy Short Course. Special attention will be given to those things

the successful creameryman must know but which are not readily learned by practical work in the creamery. In this class comes testing



Testing Milk

butter for moisture and salt, creamery book-keeping, calculation of the cost of manufacture, overrun, and similar problems.



The scientific principles of cream ripening, pasteurization and starters will be taught by special experts in bacteriology and dairy chemistry. The practical application of these facts, including every phase of practical creamery management, will be taught by some of the most expert practical buttermakers of the state.

It is assumed that the students in attendance are familiar with ordinary churning, therefore all churning done will be primarily to demonstrate the methods of controlling moisture and salt and to give practice in keeping accurate records of the butterfat received and its disposal.

This course is intended to meet the needs of the mature-minded, experienced creameryman and, in many cases, solve specific problems which have arisen or been suggested as a result of their own experience.

### **Expenses**

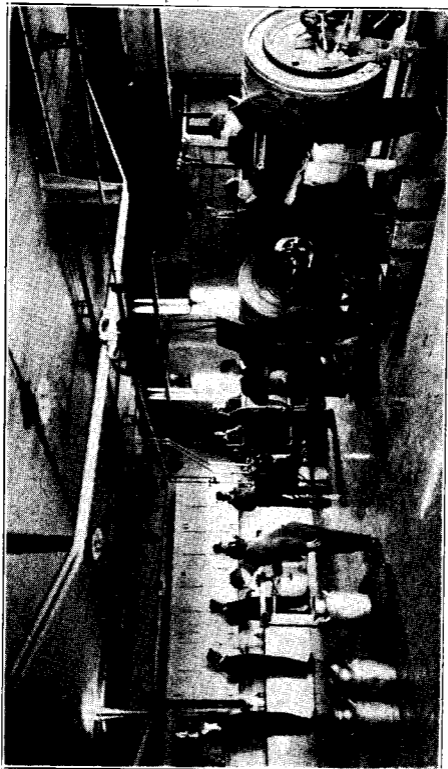
Necessary expenses in addition to railroad fare, board, and room will be about as follows:

Registration fee .....	\$10
White suits.....	6
Books .....	5
Laundry, etc. ....	5
Room and board will be at least	\$1.50 a day.

### **Creamery Operators' Short Course (for Beginners)**

While previous creamery experience is not required, it is desirable, and most of the students in this course in the past have had at least ex-

perience as helpers in a creamery. This course will begin January 2, 1922, and continue for six weeks. It will be devoted entirely to instruc-



Creamery Operations

tion in creamery work and will include: (1) Use of the Babcock Test in determining the per cent fat in milk, cream, skimmilk, and

buttermilk; (2) grading of cream by use of acid tests; (3) pasteurization and ripening of cream; (4) use of starters in producing desired flavors; (5) proper methods of making butter in order to control its composition with reference to moisture, fat, and salt; (6) proper treatment and preparation of butter containers to eliminate mold and prevent shrinkage; (7) importance and relation of accuracy in weights, tests, etc., to the success of creameries; (8) use of the Kohman method of butter analysis; (9) separate tests for moisture, salt, fat, and curd in butter, and the relation of these constituents to overrun and the success or failure of a creamery.

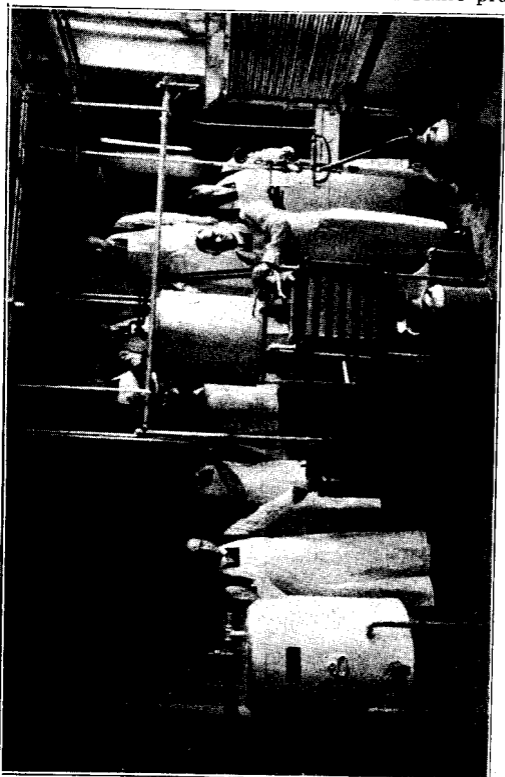
It is generally recognized that the success of a creamery depends to no small extent upon good bookkeeping and a good system of records which make it possible to properly analyze the business of the factory. Correct methods for carrying out this important part of the work can be best learned in the Dairy Course. Careful and full instruction will be given in bookkeeping adapted to the factory work and the calculation of results from the operation of the business.

**Expenses.**—A registration fee of \$10 is charged, health fee \$1. Books will cost about \$5; white suits \$6; laundry \$6; board and room at least \$1.50 a day.

### **Ice Cream Makers' Short Course**

This course will begin November 28, and continue one week. It is arranged to follow the Creamery Operators Course, as many

creamerymen are interested in ice cream and wish to get instruction on this subject also. It is primarily for those who have had some prac-



Emulsifying the Mix

tice and experience in making ice cream, but will also be so handled that those who have had no experience may enter. It will be taught

from the standpoint of the local creamery and small town plant rather than from that of the city enterprise. Many Minnesota creameries are already making ice cream. Any man who is already familiar with creamery or milk plant machinery can in one week acquire sufficient skill in ice cream making to enable him to handle a small ice cream side line.

This course is open to anyone who has had experience in handling milk and in making butter.

**Expenses.**—A registration fee of \$5 is charged for the week. White suits, books, laundry, etc., will cost about \$6. Board and room at least \$1.50 per day.

### **Milk Plant Operators' Short Course**

About fifty per cent of the milk produced in the United States is used as fluid milk or cream. This percentage is constantly increasing. The demand for milk in cities of 5,000 inhabitants or more is such as to make a milk plant an attractive business proposition. This demand is causing many young men to turn their attention to the organization and operation of such plants.

This course will begin December 5, 1921, and continue one week. It will give the student definite information concerning relation of bacteria to milk, proper methods and temperature for pasteurization, and suitable machinery for handling and distributing the milk supply. The problems of clarification, standardization, and pasteurization will be carefully discussed and

practice work done. A system of milk plant accounting will be studied. Public control of the milk problem will be considered. Handling of ammonia refrigerating plants will also be demonstrated and discussed.

In addition to the work at the Dairy School, several trips will be made to near by city milk plants.

**Expenses.**—A registration fee of \$5 is charged for the week. Expense for books, laundry, white suits, etc., will amount to about \$6. Board and room about \$1.50 per day.

### **Cheese Factory Operators' Short Course**

The course in cheesemaking will begin February 13, 1922, and continue for four weeks. It is open to any young man who has had at least six months' experience in cheesemaking.

The purpose of the course is to familiarize the student with the proper method of manufacturing and curing cheddar cheese. In the operation of cheese factories the man whose services are in demand is the one who can take responsibility and insure good results.

To make a good product under all conditions, or if the conditions are not right to make them so, requires both a knowledge of the cheese business and experience. The place to get experience is in a good factory. Here a man learns how to do things. To be a real expert he must also know why he does things. He must know the facts and principles behind the practical process. The Short Course in Cheesemaking gives this training in the fundamen-

tals and at the same time gives instruction in the best practical methods of making, curing, and marketing the product.



Students Learn "How to Fix It"

In order to give the students the best all-round experience and training, a part of the

course will be given at the University and part in a well-equipped cheese factory.

The students register and take the first part of the course at Dairy Hall of the University, and later will go with the instructor to a factory to be announced later. Here practical, experienced experts in cheesemaking teach the best methods of factory management. Much of this instruction is given at the cheese vat while the process of making is under way.

Specialists in bacteriology and dairy chemistry teach the composition of milk and dairy products, the principles and use of all kinds of tests used in the cheese factory, the sanitary handling of dairy products, and what takes place during the making and curing of cheese. The success of the factory also depends to a considerable extent upon having a good system of bookkeeping and accounting. This is taught by an expert in this subject.

**Expenses.**—In addition to railroad fare, board, and room, the necessary expenses will be a registration fee of \$10; and other expenses, including books, white suits, laundry, amounting to about \$10. Board and room will be about \$1.50 per day.

### **Creamery Managers' Conference**

The 640 coöperative creameries owned and operated by the producers are the cornerstone of profitable dairying in Minnesota. They bring to the producer all there is in the business and provide healthy competition. If the time ever comes when the coöperative creamery ceases



to exist in the Northwest, the producers of butterfat and of pure-bred dairy stock as well will suffer.

Of all problems confronting the small creameries of Minnesota, the matter of efficient management is the most pressing. Our veteran successful managers of coöperative creameries will be glad to pass on to the younger managers what they have learned.

To assist the farmer-managers to solve the many vexing problems, both old and new, a conference was established in 1915 and repeated yearly. All sorts of questions were threshed out. It will be repeated again this winter. Coming as it does during Farmers' Week when there are so many other helpful meetings, a good attendance is expected.

### Dairy School Certificates

The University of Minnesota Dairy School Certificate is awarded as evidence of special skill and efficiency in the manufacture of dairy products.

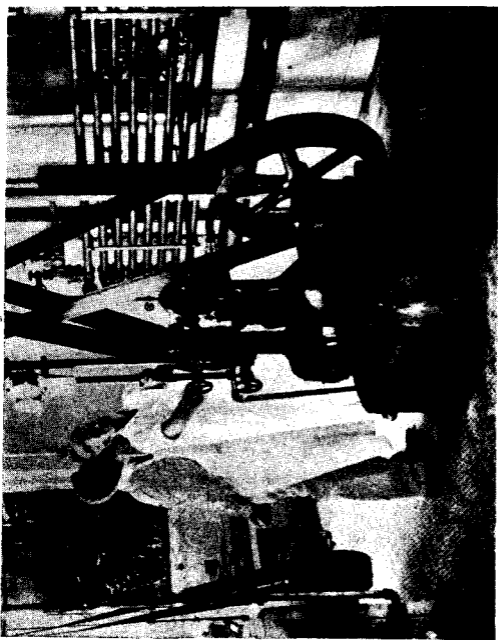
The conditions under which the certificate is granted are as follows:

1. The candidate must have spent not less than six weeks in the Winter Dairy Course and made a grade of not less than 60 in each subject taken.

2. He must also have worked in a creamery, cheese factory, or other dairy manufacturing plant for not less than two seasons, one of these seasons to follow the period spent in school, and during at least one of the two sea-

sons he must have had practical charge of the factory in which he was working.

3. The operations of the factory are to be reported monthly, or as often as directed, on blanks furnished by the Dairy Division.



Studying Refrigeration

4. The Dairy Division must receive a favorable report of the work of the candidate from the inspectors of the Dairy and Food Commission, or from some other person authorized by the University to make such inspection.

### **Application Forms**

Those expecting to attend the Dairy Short Courses should write at once to the Division of Dairy Husbandry, University Farm, St. Paul, Minn., for an application form.

# *The Bulletin of the University of Minnesota*

*General Extension Division  
Evening Courses in Engineering  
1921-1922*



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## CALENDAR

1921-1922

1921

September	19-24	Week	Registration week
September	26	Monday	Regular class work begins
November	24	Thursday	Thanksgiving Day; a holiday
December	24	Saturday	Christmas recess begins

1922

January	2	Monday	Class work resumed
January	23-27	Week	Examination week, first semester
January	27	Friday	First semester ends
January	30	Monday	Second semester begins
May	22-26	Week	Examination week, second semester
May	26	Friday	Second semester ends
May	29	Monday	Annual dinner and closing exercises

GENERAL EXTENSION DIVISION  
EVENING ENGINEERING COURSES  
FACULTY

- LOTUS DELTA COFFMAN, Ph.D., President  
WILLIAM WATTS FOLWELL, LL.D., President Emeritus  
CYRUS NORTHP, LL.D., President Emeritus  
\*RICHARD REES PRICE, M.A., Director of University Extension  
J. J. PETTIJOHN, B.A., Acting Director of University Extension  
LEON ARNAL, Architecte Diplômé Government France, Professor of  
Architecture  
FREDERICK H. BASS, B.S., Professor of Municipal and Sanitary Engineering  
WILLIAM E. BROOKE, B.C.E., M.A., Professor of Mathematics and Mechanics  
SAMUEL C. BURTON, M.A., Assistant Professor of Architecture  
ALVIN S. CUTLER, C.E., Associate Professor of Railway Engineering  
OLIVER C. EDWARDS, B.S., M.E., Assistant Professor of Mechanical Engi-  
neering, General Extension Division  
JAMES H. FORSYTHE, M.A. in Arch., Associate Professor of Architecture  
JOHN G. FRAYNE, B.A., Instructor in Mathematics and Mechanics  
ROBERT W. FRENCH, B.S. in C.E., Assistant Professor of Drawing and  
Descriptive Geometry  
CARL A. HERRICK, M.E., Assistant Professor of Mathematics and Mechanics  
WILLIAM F. HOLMAN, Ph.D., Associate Professor of Mathematics and  
Mechanics  
MAURICE B. LAGAARD, C.E., Instructor in Civil Engineering  
FRED C. LANG, C.E., Instructor in Civil Engineering  
GEORGE A. MANEY, C.E., M.S., Assistant Professor of Civil Engineering  
JOHN V. MARTENIS, M.E., Associate Professor of Mechanical Engineering  
EDWIN R. MARTIN, E.E., Assistant Professor of Electrical Engineering  
JOHN I. PARCEL, B.A., B.S. in C.E., Professor of Structural Engineering  
ORRIN W. POTTER, M.E., Instuctor in Drawing and Descriptive Geometry  
GEORGE C. PRIESTER, B.E., M.S., Assistant Professor of Mathematics and  
Mechanics  
FRANK B. ROWLEY, B.S., M.E., Professor of Mechanical Engineering  
WILLIAM T. RYAN, E.E., Associate Professor of Electrical Engineering  
GEORGE D. SHEPARDSON, M.A., M.E., D.S., Professor of Electrical Engi-  
neering  
CHARLES F. SHOOP, B.S., B.S. in M.E., Associate Professor of Mechanical  
Engineering  
OTTO S. ZELNER, B.S. in C.E., Assistant Professor of Surveying

\* Absent on leave, 1921-1922.

## EXTENSION SERVICE

The Extension Service of the University of Minnesota is organized to include:

- A. Evening classes, in Minneapolis, St. Paul, Duluth, and other cities.
  - 1. Courses leading to credit in the College of Science, Literature, and the Arts, in the College of Education, and in the School of Business.
  - 2. Courses in business administration, accountancy, and finance.
  - 3. Practical courses in engineering and in industrial subjects.
- B. Correspondence courses.
- C. Extension lectures, singly or in groups, and lyceum lectures, concerts, and entertainments.
- D. The Municipal Reference Bureau, which compiles and furnishes to city officials information pertaining to municipal government and administration.
- E. The Bureau of Visual Instruction, through which loan collections of lantern slides and films are furnished to schools and clubs.
- F. Drama Service, through which dramatic clubs and school societies are given advice about the production of amateur theatricals, and copies of plays are lent for reading and selection.
- G. Community Service, through which the elements making up a community and its trading fringe are given advice and assistance for bringing together all the social forces into an organization whose purpose shall be to make the people healthy and wealthy and wise.
- H. Agricultural Extension, including lectures, demonstrations, institutes, and short courses under the direction of the College of Agriculture, Forestry, and Home Economics.

# EVENING EXTENSION COURSES

## GENERAL INFORMATION ADMISSION TO COURSES

It is not intended that any regulation should debar from the privileges of these courses any person who can pursue them profitably. Those persons desiring credit toward a university degree must of course comply with the regulations laid down by the college in which credit is desired. Those not desiring such credit may be admitted, provided they are sufficiently mature (more than eighteen years of age) and can satisfy the departments in which they wish to study that they are able to carry the work profitably to themselves and without hindrance to the classes.

### CREDIT FOR EXTENSION COURSES

Credit toward a degree will be given students who satisfy the entrance requirements of the college in which credit is desired and who successfully complete any of the extension courses of university grade. This applies to all the courses listed under academic or collegiate courses, unless otherwise specified. It also applies to nearly all the business courses. No courses listed under engineering carry credits. Credit in any extension course will be awarded only to those students who pass the final examinations of that course. Such credits will be recorded upon matriculation in the University. Courses requiring one evening (two hours) a week for recitation normally carry 2 semester credits. Those requiring more time usually carry correspondingly more credits. In the Extension Division credits are still reckoned on the semester, not the quarter, basis. The school year is divided into two semesters of sixteen weeks each, with an extra week devoted to examinations. Normally each class meets one night a week for two hours.

The statement concerning credit for the Certificates in Accountancy, in Finance, and General Business will be found on pages 27, 28, and 29 in the Announcement of Evening Classes.

Students *must indicate at the time of registration whether or not they desire university credit in the courses pursued.*

### *Regulations Concerning Credit in the College of Science, Literature, and the Arts*

1. All courses for which credit is given in the College of Science, Literature, and the Arts must be authorized with the credits by the Advisory Committee. But credit shall be given only to those extension courses which are conducted in essentially the same manner as the corresponding courses in the University and which are carried on under similar conditions as to attendance, term's work, quizzes, and examinations.

2. Each credit course shall be directly in charge of a member of the faculty.



3. Any regularly enrolled University student successfully completing an approved course shall receive an appropriate credit.

4. Any person shall receive a certificate upon satisfactorily completing an approved course. The certificates entitle the holder to the corresponding University credits whenever he has earned 30 credits in residence. The University examiner shall in all cases pass upon the qualifications of the student.

5. The maximum credit towards a degree for work done in extension courses shall not exceed one half the unit hours required for graduation.

6. Credit for an amount not exceeding one quarter of the unit hours required for graduation may be given at the University of Minnesota to students of such other extension schools or departments as may be approved by the advisory committee, provided that such credit shall be subject to the same provisions as govern credits in the General Extension Division of the University of Minnesota.

#### RESIDENT STUDENTS

1. No University student may enroll for extension courses for the purpose of removing a condition or failure.

2. No University student may enroll for an extension course if this would increase his credit hours beyond what the rules allow.

3. Any University student who wishes to enroll for an extension course must first obtain the approval of the dean of his college.

#### FEEES

Collegiate courses meeting one evening a week require a fee of from \$5 to \$7.50 a semester of sixteen weeks. For collegiate courses meeting two evenings a week, the fee is from \$10 to \$15 a semester.

The fee for the business and engineering courses for a single subject is \$7.50 a semester, with the exception of a few advanced or technical courses for which the fee is \$10 a semester. Each class is a separate unit. The grouping of subjects into courses does not affect the unit fee for each subject.

The fee does not include the cost of texts or materials. The cost of these items varies from \$1 to \$3 a course.

All fees are payable at the time of registration, and registration should not be deferred longer than the second meeting of class. Checks should be made payable to the University of Minnesota.

Special arrangements are made with organizations, clubs, and business concerns, whereby instruction may be given to groups of students within the organization at a sum which will somewhat reduce the individual rate per member. However, such classes can not be restricted to that group alone but must be open to the general public.

#### REFUNDS

No fee will be refunded on account of withdrawal from any course. Exceptions to this rule will be made only in case of (a) removal from the city or (b) illness or physical disability as attested by the certificate of a reputable physician. Application for pro rata refund under the above conditions *will not be considered later than fifteen days after registration.*

## LENGTH OF COURSE

A semester consists of sixteen weeks of instruction with an additional week for the final examination.

## PLACES FOR CONDUCTING CLASSES

Most of the classes in engineering will be held in the Main Engineering Building, Electrical Engineering Building, the Mechanical Engineering, or the Experimental Engineering Building.

Other classes in Minneapolis are conducted at the University, at the Public Library, at the City Hall, and in some of the public schoolhouses. Definite locations for each class will be announced in a circular to be published about September 15.

In St. Paul the work will be carried on at the City Hall and the Public Library. Additional accommodations will be provided for in some cases.

In Duluth the work will be carried on in the St. Louis County Court-house.

## NUMBER FOR WHOM CLASSES WILL BE ORGANIZED

Classes will not be organized for a smaller enrolment than fifteen and in some courses a larger registration will be required.

## TIME OF MEETING

Classes ordinarily meet at 7:30 and dismiss at 9:30. Classes in business subjects frequently meet at 6:30.

## ENROLMENT

Registration for the first semester takes place during the week preceding the organization of classes (September 19-24). Students are advised to register with the instructor at the first meeting of the class.

## RULE REGARDING ABSENCES

The attention of students and faculty is called to the following rule regarding absences:

"No student whose absences exceed three (3) of the regular scheduled sessions of the course for a semester shall be admitted to the final examination of the course without special permission of the director of University Extension."

## PROGRAM OF CLASSES

Folders will be issued about September 15, giving the program of classes and schedules of meeting places. It should be understood that *not all the courses listed in this bulletin are given in any one year*. Final announcement may be found in the special folder. Folders will be issued for the collegiate courses, the business courses, and the engineering courses. Separate bulletins are also issued for each of these groups of courses.

## LOCATION OF EXTENSION OFFICES

The offices of the General Extension Division may be found on the ground floor of the Main Engineering Building, on Washington Avenue and Church Street Southeast. To telephone the office call N. W. Dinsmore 2760 and ask the University central for the General Extension Division

## DEPARTMENT OF ENGINEERING INSTRUCTION

The demand for men specially trained in engineering has been steadily increasing each year. Every branch of the profession has been calling for the services of trained men. By trained men is meant those who can plan work and use good engineering judgment in any given project.

Ex-President Woodrow Wilson emphasizes this when he says:

My attention has lately been called in particular to the falling off in the number of engineering students, and this has given me a good deal of concern, because it is not only immediately necessary that as many students as possible should prepare themselves for engineering duties in the army and navy, but it is also of the first consequence to the country that there should be an adequate supply of engineers for the period of reconstruction which must follow the war. Not only has technical training become of enormous importance in military operations, but the rôle of the engineer has become more and more important in every process of our industrial life.

To meet this demand the General Extension Division now offers groups of courses in architecture, civil engineering, electrical engineering, and mechanical engineering. These course groups are arranged to be completed in either three- or four-year periods and are planned primarily for workers in industrial establishments.

The subject of engineering is one that requires very thoro study, and no step should be neglected. These courses have been laid out with great care, and are especially adapted to the needs of men working in shops and other industrial and manufacturing establishments, to the end that such men may have added to their practical training a technical and theoretical knowledge which will enable them to advance more rapidly in their chosen line of work.

It has been found that many persons register who can not take the work with any great profit to themselves because of inadequate preparation. For this reason it is desirable that students should consult with the director of the General Extension Division before taking up any course, so that they may have proper guidance and direction.

Students who have had sufficient preparation need not start at the beginning, but may take up the work at the point where they can pursue it with advantage.

These courses also offer an opportunity to college graduates, who may wish to specialize in some subject not covered in their regular college work.

When a student completes any one of the consecutive courses, and has a total of 30 credits a certificate in engineering from the University of Minnesota will be granted.

### FEEES

The fee for each engineering course is \$7.50 a semester, with the exception of a few advanced or technical courses for which the fee is \$10 a semester. Each class is a separate unit. The grouping of subjects into courses does not affect the unit fee of each subject.

## TEXT MATERIAL

When text material is furnished in printed or mimeographed form the student is required to reimburse the University for its cost. This cost varies from \$1 to \$3.

## RULE REGARDING ABSENCES

The attention of students and faculty is called to the following rule regarding absences:

"No student whose absences exceed three (3) of the regular scheduled sessions of the course for a semester shall be admitted to the final examination of the course without special permission of the director of University Extension."

## CREDIT

Credit in any extension course will be awarded only to those students who pass the final examination of the course.

## LENGTH OF COURSE

A semester consists of sixteen weeks of instruction with an additional week for the final examination.

## THREE-YEAR COURSE

The following courses are arranged to be completed in three years of three evenings a week. Students, however, may adapt the number of evenings a week to their own specific circumstances, bearing in mind that the total number of semester credits required for a certificate is 30.

## ARCHITECTURE

### FIRST YEAR

#### *First Semester*

Elementary Architectural Design  
Shop Mathematics I

#### *Second Semester*

Elementary Architectural Design  
Shop Mathematics II

### SECOND YEAR

#### *First Semester*

Intermediate Architectural Design  
Shop Mathematics III

#### *Second Semester*

Intermediate Architectural Design  
Mechanics, Strength of Materials

### THIRD YEAR

#### *First Semester*

Advanced Architectural Design  
Structural Design

#### *Second Semester*

Advanced Architectural Design  
Reinforced Concrete

This makes a total of 24 credits. The student is permitted to elect other acceptable subjects to bring the total to 30.

## CIVIL ENGINEERING

(For Office Men)

### FIRST YEAR

<i>First Semester</i>	<i>Second Semester</i>
Shop Mathematics I Mechanical Drawing	Shop Mathematics II Structural Drafting

### SECOND YEAR

<i>First Semester</i>	<i>Second Semester</i>
Shop Mathematics III Applied Mechanics	Strength of Materials Structural Design

### THIRD YEAR

<i>First Semester</i>	<i>Second Semester</i>
Reinforced Concrete Theory of Engineering or Roof-Trussed Bridges Design	Reinforced Concrete Design Theory of Engineering or Bridge and Building Design

## CIVIL ENGINEERING

(For Field Men)

### FIRST YEAR

<i>First Semester</i>	<i>Second Semester</i>
Shop Mathematics I Lettering and Sketching	Shop Mathematics II Mapping

### SECOND YEAR

<i>First Semester</i>	<i>Second Semester</i>
Shop Mathematics III Plane-Surveying	Stadia and Topographical Surveys or Plotting and Calculation Curves and Earthwork

### THIRD YEAR

<i>First Semester</i>	<i>Second Semester</i>
Highways or Municipal Engineering Theory of Engineering	Railways or Municipal Engineering Theory of Engineering

This makes a total of 24 credits in each of the civil engineering courses. The student is permitted to elect other acceptable subjects to bring the total to 30.

Students in civil engineering are advised to take up the study of calculus. This course is not required; but it will prove of great advantage to anyone who desires to do more advanced work later.

## ELECTRICAL ENGINEERING

### FIRST YEAR

<i>First Semester</i>	<i>Second Semester</i>
Shop Mathematics I Elementary Electricity I Experimental Electricity	Shop Mathematics II Elementary Electricity II Experimental Electricity

<i>First Semester</i>	SECOND YEAR	<i>Second Semester</i>
Alternating Currents I	Alternating Currents II	
Shop Mathematics III	Shop Mathematics IV	
Mechanical Drawing	Mechanical Drawing	
or	or	
Applied Mechanics	Strength of Materials	
or	or	
Experimental Electricity	Experimental Electricity	

<i>First Semester</i>	THIRD YEAR	<i>Second Semester</i>
Direct-Current and Alternating-Current Machinery	Central Power Stations	
or	or	
Telephony	Telephony	
Shop Mathematics V	Shop Mechanics VI	
Electrical Machine Design	Electrical Machine Design	

## MECHANICAL ENGINEERING

<i>First Semester</i>	FIRST YEAR	<i>Second Semester</i>
Shop Mathematics I	Shop Mathematics II	
Mechanical Drawing	Mechanical Drawing	

<i>First Semester</i>	SECOND YEAR	<i>Second Semester</i>
Shop Mathematics III	Shop Mathematics IV	
Applied Mechanics	Strength of Materials	
Mechanical Drawing—Advanced	Mechanical Drawing—Advanced	
or	or	
Electricity—Elementary	Plumbing	
or	or	
Heat Engines	Heating and Ventilating	

<i>First Semester</i>	THIRD YEAR	<i>Second Semester</i>
Shop Mathematics V	Shop Mathematics VI	
Machine Design	Machine Design	
or	or	
Theory of Engineering	Theory of Engineering	
Testing Materials	Steam-Engine Testing	
	or	
	Gas-Engine Testing	

There are certain options allowed the student depending largely upon the work he intends to follow. This information must be furnished the General Extension Division at the time the student registers and his options will then be given him.

## DESCRIPTION OF COURSES

- I. ARCHITECTURAL HISTORY. Twelve lectures illustrated with lantern slides, covering the ancient and Renaissance periods. One evening a week; second semester. MR. FORSYTHE.

2. **ELEMENTARY ARCHITECTURAL DESIGN.** Shades and shadows and wash rendering. Architectural elements such as doors, windows, moldings, and the architectural orders; general drawing, exercises, and lectures in the application of these elements to simple problems in design and a survey course of lectures in architectural history illustrated by lantern slides. Open to high-school students who have had mechanical drawing, to those who have one year or more in an architect's office, and to those who, in the opinion of the instructors, have had equivalent experience. Two evenings a week; both semesters. Monday and Thursday evenings, 7:30-9:30. MR. FORSYTHE.
  3. **INTERMEDIATE ARCHITECTURAL DESIGN.** Regular Class B "Analytique" or order problems of the Society of Beaux Arts Architects, or equivalent designs in architectural problems from the regular course of the University of Minnesota. Open only to those who have completed Course 2, or who have had two years or more in an architect's office, or have had equivalent preparation in an architectural school. Two evenings a week; both semesters. Monday and Thursday evenings, 7:30-10:00. Fee, \$5 a problem, or \$10 a semester. MR. FORSYTHE.
  4. **ADVANCED ARCHITECTURAL DESIGN.** Class B, plan problems, and Class A, problems of the Society of Beaux Arts Architects, or equivalent design problems from the regular course in architecture at the University of Minnesota. Open only to those who have completed the required "Analytique" or order problems, or to those who have had one or more years of design in any architectural school. Two evenings a week; both semesters. Monday and Thursday evenings, 7:30-10:00. Fee, \$5 a problem, or \$10 a semester. MR. ARNAL.
- NOTE: Regular instruction will be given on Monday and Thursday evenings, but students in these classes may work in the drafting rooms of the architectural department on other evenings, except Sunday.
5. **FREEHAND DRAWING.** Drawing and painting from life and from casts, with lectures on the construction of the human figure and its application to decoration. Students completing both semesters will be taught how to make etchings. One evening a week; both semesters. MR. BURTON.
  6. **MAP-DRAWING.** (a) Farm and city plats. (b) Real-estate display maps. (c) Landscape architect's maps. (d) Topographic and hydrographic symbols. One evening a week; second semester. MR. ZELNER.
  7. **LETTERING AND TITLES FOR ENGINEERS.** Principally freehand Reinhardt lettering. Title lay-outs and lettering. One evening a week; first semester. MR. ZELNER.
  8. **PLANE-SURVEYING.** Elements of plane-surveying relating to methods of chain, compass, transit, and stadia surveys; leveling; methods of keeping field notes; determination of area of irregular plots: computation

- and plotting of field notes; care, use, and adjustment of instruments; methods of subdivision of the United States; public lands. One evening a week; first semester. MR. CUTLER.
9. CURVES AND EARTHWORK. Mathematics of simple, compound, and spiral curves; preliminary and location surveys; plotting of profiles; vertical curves; cross-sectioning and computation of earthwork volumes; methods of computation of overhaul; mass diagram, right-of-way and station ground maps. One evening a week; second semester. MR. CUTLER.
  10. CONCRETE MATERIALS: SELECTION AND TESTS. This course will cover the selection of materials entering into concrete, their properties and the tests to be applied. A study will be made of the proper combinations to obtain the best mixtures for given constituent materials at the lowest cost. Local materials will be used and those pursuing the course will make their own specimens and perform all the tests. One evening a week; first semester. MR. LAGAARD.
  11. REINFORCED CONCRETE. Covers the elements of the theory and practical design of reinforced concrete structures, including floors, roofs, walls, columns, foundations, and retaining walls. One evening a week; both semesters. MR. MANEY.
  12. STRUCTURAL DESIGN. This course will include a treatment of structural mechanics and stress computation, and the elements of the principles and practice governing the design of tension and compression members, beams, girders, and columns. Prerequisite: an elementary working knowledge of mathematics through trigonometry, and some knowledge of elementary physics. One evening a week; both semesters. MR. MANEY.
  13. ELEMENTARY ELECTRICITY. This course will start with the simple laws of magnetism and advance through the theory of direct-current machinery. Special attention will be given to direct-current motors and generators, armature windings, commutators, and wiring diagrams. The course will be of value to those who wish to take up the study of alternating-current machinery and power plants. Lesson sheets will be provided and demonstration experiments made. One evening a week; both semesters. MR. MARTIN.
  14. ALTERNATING CURRENTS. This course is planned to meet the need for an elementary course on alternating-current circuits and machines. General principles will be closely associated with the machines, the methods, and the facts of present-day practice. Theoretical demonstrations and discussions will be supplemented by a certain amount of laboratory work. The course will cover series and parallel circuits, single and polyphase systems, power and power factor. Transformers, induction motors, alternators, synchronous motors, rotaries, single-phase motors and transmission lines. One evening a week; both semesters. MR. RYAN.



15. EXPERIMENTAL ELECTRICITY. This course is provided for those students who have completed the course in elementary electricity. The course consists of experiments that each student should perform for himself, and the laws of electricity and magnetism will be fully developed. One evening a week; both semesters. MR. MARTIN.
16. CENTRAL STATIONS. Electric-power generating and distributing systems; demand, diversity, and load factors; load diagrams; voltage regulation; protective apparatus; selection of prime movers and units; methods of charging and metering; maintenance of plants; emergencies. One evening a week; first or second semester. MR. RYAN.
17. ELEMENTS OF TELEPHONY. Nature of voice sounds, construction and operation of receivers and transmitters, reading blueprints and circuits, magneto and central-energy circuits, the electro-magnet as used in telephony, batteries, and other generating apparatus, signalling apparatus. Some previous knowledge of alternating currents is desirable, but not absolutely necessary. The treatment will be elementary, using only simple mathematics. Experimental illustrations will be given so far as practical. One evening a week; second semester. MR. SHEPARDSON.
18. SHOP MATHEMATICS I. This course is designed to meet the needs of shop men, and affords an opportunity to take up engineering work of a higher grade. Practical shop problems will be thoroly discussed. This course together with one in drafting is essential for all other engineering branches. It will cover the subject of fractions, decimals, percentage, weights of materials, areas and volumes, thread-cutting, gearing, belts and pulleys, the milling machine, and a general drill in equations and the use of formulae. One evening a week; first semester. MR. EDWARDS.
19. SHOP MATHEMATICS II. This is a continuation of Course I, and will take up the subjects of algebra and geometry. One evening a week; second semester. MR. EDWARDS.
20. SHOP MATHEMATICS III. TRIGONOMETRY. This course is designed for those who have had the subjects of algebra and geometry and wish to pursue civil-engineering studies. The solution of right and oblique triangles will be thoroly discussed and practical plane-surveying problems will be given special attention. One evening a week; first semester. MR. EDWARDS.
21. SHOP MATHEMATICS IV. ANALYTIC GEOMETRY. This course is of great importance to the engineering student who wishes to take up the study of calculus. It consists of the study of the straight line, circle, ellipse, parabola, hyperbola, and a few of the higher plane curves met with in practice. One evening a week; second semester. MR. EDWARDS.

22. SHOP MATHEMATICS V. CALCULUS. This course is open to those who have completed mathematics through analytic geometry. Stress will be laid upon the various derivatives and their application to tangents, normals, evolutes, involutes, and maximum and minimum. Engineering examples will be given whenever possible. One evening a week; first semester. MR. EDWARDS.
23. SHOP MATHEMATICS VI. This is a continuation of Course V and will take up the subject of integration. Important mechanical and electrical problems will be introduced and discussed in class. One evening a week; second semester. MR. EDWARDS.
24. ELEMENTARY APPLIED MECHANICS. A short, practical course in elementary mechanics designed to meet the needs of students who have had a limited training in mathematics. Numerical calculations, simple graphical calculations, forces, simple machines, work, power, and energy. One evening a week; first semester. MR. BROOKE.
25. STRENGTH OF MATERIALS. An elementary course on the strength of materials, designed to follow the course in applied mechanics. The subjects to be treated are: the properties of materials, stress and strain, elastic and ultimate strength, deformations, principle of moments, moments of inertia, simple stresses, sheer, riveted joints, the general elementary theory of beams, columns, and shafts. One evening a week; second semester. MR. BROOKE.
26. TESTING OF MATERIALS. Investigation of the physical properties of various metals and other engineering materials, including the more common grades of commercial steels, wood, cement, concrete, ropes, cables, belting, chains, etc. Supplemented by lessons on the various materials of construction and standard methods of testing. One evening a week; first semester. MR. HOLMAN.
27. STEAM-ENGINE AND POWER-PLANT TESTING. This course is intended for stationary engineers who wish to become more efficient in their line of work. The course will consist of lessons supplemented by experimental demonstrations illustrative of certain portions of the work. Actual problems arising in power-plant testing will be worked out in class with complete explanations and instructions for their solution. The laws of mechanics, heat, power, work, and energy will be applied to engine and power-plant testing. One evening a week; first semester. MR. SHOOP.
28. GAS ENGINES. This is a practical course in the theory of construction and operation of the gas engine. It will include various types of engines, cycles, ignition, carburetion, cooling, oiling, methods of determining horse-power, etc. One evening a week; first semester. MR. ROWLEY.

29. GAS-ENGINE TESTING. A practical laboratory course in gas-engine testing in which the student will perform tests on the various types of gas engines, as stationary, oil- and kerosene-burning engines, automobile, aeroplane, and tractor motors. The student must supply himself with a notebook in which records will be kept of the various tests. One evening a week; second semester. MR. ROWLEY.
30. HEAT ENGINES. This is an elementary course required for all engineering students. It relates especially to the steam engine and boiler, the steam turbine, and the gas engine. Attention is given to the different types of engines, boilers, and gas engines. The general problem of a modern power plant is considered for the benefit of those who do not devote further time to the subject. One evening a week; both semesters. MR. SHOOP.
31. BOILER-ROOM PRACTICE. This course has been written for the benefit of the persons who have charge of boiler plants. It is important for janitors in charge of schoolhouses and apartment houses as well as factory boiler shops. It will be beneficial to those who are expecting to obtain a license as a boiler inspector. One evening a week; first semester. MR. MARTENIS.
32. ADVANCED BOILER-ROOM PRACTICE. This is a continuation of the preceding course and will take up the subject of the steam engine and its accessories. This course is of interest to those seeking a chief engineer's license. One evening a week; second semester. MR. MARTENIS.
33. PLUMBING. This course is designed to meet the needs of the practical shop man and will cover the principles of plumbing and the best practice in use at the present time. It is hoped that a standard text will be available. One evening a week; second semester. MR. MARTENIS.
34. HEATING AND VENTILATING. The course will cover present heating and ventilating practice and is designed for heating contractors and others desirous of obtaining a fundamental knowledge of the subject. The plan of instruction includes a study of heat; methods employed for heating and ventilating buildings of various kinds; piping systems and temperature regulation. One evening a week; first semester. MR. MARTENIS.
35. STEAM FITTING. This course will cover steam-using machines and equipment. Particular emphasis is placed on heating appliances and refrigerating machines. One evening a week; first semester. MR. MARTENIS.
36. ELEMENTARY MECHANICAL DRAWING. This is a beginning course and includes instruction and practice in the use of drawing materials and instruments, lettering, tracing, view-drawing, dimensioning, blueprint reading, and the making of working drawings of machine parts. One evening a week; both semesters. MR. FRENCH.

37. **TEACHERS' COURSE IN MECHANICAL DRAWING.** This is a special course offered to those who teach drawing in the grade and high schools and who wish better to acquaint themselves with standard drafting-room practice. One evening a week; both semesters. MR. FRENCH.
38. **MECHANICAL DRAWING FOR WOMEN.** This course is similar to Course 36 above with the exception that more emphasis is laid on lettering and tracing at the option of the student. One evening a week; both semesters. MR. FRENCH.
39. **BLUEPRINT READING AND SKETCHING.** This course is intended for those who wish to get a working knowledge of drawings and blueprint reading without spending the time necessary to learn to make drawings. No instruments will be required. Various types of machine and other drawings will be thoroly discussed in class. Blueprints under discussion will be in the hands of each member of the class. Determination of quantities from drawings for cost estimates will be illustrated and discussed. The essential theory of drawing for machine-building and other construction purposes will be made clear. Practical sketching for shop and illustrative purposes will be explained. Practice home sketching work will be assigned to any who wish it; but such extra work is not required and will not be necessary to the understanding of subsequent lectures and class work. One evening a week; first semester. MR. FRENCH.
40. **COST-ESTIMATING.** Current costs of engineering construction work such as buildings, bridges, culverts, excavation, roads, and pavements. Labor and material costs. Analysis of construction for purposes of cost-estimating. Unit costs on different types of work. Actual estimates of recent and current construction. A working knowledge of blueprint reading is required for this course. Lectures and assigned problems. One evening a week; both semesters. MR. FRENCH.
41. **ADVANCED MECHANICAL DRAWING.** A practical course in drafting and drafting-room methods taking up the detail of machine parts as fastenings, screws, bolts, rivets, and rivet joints; keys, cotters, and pins; pipe and pipe fastenings; bearings and journals, pulleys and belting; spur gears, bevel gears, and spiral gears; cams, link motions, etc.; the application of empirical design and the principles of mechanics; assembly, diagrammatic and layout drawings. It is assumed that the student has a previous knowledge of drawing equivalent to Course 36. One evening a week; both semesters. MR. HERRICK.
42. **MACHINE DESIGN.** An elementary course in the calculation and design of machines and machine parts; such as machine frames, shafting, fly wheels, pulleys, riveted and screwed fastenings, bearings, spur gearing, bevel gearing, and helical gearing. Lectures and drawing-room practice of practical problems will be given.

Prerequisite: previous knowledge of drawing equivalent to Course 41 and mathematics through Course 20. A working knowledge of elementary physics, Course 43, and strength of materials, Course 25, is desirable. One evening a week, both semesters. MR. HERRICK.

43. PRACTICAL PHYSICS. This course will consist of lectures and laboratory work in general physics designed to meet the needs of technical students. Stress will be laid primarily on the sections of mechanics, heat, and electricity. Such a course will be of great advantage to the student who wishes to proceed with the subjects of technical mechanics, strength of materials, and general electric problems. Geometrical optics, sound, and the general principles of radio-activity and X-rays will also be taken up. One evening a week; both semesters. MR. FRAYNE.
44. ENGLISH FOR ENGINEERS. A course in practical English, designed to meet the professional needs of engineering students. The material of this course will include business letters—about twelve types; reports; estimates; instructions, etc. Some attention will be given to oral English. The underlying purpose of this course is to acquaint the student with the various kinds of business letters, reports, etc., and to teach him how to prepare and use them effectively. A secondary purpose is to show the prospective engineer that training in expression—written or oral—is training in clear, straight thinking and hence is a real stimulus to general efficiency. Students will be expected to do a certain amount of writing and take part in the weekly discussions of problems bearing upon the work of the course. Ability to write simple, grammatically correct English is a prerequisite to this course. One evening a week; both semesters.
45. THEORY OF ENGINEERING. A general course given to those students who have had two years' training in engineering work. This course includes the practical application of the fundamentals to engineering problems. Only students who have taken Courses 12, 13, 18, 19, 20, 21, 24, 25, 36, 27, 35, are eligible. Kent's *Mechanical Engineers' Pocket Book*, *Machinery Hand Book*, or Mark's *Mechanical Engineers' Hand Book* will be used as a text. The design of a simple machine will be taken up and discussed. One evening a week; both semesters. MR. EDWARDS.
46. HIGHWAYS AND PAVEMENTS. Elementary course relating to the economics, location, construction, and maintenance of highways and pavements, also a study of road-building materials, and methods of testing. One evening a week; both semesters. MR. LANG.
47. MUNICIPAL ENGINEERING. Development of municipal public works. City-planning, transportation, and housing. The principles of public health and sanitation. Public water supplies, sewerage and sewage disposal, refuse collection and disposal, and the sanitation of buildings. One evening a week; both semesters. MR. BASS.

48. WATER POWER AND ELEMENTS OF HYDROLOGY. Types of low, medium, and high-head developments. Details of developments; spillway dams; hollow reinforced concrete dams, arch dams, high masonry dams, movable dams. Turbine settings and characteristics. One evening a week; both semesters. MR. BASS.
49. ADVANCED REINFORCED-CONCRETE DESIGN. A course in the theory and design of structures planned to meet the needs of graduate students who wish to go into the subject more thoroly. Reinforced-concrete arches, framed structures, continuous beams, culverts, and circular pipes, which involve statically indeterminate methods for solutions to obtain correct moments and shears will constitute the problems to be considered. Enough of the theoretical work will be done to make possible accurate calculations of moment and shear forces. The design of resisting sections will be studied from a critical point of view, and applications made of the most recent developments in reinforced-concrete design methods and materials. One evening a week; both semesters. MR. PARCEL.
50. FOUNDRY PRACTICE. This is a semi-technical course dealing with every-day foundry problems from a technical standpoint. It is designed to link up the practical with the technical in the simplest manner possible. It will appeal especially to foremen, clerks, mechanics, and any person interested in foundry practice, who has had the equivalent of a common grade-school education. The course will cover the following subjects: drawing, materials, metallurgy, sands, refractories, fluxes, foundry economies, foundry machinery, and office practice. One evening a week; both semesters. MR. POTTER.

#### TRADE AND INDUSTRIAL TRAINING

1. METHODS OF ESTABLISHING TRAINING DEPARTMENTS IN FACTORIES AND STORES.
2. SHEET-METAL DRAFTING FOR TINSMITHS AND SHEET-METAL WORKERS.
3. SCIENTIFIC METHODS OF HANDLING AND TESTING LABOR.
4. CAUSES AND CURES OF INDUSTRIAL UNREST.
5. BUSINESS AND FACTORY MANAGEMENT.
6. FOREMAN'S COURSE IN HANDLING LABOR.
7. EMPLOYMENT MANAGEMENT.

For description of these courses see collegiate courses bulletin.

CERTIFICATE HOLDERS

CERTIFICATE HOLDERS OF 1921

On May 31, 1921, the following persons were granted University engineering certificates:

*Certificates in Engineering*

Livermore, Harvey J., St. Paul  
Ryan, James L., St. Paul

Stachle, Gilbert C., Minneapolis  
Trierweiler, Dominic G., St. Paul

## REGISTRATION 1920-1921

### SIGNIFICANCE OF SYMBOLS

- \*Also in St. Paul Business
- \*\*Also in St. Paul Collegiate
- \*\*\*Also in Engineering
- †Also in Minneapolis Business
- ††Also in Minneapolis Collegiate
- †††Also in Minneapolis Collegiate and Minneapolis Business
- °Also in Minneapolis Business and St. Paul Business
- \*††Also in Minneapolis Collegiate and St. Paul Business
- ‡Also in St. Paul Business and St. Paul Collegiate

#### ENGINEERING

- |   |   |
|---|---|
| <p>Ackerman, Clarence, 1224 Logan Ave. N.</p> <p>Adams, Marguerite E., 204 W. Grant St.</p> <p>Ahlquist, Carl, 4608 32nd Ave. S.</p> <p>Albrecht, Carl F., 898 E. 5th St., St. Paul</p> <p>Alderson, W. H., 1810 Ashland Ave., St. Paul</p> <p>Almquist, Herbert, 3833 Bryant Ave. S.</p> <p>Altman, Otto A., 879 Charles St., St. Paul</p> <p>Anderson, Albert E., 131 E. 14th St., Apt. 9</p> <p>Anderson, Evold W. C., 1210 E. 25th St.</p> <p>Anderson, G. A., 1152 Laurel Ave., St. Paul</p> <p>Anderson, Herman W., 816 Hardenburg Place, St. Paul</p> <p>Aordal, Carl J., 1629 7th St. S.E.</p> <p>Balding, F. J., 1389 Albany St., St. Paul</p> <p>Balkins, Ellis H., 1850 Jackson St. N.E.</p> <p>Bartishofski, Frank, 850 University Ave., St. Paul</p> <p>Bastis, Emil, 248 22nd Ave. S.</p> <p>Batdorf, Robert A., 4201 Bryant Ave. N.</p> <p>Batzli, O., 4231 Humboldt Ave. N.</p> <p>Beach, G. P., 1403 Albany St., St. Paul</p> <p>Benson, Clifford E., 4219 Bryant Ave. N.</p> <p>Benson, R. E., 2864 Irving Ave. S.</p> <p>Bernard, Walter L., 914 Arkwright St., St. Paul</p> <p>Bilodeau, Arthur, 1602 University Ave. N.E.</p> <p>Blanchard, Cecil D., 87 Prior Ave. N., St. Paul</p> | <p>Bloom, Ralph L., 1537 E. 28th St.</p> <p>Boker, John P., 88 Arthur Ave. S.E.</p> <p>††Boker, Vitus A., 88 Arthur Ave. S.E.</p> <p>Boling, Arne, 64 W. Summit Ave., St. Paul</p> <p>Boody, P. L., 4311 E. Lake St.</p> <p>Boon, Leonard F., 312 16th Ave. S.E.</p> <p>Bovaird, Ellis L., 709 Cherokee Ave., St. Paul</p> <p>Boyd, Harold C., 1708 1st Ave. S.</p> <p>Bremseth, Oliver A., 3513 Colfax Ave. S.</p> <p>Broms, Thurston, 2025 29th Ave. S.</p> <p>Brown, Wayne S., 815 Aurora Ave., St. Paul</p> <p>Brusch, Elmo F., 483 Sherburne Ave., St. Paul</p> <p>Bryce, Arthur J., 246 E. Page St., St. Paul</p> <p>Buell, Edwin A., 2551 N.E. Ulysses St.</p> <p>Buetow, Max, 506 Central Ave. W., St. Paul</p> <p>Burlingame, Robt. E., 106 W. Rustic Lodge</p> <p>Caldwell, W. H., 1711 Selby Ave., St. Paul</p> <p>Campbell, D., 710 7th Ave. S.E.</p> <p>Campbell, Robert E., 1449 Laurel Ave., St. Paul</p> <p>Capwell, Claud, 923 Franklin Ave., E.</p> <p>Carlson, Homer, 1856 Prospect Ave., St. Paul</p> <p>Carlson, Lawrence, 2632 17th Ave. S.</p> <p>Carlson, V., 3144 Elliott Ave.</p> <p>Case, M. Maud, 603 E. 14th St.</p> <p>Chapman, Stella L., 3708 Colfax Ave. S.</p> <p>Chilman, Adolph, 618 Magnolia St., St. Paul</p> |
|---|---|



Christensen, Sigfred G., 112 Winnipeg Ave., St. Paul  
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 Colbert, Edward S., 614 Western Ave., St. Paul  
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 Copeland, James M., 3216 Hennepin Ave.  
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 Cowan, Boyd H., Y.M.C.A.  
 Cowling Chas. N., 184 W. Robie St., St. Paul  
 Crossman, George A., 5811 Nicollet Ave.  
 Cunningham, James B., 394 Dayton Ave., St. Paul  
 Dahle, Frederick B., 1830 Selby Ave., St. Paul  
 Dahlstrom, Arthur, 107 Orlin Ave. S.E.  
 Dale, Dallas W., 429 2nd Ave. S.E.  
 Dale, D. P., 1513 E. Hennepin Ave.  
 Dane, Royden S., Kennedy St. & Arthur St. N.E.  
 ††Davlin, L. P., care Mpls. Journal  
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 Duemke, B. B., 2309 N.E. Buchanan St.  
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 Henneman, R. E., 3038 21st Ave. S.  
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 St.  
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 Johnson, Elmer, 1306 N.E. Lincoln  
 St.  
 Johnson, Elof, 1259 Cleveland Ave.  
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 Johnson, Emil L., 426 Blair St., St.  
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 Johnson, Gerhard M., 814 24th Ave.  
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 St. Paul  
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 King, Cecilia, care General Hospital  
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 Kock, J. E., 771 Smith Ave. S., St.  
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 Kolar, J. L., 179 Malcolm Ave. S.E.  
 Konsbruck, Joseph Wm., 2542 N.E. Gar-  
 field St.  
 Kroening, Emil, 780 Park Ave., St. Paul  
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 St.  
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 Larson, L. C., 2648 N.E. Ulysses St.  
 Larson, Maynard H., 623 Franklin Ave.  
 E.  
 Larson, Nils J., 3825 15th Ave. S.  
 Lavine, Edgar W., 833 18½ Ave. N.E.  
 Lee, Lawrence E., 889 Clarke St., St.  
 Paul  
 Legg, W. B., 808 Cromwell Ave., St.  
 Paul  
 Lemm, Morley B., 2207 Blake St., St.  
 Paul  
 Lennark, Oal J., 3516 14th Ave. S.  
 Leppla, Lester B., 1618 Carroll Ave.,  
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 Levengood, Archie Grey, 2730 5th Ave.  
 S.  
 Lewis, Herbert N., 1509 26th Ave. N.E.  
 Lewis, John T., care St. Hilaire Rtl.  
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 Livermore, Harvey J., 1611 Carroll Ave.,  
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 Lord, Bernard H., 2601 Humboldt Ave.  
 N.  
 Lindeke, Harold A., 922 Margaret St.,  
 St. Paul  
 Lund, H. O., 21 Melbourne Ave. S.E.  
 Lundberg, Verna M., 4129 Bryant Ave.  
 S.  
 Lyden, Theodore W., 2153 Scudder St.,  
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 McCutchan, Julian F., 724 Cromwell  
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 Malone, John F., 3217 Park Ave.  
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 haha St., St. Paul  
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 Masley, Proxie, 1425 N.E. Washington  
 St.  
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 N.  
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 S.E.  
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 N.E.

Mitchell, C. H., 414 S.E. Harvard St.  
 Mogen, O. B., 12 W. 29th St.  
 Monahan, George L., 1311 E. 39th St.  
 Moore, George B., 2442 10th Ave. S.  
 Murphy, Allan, 1079 Burgess St., St. Paul  
 Myhie, Arthur H., 1831 Clinton Ave.  
 Nachtsheim, C. A., 917 Margaret St., St. Paul  
 Napavance, Wm., 2102 N.E. 6th St.  
 Neville, Earle L., 827 17th Ave. N.  
 Newquist, Harry, 487 Aurora Ave., St. Paul  
 Nimis, Carl A., 185 Rondo St., St. Paul  
 Nitardy, Otto J., 1915 Hennepin Ave.  
 Nitardy, Walter C., 1915 Hennepin Ave.  
 Norburg, Otto E., 558 St. Peter St., St. Paul  
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 †Olson, Martin H., 2416 17th Ave. S.  
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 Osgard, Norbet E., 285 Lafond St., St. Paul  
 Ostvig, Richter N., 215 S. 11th St.  
 Overholt, Harley G., 2856 Irving Ave. S.  
 Pager Henry L., 956 Earl St., St. Paul  
 Paily, Roger B., 4632 Emerson Ave. S.  
 Peasley, William M., 137 Cleveland Ave. S., St. Paul  
 Peterson, Alvin F., 3036 12th Ave. S.  
 Peterson, Arthur M., 2933 33rd Ave. S.  
 Peterson, Earl C., 3657 Stevens Ave.  
 Peterson, Edward J., 322 S. Exchange St., St. Paul  
 Peterson, F. T., 601 17th Ave. N.E.  
 †Peterson, Harold R., 3443 5th Ave. S.  
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 Peterson, Manuel W., 3036 12th Ave. S.  
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 Peterson, Wallace, 2724 12th Ave. S.  
 Pieh, Lillie M., 818 E. 18th St.  
 Post, George Rosewell, 413 3rd Ave. N.E.  
 Prigge, George W., 595 Ohio St., St. Paul  
 Prydz, John, 5 Barton Ave. S.E.  
 Raymond, Edward H., 4028 22nd Ave. S.  
 Ready, A. L., 1473 Blair St., St. Paul  
 Reid, Victor H., 1500 1st Ave. S.  
 Reimer, John L., 847 Thomas St., St. Paul  
 Richardson, Harry, St. Louis Park  
 Ringholm, Swan, 3828 Bloomington Ave.  
 Robinson, Donavan J., 1018 19th Ave. N.E.  
 Robohm, J. F., Jr., 2835 Girard Ave. S.  
 Roddy, Fred T., 1411 2nd Ave. S.  
 Roden, George A., 949 Rondo St., St. Paul  
 Root, George Harold, Y.M.C.A., St. Paul  
 Rosenlund, Oscar, 706 Robert St., St. Paul  
 Rosholt, Ruth, 1925 Penn Ave. S.  
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 Rund, Peter H., 604 20th Ave. S.  
 Russell, Jno F., 1009 29th Ave. N.E.  
 Ryan James Lee, Y.M.C.A., St. Paul  
 Rydell, Maurice, 832 Pusey Ave., St. Paul  
 St. John, Dynan A., 681 Burr St., St. Paul  
 Sagarsky, Anne, 569 Fuller Ave., St. Paul  
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 Sampson, Harry R., 2122 S. 5th St.  
 Sandgren, Carl H., 2122 Girard Ave. N.  
 Sargent, Norman D., 1431 Thomas St., St. Paul  
 Schermerhorn, James R., 418 S.E. Oak St.  
 Schimmelpennig, F. F., 418 10th Ave. N.  
 Schlingerman, Frank J., 1800 Stevens Ave.  
 Schmidt, Clara E., 2529 Hennepin Ave.  
 Schnaith, Roy W., care Crane & Ordway Co.  
 Schultz, Arthur H., 1036 Edmund St., St. Paul  
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 Semenuck, D. N., 3716 Humboldt Ave. N.  
 Sessing Gunar, 2908 1st Ave. S.  
 Setterlund, Albert, 2904 45th Ave. S.  
 Seward, Chester, 404 S. 8th St.  
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 Slaley, Louis J., 449 W. 7th St., St. Paul

Smith, Edgar W., 1770 Hennepin Ave.  
 Smith, Harry, 2606 N.E. Buchanan St.  
 Soderstrom, Wendell, 926 S.E. Fulton St.  
 Sola, Arthur S., 1552 Roblyn Ave., St. Paul  
 Sovereign, Hammond B., 868 Thomas St., St. Paul  
 Staehle, Gilbert C., 2738 Portland Ave.  
 Stevens, W. N., 2326 N.E. Filmore St.  
 Stock, Ernest G., 65 S. 11th St.  
 Strand, Eno, 1004½ Nicollet Ave.  
 Strand, Trygre, 1106 Kenwood Pkwy.  
 Strandberg, Henry J., 4212 10th Ave. S.  
 Swanson, E. F., 660 Hyacinth St., St. Paul  
 Swanson, Harold E., 238 Bates Ave., St. Paul  
 Swenson, Albert L., 1126 N.E. Jefferson St.  
 Swenson, Ernell H., 1723 Western Ave. N.  
 ††Swenson, Gustav A., 2842 31st Ave. S.  
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 Taylor, Herbert H., 425 8th Ave. S.E.  
 Taylor, Josephine, 1938 Fremont Ave. S.  
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 Van der Menten, John, 1007 Aurora Ave., St. Paul  
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 Wardner, Francis D., 1625 Carroll Ave., St. Paul  
 Warnick, A. B., 2535 1st Ave. S.  
 Weetman, George P., 715 Douglas Ave.  
 Westberg, Oscar, 209 21st Ave. S.  
 Westmark, Mauritz V., 418 N.E. Jefferson St.  
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 Williams, Levens, Minneapolis  
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 Yates, Robert La Paul, 3940 Upton Ave. N.  
 Yungbauer, Wm. F., 777 Marshall Ave., St. Paul  
 Zehn, A. R., 114 5th Ave. N., So. St. Paul

*The Bulletin*  
*of the University of*  
**Minnesota**

*Announcement of*  
*Americanization Training Course*  
**1921-1922**



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1921							1922													
<b>JULY</b>							<b>JANUARY</b>							<b>JULY</b>						
Su	Mo	Tu	W	Th	Fr	Sa	Su	Mo	Tu	W	Th	Fr	Sa	Su	Mo	Tu	W	Th	Fr	Sa
..	..	..	..	..	1	2	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	5	6	7	..	..	..	..	..	..	1
3	4	5	6	7	8	9	8	9	10	11	12	13	14	2	3	<b>4</b>	5	6	7	8
10	11	12	13	14	15	16	15	16	17	18	19	20	21	9	10	11	12	13	14	15
17	18	19	20	21	22	23	22	23	24	25	26	27	28	16	17	18	19	20	21	22
24	25	26	27	28	29	30	29	30	31	..	..	..	..	23	24	25	26	27	<b>28</b>	29
31	..	..	..	..	..	..	..	..	..	..	..	..	..	30	31	..	..	..	..	..
<b>AUGUST</b>							<b>FEBRUARY</b>							<b>AUGUST</b>						
..	1	2	3	4	5	6	..	..	1	2	3	4	..	..	1	2	3	4	5	
7	8	9	10	11	12	13	5	6	7	8	9	10	11	6	7	8	9	10	11	12
14	15	16	17	18	19	20	12	13	14	15	16	17	18	13	14	15	16	17	18	19
21	22	23	24	25	26	27	19	20	21	<b>22</b>	23	24	25	20	21	22	23	24	25	26
28	29	30	31	..	..	..	26	27	28	..	..	..	..	27	28	29	30	31	..	..
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<b>SEPTEMBER</b>							<b>MARCH</b>							<b>SEPTEMBER</b>						
..	..	..	..	1	2	3	..	..	..	1	2	3	4	..	..	..	..	..	1	2
4	5	6	7	8	9	10	5	6	7	8	9	10	11	3	4	5	6	7	8	9
11	12	13	14	15	16	17	12	13	14	15	16	17	18	10	11	12	13	14	15	16
18	19	20	21	22	23	24	19	20	21	22	<b>23</b>	<b>24</b>	<b>25</b>	17	18	19	20	21	22	23
25	26	27	<b>28</b>	29	30	..	<b>26</b>	<b>27</b>	<b>28</b>	<b>29</b>	30	31	..	24	25	26	27	28	29	30
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<b>OCTOBER</b>							<b>APRIL</b>							<b>OCTOBER</b>						
..	2	3	..	..	..	1	..	..	..	..	..	..	1	1	2	3	4	5	6	7
2	3	4	5	6	7	8	2	3	4	5	6	7	8	8	9	10	11	12	13	14
9	10	11	12	13	14	<b>15</b>	9	10	11	12	13	14	15	15	16	17	18	19	20	21
16	17	18	19	20	21	22	16	17	18	19	20	21	22	22	23	24	25	26	27	28
23	24	25	26	27	28	29	23	24	25	26	27	28	29	29	30	31	..	..	..	..
30	31	..	..	..	..	..	30	..	..	..	..	..	..	..	..	..	..	..	..	..
<b>NOVEMBER</b>							<b>MAY</b>							<b>NOVEMBER</b>						
..	..	1	2	3	4	<b>5</b>	..	1	2	3	4	5	6	..	..	..	1	2	3	4
6	7	8	9	10	<b>11</b>	12	7	8	9	10	11	12	13	5	6	7	8	9	10	11
13	14	15	16	17	18	19	14	15	16	17	18	19	20	12	13	14	15	16	17	18
20	21	22	23	<b>24</b>	25	26	21	22	23	24	25	26	27	19	20	21	22	23	24	25
27	28	29	30	..	..	..	28	29	<b>30</b>	31	..	..	..	26	27	28	29	30	..	..
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<b>DECEMBER</b>							<b>JUNE</b>							<b>DECEMBER</b>						
..	..	..	..	1	2	3	..	..	..	..	1	2	3	..	..	..	..	..	1	2
4	5	6	7	8	9	10	4	5	6	7	8	9	10	3	4	5	6	7	8	9
11	12	13	14	15	16	17	11	12	<b>13</b>	14	15	16	17	10	11	12	13	14	15	16
18	19	20	<b>21</b>	<b>22</b>	<b>23</b>	<b>24</b>	18	19	20	21	22	23	24	17	18	19	20	21	22	23
<b>25</b>	<b>26</b>	<b>27</b>	<b>28</b>	<b>29</b>	<b>30</b>	<b>31</b>	25	26	27	28	29	30	..	24	25	26	27	28	29	30
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# UNIVERSITY CALENDAR

1921-1922

1921

September	17	Saturday	Payment of fees closes, except for new students
September	19-24	Week	Registration for new students
September	20-27	Week	Examinations for removal of conditions and entrance examinations
			Physical examination for all new students
September	26-27		Changes in registration
September	27	Tuesday	Payment of fees for new students closes
September	28	Wednesday	Fall quarter begins, 8:30 a.m.
October	15	Saturday	Class Scrap Day; all classes dismissed the fourth hour
October	20	Thursday	Senate meeting, 4:30 p.m.
November	5	Saturday	Home Coming Day; classes dismissed the third and fourth hours
November	11	Friday	Armistice Day; a holiday
November	24	Thursday	Thanksgiving Day; a holiday
December	21	Wednesday	Fall quarter ends, Christmas vacation begins, 5:20 p.m.

1922

January	2	Monday	Registration for new students
January	4	Wednesday	Christmas vacation ends, winter quarter begins, 8:30 a.m.
February	16	Thursday	Senate meeting, 4:30 p.m.
February 20 to March 4			Condition examinations
February	22	Wednesday	Washington's Birthday; a holiday
March	23	Thursday	Winter quarter ends, spring vacation begins, 5:20 p.m.
March	27	Monday	Registration for new students
March	29	Wednesday	Spring vacation ends, spring quarter begins, 8:30 a.m.
May	15 to 25		Condition examinations
May	18	Thursday	Senate meeting, 4:30 p.m.
May	30	Tuesday	Memorial Day; a holiday
June	11	Sunday	Baccalaureate service
June	13	Tuesday	Spring quarter closes, 5:20 p.m.
June	14	Wednesday	Fiftieth annual commencement
June	17-19		Registration days for summer session
June	20	Tuesday	Summer session begins
July	28	Friday	Summer session closes

AMERICANIZATION TRAINING COURSE  
ORGANIZATION

LOTUS D. COFFMAN, Ph.D., President of the University

JOHN B. JOHNSTON, Ph.D., Dean of the College of Science, Literature, and  
the Arts

ALBERT ERNEST JENKS, Ph.D., Professor of Anthropology, Director of  
Americanization Training Course

FACULTY FOR THE SPECIALIZED COURSES DESCRIBED

ALBERT ERNEST JENKS, Ph.D., Professor of Anthropology, Director

RUBY BAUGHMAN, M.A., Professorial Lecturer in Americanization Training

GLADYS SPEAKER, M.A., Instructor in Americanization Training

RUTH M. LINDQUIST, M.A., Instructor in Food Management

MARGARET A. MUMFORD, M.A., Instructor in Home Management and  
Nutrition

ALONZO G. GRACE, M.A., Assistant in Anthropology and Americanization  
Training



## THE AMERICANIZATION TRAINING COURSE OF THE UNIVERSITY OF MINNESOTA

One expression of our instinct for national survival during the World War was the Americanization movement. It swept the land with the quickness of a fad, in places with a frenzy of fury. Some three years have passed. There are still functioning to-day about a score of organizations of national scope carrying on "Americanization" work. The "lunatic fringe of reformers" has practically been removed from among the workers. Those who hated the stranger here, and under the name of Americanization sought to coerce him, are departing because they discover that the real Americanization worker will not hate with them. There are still left quite a large number who, cloaking themselves under the term Americanization, seek to exploit the foreign-born among us, but in time they too will leave the ranks, dropping the use of the term. There will remain those thinking persons who realize that there are no more important problems before our nation to-day than her racial problems. These problems are not sectional; in different phases they are equally critical in the east, the west, the north, and the south. The Americanization task is one of hastening the process of inevitable assimilation of the various peoples in America toward American standards at their best, toward an ultimate unified set of standards which can reach a higher development in America than elsewhere and which alone will survive here, because they will be the natural product of American conditions.

The recruits to the ranks of Americanization workers from now on will be largely men and women who are nationally minded, who take seriously the democratic aims of American life, who believe that the various nationalistic groups among us give greater promise of adding versatility and strength to our nation if they are understood, and who know that a program of Americanization work will be successful only as it is scientifically sound. Such an educational program must be nation-wide, permanent, and, in consequence, substantially financed. It must be built on an adequate foundation, possess accurate, scientific and professional content, use attested pedagogical procedure, and develop such a technic and spirit of service that foreign-born and other adults who need it will come for it because it is what they want. All this means a distinctive kind of training. With such training Americanization leaders will be equipped to hasten the assimilation process in America.

The Americanization Training Course of the University of Minnesota is a four-year course established by the Board of Regents late in 1918, and leading to the degree of Bachelor of Science. Since Americanization workers find their task with many different kinds of peoples little understood in America, the Training Course gives much consideration to anthropology—the study of peoples and their problems. During the freshman and

sophomore years the student's time is largely consumed by courses required of all University students and by other necessary foundation courses.

### GENERAL FOUNDATION COURSES

Fifteen hours of credit are required in English; leaders who work with foreign-speaking persons must not only know the fundamentals of English, but they must know with scientific precision. Twenty hours of credit are required in history; the fundamentals of European and American history must be common knowledge to Americanization leaders, and especially must they know with detailed accuracy the strategic and climactic periods. Five hours of credit are required in American government; those who work with foreigners must be thoroly grounded in the essential facts of our government which rests solely on our citizenry. Ten hours of credit are required in economics; since our economic problems play so large a part in the daily life of all persons in America and our foreign-born residents often have very unsettled opinions about them, leaders among them must know fundamental economic laws and conditions in America. Six hours of credit are required in psychology; all leaders must know how mankind thinks, feels, and, in general, reacts. Ten credits are required in animal biology to give at least the rudiments of a biological science and its exact laboratory training. Ten to fifteen hours of credit are required in a modern language; Americanization leaders must clearly realize the usual provincial American outlook on language, and they should grasp the trite but apparently ignored truth that the vast majority of the earth's peoples speak and understand perfectly in other languages than our own; the ability to use a second language is also of great value to those working with foreigners. Other courses are recommended to our students as they individually have need—courses in education, sociology, history, government, labor, statistics, etc., in a determination to complete the foundation training of each student.

### SCIENTIFIC COURSES

The following courses are offered for their two-fold value—content and discipline. They equip the student with knowledge necessary to help understand the large problems in Americanization work and assist also in laying a broad foundation for the understanding of the human relations of society. The courses follow as numbered and described in the regular University bulletin.

1. **INTRODUCTION TO ANTHROPOLOGY.** Origin and development of mankind and the races; racial distribution and immigration; the bearing of anthropology on present-day thought and problems. MR. JENKS, MR. GRACE.
4. **CULTURAL ANTHROPOLOGY.** Origin and early development of the most important activities and institutions which had their beginning among primitive men. MR. JENKS.

5. GENERAL IMMIGRATION. Facts of recent world migrations. Chief causes of emigration from old nests, and of immigration to the United States; federal and state problems of immigrant legislation, control, and distribution. MR. GRACE.
12. GENERAL ETHNOLOGY. The different so-called races of men; their historical classifications; determinants of ethnic types; important ethnic problems. MISS SPEAKER, MR. GRACE.
110. PHYSICAL ANTHROPOLOGY AND AMALGAMATION. Theory of evolution as applied to natural and cultural man. Eugenics in theory, law, and practice. Studies in amalgamation of peoples. MR. JENKS.
- 123-124. PROBLEMS IN ANTHROPOLOGY. An advanced course of method and independent research. MR. JENKS.
204. SEMINAR IN ANTHROPOLOGY. Individually directed research. MR. JENKS.

#### PROFESSIONAL COURSES

The Americanization leader must possess a fund of dependable information which the average college graduate does not obtain. The following courses have been carefully selected as necessary in assisting the student to meet his professional needs. In the main they deal with the ethnic or other groups of peoples which are found in America. It must not be understood by the title of this section that its courses constitute all those necessary for professional Americanization workers.

- 57-58-59. RACE LEADERS AND PROGRAMS. Studies of racial or national leaders in Europe. Preparation of programs, in English, from racial data as means of contact for mutual understanding between Americans and various racial groups in America. MISS SPEAKER.
70. FOOD PREPARATION IN RELATION TO SOCIAL WORK. A study of the principles underlying cookery with special emphasis on the preparation of foods to be used in homes with limited incomes. MISS LINDQUIST.
71. ELEMENTARY DIETETICS FOR THE SOCIAL WORKER. Involves principles underlying adequate feeding. Food habits of different economic and racial groups forming the basis for actual planning and preparation of meals. MISS MUMFORD.
72. HOME-MANAGEMENT PROBLEMS. Involves the making of sound budgets. Studies are based upon racial groups and the size of the family, together with the income. MISS LINDQUIST.
112. THE AMERICAN NEGRO. Development of the American negro; his characteristics, conditions, and developing tendencies; negro and immigration adjustments. (Not offered in 1921-22.) MR. JENKS.

113. **THE OLDER IMMIGRANTS.** Characteristics, contributions, and distribution of the older immigrant peoples in America; their modification and importance to us. MR. JENKS.
114. **THE NEWER IMMIGRANTS.** Characteristics, contributions, and distribution of the newer immigrant peoples in America; their modification and importance to us. MR. JENKS.
115. **AMERICANISMS AND ASSIMILATION.** Essential and unique historical Americanisms and their value and virility for the future in America. Conditions and facts of assimilation. MR. JENKS.
117. **THE IMMIGRANT WOMAN.** The peculiar problems of the woman immigrant in personal service, in industrial groups, in the home, and out of regular employment. MISS SPEAKER.
118. **GOVERNMENT AND THE IMMIGRANT.** Legal and administrative aspects of Americanization. Federal and state laws affecting immigration, citizenship, and naturalization; practical administration of these laws through governmental agencies; political experiences of the foreign-born. MR. GRACE.

#### TECHNICAL AND METHOD COURSES

The Americanization leader performs a new task. A new equipment is needed for this task—entirely with adults, and largely with those of foreign birth. The following courses have been especially prepared to help meet the needs of those who go out to carry on this most important piece of work:

128. **TECHNIC OF TEACHING ADULTS.** Technic of teaching adults—the foreign-speaking, the illiterate, the fatigued—in keeping with the dignity of mature years, and the mental processes of mature minds. MISS BAUGHMAN.
129. **METHODS OF AMERICANIZATION.** Practical methods of Americanization in use in the United States, together with facts and conditions of their success or failure. MR. JENKS, MISS BAUGHMAN.
130. **ORGANIZATION OF AMERICANIZATION WORK.** Existing Americanization organizations—federal, state, municipal, neighborhood, industrial, church, racial, family, etc. Methods of organizing groups, and of interorganic coöperation. MR. JENKS, MISS SPEAKER, MR. GRACE.
136. **AMERICANIZATION DIRECTORSHIP.** The direction of Americanization work in federal, state, county, city, community, school, industrial, and home groups. MR. JENKS and expert practical directors in various fields.

141. PRINCIPLES OF ADULT ELEMENTARY EDUCATION. Language study as a fundamental tool in assimilation of peoples; ethnic peculiarities of language habit; racial bases for development of subject-matter; problems of adult language-habit substitution; voluntary versus compulsory nationalization of language. MISS BAUGHMAN.
142. THE ADULT ELEMENTARY LEARNING PROCESS. Physiology of vocal sound production; psychology of sound and symbol interpretation; phonics and phonetics and their relation to reading, spelling, writing, and intelligible speech. MISS BAUGHMAN.
143. THE ADULT ELEMENTARY TEACHING PROCESS. Survey of current methods of instruction; courses of study, textbooks, leaflets, vocabulary studies; beginning, intermediate, and advanced instruction in the English language; teaching materials and devices. MISS BAUGHMAN.

### PRACTICAL FIELD COURSES

In the live modern training school, knowledge of theories walks arm in arm with knowledge by doing. Theories are tested quickly by actual work in the field and the solution of a practical field problem is made easier, more interesting, and vital if checked as soon and as frequently as possible by suggestive theories. The knowledge necessary for Americanization leadership to-day means, then, special training in both theory and practical field-work adequate to start and maintain leadership in the task in hand. The following nine courses give practical field experience in actual contact with foreign peoples in survey, organization, preparation of data for courses, etc., while the last six give ample opportunity for research in advanced problems.

- 131-132-133. SUPERVISED AMERICANIZATION WORK. Practical field-work among foreign peoples in our vicinity. MISS BAUGHMAN, MISS SPEAKER, MR. GRACE.
- 150-151-152. FIELD PROBLEMS IN AMERICANIZATION. An advanced course of method and independent research. MISS BAUGHMAN.
- 123-124. PROBLEMS IN ANTHROPOLOGY. An advanced course of method and independent research. MR. JENKS.
204. SEMINAR IN ANTHROPOLOGY. Individually directed research. MR. JENKS.

### THE GOAL

The entire four-year Americanization Training Course was planned to equip capable students with full understanding of the professional attitude of public servants and with such practical knowledge and discipline as will compel at large the needed recognition of all such high-grade and distinctive public service. It should enable its graduates to win the remuneration which

will allow those superior among them to remain permanently at the Americanization task and be able to maintain such standards of living and cultural development as are essential to continuous whole-time and whole-hearted service-vocations. Only thus can Americanization work become genuinely professional and rank with the best constructive efforts of our nation. The course has already sent out more than fifty persons who are at the Americanization task in various practical fields. Among the positions they occupy are the following:

State directors and regional state directors, under departments of public instruction

State directors under denominational churches

City directors under board of education, Y.M.C.A., and churches

City directors of women under citizen committees, and under women's clubs

Home workers under city boards of education, the Y.W.C.A., and various clubs

City school teachers under boards of education.

#### SCHOLARSHIPS FOR AMERICANIZATION WORK

The following scholarships have been furnished students of the Americanization Training Course for the academic year of 1921-22:

\$100 by the Argosy Club of Minneapolis

\$200 by the Board of Home Missions and Church Extension of the Methodist Episcopal Church

\$100 by the Lions Club of Minneapolis

\$100 by the Pathfinder Club of Minneapolis

\$400 by the Woman's Committee of the Council of Defense. This scholarship is to be assigned to a woman graduate student in the dual field of Americanization and Home Economics.

These scholarships carry also exemption from payment of all University registration and other customary fees.

#### SUMMARY OF REQUIRED AND ELECTIVE COURSES

##### FRESHMAN YEAR

REQUIRED	CREDITS
Rhetoric-English .....	15
Modern European History (1-2)....	10
American History .....	5
General Zoology .....	10
Introduction to Anthropology.....	5

##### SOPHOMORE YEAR

REQUIRED	CREDITS	ELECTIVES
Modern language .....	9 or 15	Public Speaking
American History (continued)..	5	Modern language
American Government .....	5	Geography
Ethnology .....	3	Modern Social Reform Movements
General Immigration .....	3	Cultural Anthropology
General Psychology .....	6	Elements of Educational Psychology
Electives .....	9 to 18	Food Preparation
		Elementary Diétics

SUMMARY OF REQUIRED AND ELECTIVE COURSES II

JUNIOR YEAR

In the Senior College (junior and senior years) the electives of individual students will vary much, depending on the phases of work and the groups of peoples in which the student is specializing. All electives must be approved by the director.

REQUIRED	CREDITS	ELECTIVES
American People .....	9	Supervised Americanization Work
Technic, Methods, and Organization of Americanization Work..	9	Municipal Government
General Economics .....	10	State and Local Government
Electives .....	18 to 23	Immigrant Woman
Aliens' Viewpoints		Race Leaders and Programs
(Special lectures by race leaders but without credit.)		Labor Problems
		Statistics
		Housing Problems
		Home Management
		Social Psychology
		History of Education
		Educational Sociology
		Physical Anthropology
		Political and Social Ethics

SENIOR YEAR

REQUIRED	CREDITS	ELECTIVES
American Negro .....	3	Americanization Directorship
Government and the Immigrant.....	3	Field Problems in Americanization
Supervised Americanization Work (if not previously elected).....	9	Genetics and Eugenics
Race Leaders and Programs (if not previously elected) .....	6	Social Statistics
Principles of Adult Elementary Education .....	3	Socialism
Adult Elementary Learning Process..	3	Child Welfare
Adult Elementary Teaching Process..	3	Philippine Peoples
		Municipal Problems
		Mental Diagnosis

For the requirements for the teacher's certificate in Americanization Training, see the bulletin of the College of Education.

For courses in home economics open to students in Americanization Course, see statement of Department of Home Economics.

CREDITS, AND PREREQUISITE COURSES IN THE DEPARTMENT OF ANTHROPOLOGY, AND THE AMERICANIZATION TRAINING COURSE

No.	Title	Credits	Offered to	Prerequisite courses
1	Introduction to Anthropology	5	3d quar. fr., also soph., jr., sr.	None
4	Cultural Anthropology.....	3	Soph., jr., sr.	1
5	General Immigration .....	3	Soph., jr., sr.	1
12	Ethnology .....	3	Soph., jr., sr.	1
57-58-59§	Race Leaders and Programs	9	Jr., sr.	Three courses
70‡	Food Preparation in Relation to Social Work.....	3	Soph., jr., sr.	An. Biol. 1-2
71	Elementary Dietetics for the Social Worker.....	3	Soph., jr., sr.	70, Physiol. 3, or parallel
72	Home-Management Problems	3	Soph., jr., sr.	71, Econ. 7, or parallel
[108	Philippine Peoples.....	3	Jr., sr., grad.	Three courses]
110	Physical Anthropology and Amalgamation .....	3	Jr., sr., grad.	1, and An. Biol. 1-2 or three courses
[112	The American Negro.....	3	Jr., sr., grad.	Three courses]
113	The Older Immigrants.....	3	Jr., sr., grad.	Three courses
114	The Newer Immigrants.....	3	Jr., sr., grad.	Three courses
115	Americanisms and Assimila- tion .....	3	Jr., sr., grad.	Three courses
117	The Immigrant Woman.....	3	Jr., sr., grad.	Three courses
118	Government and the Immi- grant .....	3	Jr., sr., grad.	Three courses incl. 5
123-124§	Problems in Anthropology..	6	Jr., sr., grad.	Three courses
128	Technic of Teaching Adults	3	Jr., sr., grad.	Three courses
129	Methods of Americanization	3	Jr., sr., grad.	128
130	Organization of Americaniza- tion Work .....	3	Jr., sr., grad.	128
131-132-133§	Supervised Americanization Work .....	9	Jr., sr., grad.	128
136	Americanization Directorship	1	Jr., sr., grad.	130 or parallel
141	Princip. of Adult Elem. Educ. ....	3	Jr., sr., grad.	128
142	Adult Elem. Learning Pro- cess .....	3	Jr., sr., grad.	141
143	Adult Elem. Teaching Pro- cess .....	3	Jr., sr., grad.	142
150-151-152§	Field Problems in American- ization .....	6	Jr., sr., grad.	128
204	Seminar in Anthropology....	3	Grad.	Three courses

[ ] Not offered in 1921-22.

‡ Does not count as a Senior College course.

§ A student may enter any quarter.



PROGRAM

PROGRAM FOR YEAR 1921-22

No.	Title	Hour	Day	Building	Instructor
1f	Introduction to Anthropology..	II	MWThFS	15F	Mr. Jenks
		V	MTWThF	15F	Mr. Grace
1w	Introduction to Anthropology..	V	MTWThF	15F	Mr. Grace
1s	Introduction to Anthropology..	II	MWThFS	15F	Mr. Grace
		V	MTWThF	25F	Mr. Grace
4w	Cultural Anthropology.....	II	MWF	25F	Mr. Jenks
5f	General Immigration.....	III	TThS	15F	Mr. Grace
5w	General Immigration.....	III	TThS	15F	Mr. Grace
5s	General Immigration.....	III	TThS	15F	Mr. Grace
12f	Ethnology .....	II	TThS	12F	Miss Speaker
12w	Ethnology .....	III	MWF	25F	Mr. Grace
12s	Ethnology .....	II	TThS	25F	Miss Speaker
57f-58w-59s	Race Leaders & Programs....	I	TThS	25F	Miss Speaker
70f	Food Preparation .....	V-VI	MWF	HE	Miss Lindquist
71w	Elementary Dietetics .....	V-VI	MWF	HE	Miss Mumford
72s	Home Management.....	V-VI	MWF	HE	Miss Lindquist
110s	Physical Anthropology.....	II	MWF	25F	Mr. Jenks
113f	Older Immigrants .....	III	MWF	15F	Mr. Jenks
114w	Newer Immigrants .....	III	MWF	15F	Mr. Jenks
115s	Americanisms and As- similation .....	III	MWF	15F	Mr. Jenks
117w	Immigrant Woman.....	II	TThS	25F	Miss Speaker
118f	Government and the Immi- grant .....	IV	MWF	Ar	Mr. Grace
123f	Problems in Anthropology....	Ar	Ar	Ar	Mr. Jenks
124w	Problems in Anthropology....	Ar	Ar	Ar	Mr. Jenks
128f	Tech. of Teaching Adults....	I	MWF	12F	Miss Baughman
128s	Tech. of Teaching Adults....	I	MWF	12F	Miss Baughman
129w	Methods of Americanization..	I	MWF	12F	Mr. Jenks, Miss Baughman
130s	Organization of Americanization Work .....	I	MWF	25F	Mr. Jenks, Miss Speaker, Mr. Grace
131f-132w- 133s	Supervised Americanization Work.....	VI	T and ar	12F	Miss Baughman, Miss Speaker, Mr. Grace
136s	Americanization Directorship..	Ar	Ar	Ar	Mr. Jenks
141f	Principles of Adult Element- ary Education .....	II	MWF	12F	Miss Baughman
142w	Adult Elementary Learning Process .....	II	MWF	12F	Miss Baughman
143s	Adult Elementary Teaching Process .....	II	MWF	12F	Miss Baughman
150f	Field Problems in American- ization .....	IV	MW	12F	Miss Baughman
151w	Field Problems in American- ization .....	IV	MW	12F	Miss Baughman
152s	Field Problems in American- ization .....	IV	MW	12F	Miss Baughman
204s	Seminar in Anthropology.....	Ar	Ar	Ar	Mr. Jenks

# *The Bulletin of the University of Minnesota*

*The Course in Embalming  
Conducted by The Medical School  
in coopération with  
The General Extension Division  
January 3 to March 24  
1922*



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Act of October 3, 1917, authorized July 12, 1918*

## THE COURSE IN EMBALMING ANNOUNCEMENT

The University of Minnesota Medical School, in coöperation with the General Extension Division, announces the seventh annual session of the School of Embalming, January 3 to March 24, 1922. This is a course for undertakers and embalmers. It is conducted in the University laboratories. The instruction is given by members of the University faculty, with the coöperation of the Minnesota State Board of Health. A practical course in embalming is given the last ten days of the session by a well-known specialist.

### GENERAL INFORMATION

The course will begin on Tuesday, January 3, 1922 and continue for a period of twelve weeks.

Applicants are required to have not less than one year of high-school study, or its equivalent, attested by certificate or diploma. There will be no exceptions made to this rule. The certificate or diploma *must* accompany the application for registration.

Certificates of good moral character must be presented from a reputable physician and also from a reliable business man or firm. These certificates should also accompany the application for registration.

Applicants should register at Room 5, Main Engineering Building, University campus, not later than January 2, and will pay a fee of \$50 at the time of registration.

Examinations will be held at the close of the course and the University Certificate in Embalming will be issued to successful candidates. This certificate will be accepted by the Minnesota State Board of Health in lieu of an examination and the embalmers' license will be granted upon compliance with other requirements. A fee of \$5 must be paid to the State Board of Health by those students desiring this license.

The Minnesota State Board of Health requirements for the embalmers' license are as follows:

#### EMBALMERS—EXAMINATION AND LICENSE

29. Every funeral director or embalmer who wishes to qualify as competent to prepare a body for burial or transportation, as required by the laws of the State of Minnesota (Chapter 101, Laws of 1905, sections 5049-5054, General Statutes 1913) shall comply with the following requirements:

He shall make application to the Minnesota State Board of Health for a license. Such application shall contain the name of the applicant in full, age, and place of residence. It shall be endorsed by a licensed embalmer and two registered physicians of good repute as to the applicant's general standing.

#### NECESSARY QUALIFICATIONS

The applicant must be at least twenty-one years of age, must have had at least one year of practical experience under a licensed embalmer, and must be of good moral character.

The examination shall consist of:

Anatomy .....	10 questions
Bacteriology .....	10 questions
Elementary chemistry.....	10 questions
Public health, sanitation and laws and regulations..	10 questions
The practice of embalming.....	20 questions
Business methods.....	5 questions

The applicant must attain a proficiency of 75 per cent on the entire examination.

Board may be obtained near the University campus at about \$6 to \$9 per week. Lodging will cost from \$5 to \$7 per week. The Minnesota Union maintains a cafeteria at which meals are furnished at a very moderate cost.

The office in Room 5, Main Engineering Building is reached by the Minneapolis-St. Paul streetcar line. Get off at Washington Avenue S.E., and Church Street.

For further information, address the General Extension Division, University of Minnesota, Minneapolis, Minn.

## COURSES OF STUDY

### ANATOMY

CHARLES A. ERDMANN, Phm.G., M.D., Associate Professor of Applied Anatomy, and assistants.

60 hours. Lectures, recitations, and lantern demonstrations; laboratory work, in which each student will dissect the thoracic and abdominal viscera, will obtain experience in personally raising the different arteries, and will familiarize himself with the anatomy relating to practical embalming. Exercises in the Institute of Anatomy. Subjects of study:

1. The cells, tissues, organs
2. The framework of the body
3. The musculature; topography of the viscera
4. The alimentary canal
5. The circulatory system
6. The respiratory system
7. The urinary system
8. The reproductive system

### BACTERIOLOGY

WINFORD P. LARSON, M.D., Professor of Bacteriology, and assistants.

60 hours. Lectures, recitations, demonstrations, and practical work for each student; in Millard Hall. Subjects of study:

1. Classification of bacteria. Morphological types
2. Saprophytic bacteria in their relation to the natural processes of putrefaction, liquefaction, and oxidation of animal and vegetable tissues
3. Parasitic or disease-producing bacteria
4. Methods of differentiating bacteria
5. Methods of cultivating bacteria
6. Methods of estimating the numbers of bacteria in measured quantities of material
7. Practical studies of disinfection and disinfectants
8. Experiments with the various germicides in relation to color, preservation, and effects upon animal tissues

Textbook: Morley's *Fundamentals of Bacteriology*

### AUTOPSIES

ELEXIOUS T. BELL, B.S., M.D., Professor of Pathology.

12 hours. Practical demonstration of autopsy technic; methods of embalming bodies after post-mortem examination; demonstration of cremation, etc. Places and hours in which studies are conducted, with successive groups of students, will be announced.

### CHEMISTRY

RAYMOND E. KIRK, M.S., Assistant Professor of Chemistry.

60 hours. Lectures, demonstrations, and individual laboratory work covering the fundamental ideas of the science and some practical applications with especial reference to those materials used by embalmers and the general chemical reactions involved in their work. Given in the laboratories of the School of Chemistry. Subjects of study:

1. Structure of matter
2. Types of matter
3. Behavior of matter
4. Chemical action
5. Typical non-metallic elements
6. Solutions
7. Acids, bases, and salts—valence
8. Electrolytic dissociation—ions
9. Typical metallic elements
10. Naming of chemical compounds
11. Types of chemical change
12. Organic compounds
13. Organic reactions

Textbooks: *First Course in Chemistry* and *Exercises in Chemistry*.  
McPherson and Henderson.

### PUBLIC HEALTH

The Minnesota State Board of Health staff will give a series of lectures by representatives of the Division of Preventable Diseases, DR. ORIANNA MCDANIEL, Director; Division of Sanitation, MR. HAROLD A. WHITTAKER, Director; and the Division of Venereal Diseases, DR. HARRY G. IRVINE, Director. Lectures given in Millard Hall. Subjects:

Public health laws, rules, and regulations. Five hours.

Preventable diseases. Ten hours.

Environmental sanitation and its relation to public health. Four hours.

Venereal diseases. One hour.

### PROFESSIONAL EMBALMING AND FUNERAL MANAGEMENT

ALBERT WORSHAM, of Chicago, Illinois.

60 hours. Lectures, practical demonstrations, and recitations; conducted in the Institute of Anatomy. Subjects of study:

1. Embalming, its purpose
2. Decomposition, putrefaction, and fermentation
3. Arterial embalming
4. Capillary and tissue injection; tissue gas
5. Discolorations; causes and methods of prevention and removal
6. Cavity preservation
7. Treatment of post-mortem and mutilated cases
8. Plastic surgery and cosmetics
9. Dessication and mould
10. Communicable diseases; treatment of cases
11. Preparations for transportation
12. Laying-out of bodies
13. Dressing of body
14. Costs and overhead expenses
15. Show-rooms and salesmanship
16. Advertising
17. Funeral management
18. Collections

### BUSINESS ORGANIZATION AND MANAGEMENT

Under the direction of CHARLES L. JAMISON, B.A., of the School of Business. Ten lectures upon purchasing, credit, collections, correspondence, office organization problems, etc.; in Millard Hall.

### PRACTICAL WORK

Demonstrations in practical embalming and funeral management by leading members of the Minnesota Funeral Directors' Association, resident in the Twin Cities, will be given from time to time in their mortuaries at hours to be announced later.

**Bulletin of**  
**The University of Minnesota**

MINNESOTA SCHOOL OF MINES  
EXPERIMENT STATION

WILLIAM R. APPLEBY, Director  
Bulletin No. 9

**MAGNETIC CONCENTRATION**  
**OF IRON ORE**

BY

EDWARD W. DAVIS



Vol. XXIV No. 43 December 21, 1921

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## PREFACE

This bulletin has been prepared for the purpose of setting forth the principles and practice of magnetic concentration as applied to iron ores. The attempt has been made to describe simply and directly the fundamental principles of iron ore concentration, the physical laws of magnetic attraction and the manner in which the magnet may be utilized in the concentration of iron ores, together with results of tests illustrating the entire process. From a scientific viewpoint much has been omitted from this bulletin, but if the reader is interested in securing more exact and specific information, the footnotes will be found to contain references to important publications which are highly instructive.

The writer wishes to express his thanks and appreciation to Dean Appleby, whose stimulating encouragement, supervision, and advice made this investigation possible; to W. G. Swart, General Manager of the Mesabi Iron Company, who is responsible for the extensive investigation of the Mesabi low-grade magnetites; and to F. A. Jordan, Superintendent of the Mesabi Iron Company, and to W. H. Hunter, Professor of Chemistry at the University of Minnesota, for very valuable assistance.

E. W. DAVIS

Minneapolis, Minnesota,  
September 7, 1921.



## CONTENTS

	Pages
Part I. Physical structure of typical iron ores.....	7-11
Part II. Standard ore-dressing practice.....	12-21
Part III. Magnetism .....	22-29
Part IV. The oxides of iron.....	30-34
Part V. Magnetic roasting.....	35-49
Part VI. Principles of magnetic concentration.....	50-53
Part VII. Magnetic concentrating machinery.....	54-85
Part VIII. Magnetic concentration tests on natural magnetite ores .....	86-111
Part IX. Magnetic concentration tests on non-magnetic ores rendered magnetic by roasting.....	112-17
Part X. Standard testing methods for magnetic iron ores..	118-24
Part XI. Plant flow sheets for iron-ore concentration.....	125-32
Part XII. Conclusions and general survey.....	133-38

## ILLUSTRATIONS

FIGURE	TITLE	PAGE
1.	Coarsely crystalline magnetite ore.....	8
2.	Coarsely banded hematite ore.....	8
3.	Banded hematite ore.....	9
4.	Finely banded magnetite ore.....	10
5.	Thin section of finely crystalline magnetite ore.....	10
6.	Thin section of very finely crystalline magnetite ore.....	11
7.	Diagrammatic drawing of a jaw crusher.....	13
8.	Diagrammatic drawing of a gyratory crusher.....	13
9.	Diagrammatic drawing of crushing rolls.....	14
10.	Diagrammatic drawing of ball mill.....	15
11.	Diagrammatic drawing of rake type classifier.....	16
12.	Diagrammatic drawing of rotary drum filter.....	17
13.	Diagrammatic drawing of continuous sintering machine.....	18
14.	Flow sheet showing crushing in stages.....	19
15.	Flow sheet of a simple crushing plant.....	20
16.	Magnetic field of a bar magnet.....	22
17.	Magnetic field containing a large particle of magnetite.....	23
18.	Photomicrograph of particles of ore in a magnetic field.....	25
19.	High-power electromagnet.....	28
20.	High-power electromagnet with hematite.....	28
21.	High-power electromagnet with siderite.....	28
22.	High-power electromagnet with pyrrhotite.....	28
23.	High-power electromagnet with ilmenite.....	29
24.	High-power electromagnet with franklinite.....	29
25.	High-power electromagnet with magnetite.....	29
26.	High-power electromagnet with iron filings.....	29
27.	Curve showing magnetic characteristics of the oxides of iron.....	32
28.	Diagrammatic drawing of cylindrical magnetic roasting furnace.....	40
29.	Photograph of cylindrical magnetic roasting furnace.....	41
30.	Magnetic roasting efficiency curves.....	44-45
31.	Magnetic roasting efficiency curves.....	46-47
32.	Curves showing conditions necessary for 95 per cent efficiency in magnetic roasting.....	48
33.	Magnetic field containing magnetite and silica.....	51
34.	Ore particles of magnetite and silica.....	52
35.	Magnetized particles of magnetite and silica with fine magnetite attached.....	52
36.	Magnetic tube concentrator installation.....	58
37.	Photograph of the magnetic tube concentrator.....	59
38.	Diagrammatic drawing of laboratory dry magnetic cobber.....	63
39.	Photograph of laboratory dry magnetic cobber.....	64
40.	Diagrammatic drawing of wet cobber.....	65
41.	Photograph of wet cobber.....	66
42.	Diagrammatic drawing of magnetic log-washer.....	67
43.	Photograph of 24-inch magnetic log-washer.....	68
44.	Photograph of 60-inch magnetic log-washer.....	69

## ILLUSTRATIONS

D

FIGURE	TITLE	PAGE
45.	Photograph of 18-foot magnetic log-washer for the Mesabi Iron Company .....	70
46.	Diagrammatic drawing of Ball-Norton type drum cobber .....	72
47.	Photograph of Ball-Norton type drum cobber .....	73
48.	Diagrammatic drawing of magnetic grader .....	75
49.	Photograph of magnetic grader .....	76
50.	Photograph of Dings magnetic separator .....	78
51.	Diagrammatic drawing of demagnetizer installation .....	79
52.	Photograph of demagnetizer between ball mill and classifier .....	80
53.	Photograph of magnetized ore particles .....	81
54.	Photograph of magnetized ore particles after being demagnetized .....	81
55.	Diagrammatic drawing of magnetic roasting furnace .....	83
56.	Photograph of magnetic roasting furnace .....	84
57.	Typical photomicrograph of Eastern Mesabi rock .....	87
58.	Concentrating characteristic curves of Eastern Mesabi rock .....	88
59.	Cobbing characteristic curves of Eastern Mesabi rock when 30 per cent of the ore is discarded as tailing .....	91
60.	Photograph of equipment for fine grinding and magnetic concentration in the Mines Experiment Station laboratory .....	95
51.	Flow sheet for open circuit grinding and concentration test .....	96
62.	Flow sheet for open circuit grinding, concentration, and classification test .....	97
63.	Flow sheet for closed circuit grinding and concentration test .....	99
64.	Flow sheet used in testing magnetic ores .....	119
65.	Cobbing characteristic curves for ore No. 459 E .....	120
66.	Concentrating characteristic curves for ore No. 459 E .....	121
67.	Metallurgical flow sheet for ore No. 459 E .....	123
68.	Flow sheet of plant for concentrating finely crystalline magnetite .....	126
69.	Flow sheet of plant for concentrating coarsely crystalline magnetite .....	128
70.	Flow sheet of plant for concentrating titaniferous magnetite .....	130
71.	Flow sheet of plant for concentrating low-grade hematite using fine grinding .....	131
72.	Flow sheet of plant for concentrating low-grade hematite without fine grinding .....	131
73.	Flow sheet of plant for concentrating maganiferous iron ore .....	132

# MAGNETIC CONCENTRATION OF IRON ORE

## PART I

### PHYSICAL STRUCTURE OF TYPICAL IRON ORES

Concentration is the term applied to the process of dividing ores into two or more parts, at least one of which is more valuable than the original material. The product of greatest value is usually called the concentrate, and the product of least value the tailing, the intermediate products being sometimes called middlings. In iron ores, with the magnetic concentration of which this bulletin is concerned, the concentrate consists of iron oxides and the tailing of the associated minerals, no middlings ordinarily being produced.

Before the products of different values can be successfully separated, the ore must be treated in such a manner that if any bond exists between the different minerals, it will be broken and the individual particles will be freed from one another. The physical structure of the ore is therefore one of the first considerations in any concentrating problem. The usual method of breaking the bond between the particles consists in crushing or grinding the ore to such a size that some of the individual grains of mineral will become free particles. Upon the size at which these free particles exist, as well as upon the physical and chemical properties of the individual particles, depend to a large extent the nature and cost of the concentrating process.

As stated above, a study of the structure of the ore is necessarily a prerequisite to any successful attempt at concentration. Iron ores exist in so many forms that it would be inadvisable to attempt to discuss all of them here, but a few ores are described as being typical.

Figure 1 is a photograph of a piece of coarsely crystalline magnetite ore. Comparison with the accompanying scale indicates that crushing to  $\frac{1}{2}$  inch would liberate a large portion of the iron oxide and the gangue. In actual tests, however, it was found that at 1 inch a large portion of the iron oxide could be recovered in a practically pure state, and a large portion of the gangue could be discarded. A small portion of middling product remained which required crushing to  $\frac{1}{4}$  inch before a clean separation was effected.

Figure 2 is a photograph of a piece of coarsely banded hematite ore. Comparison with the accompanying scale suggests that crushing to  $\frac{1}{4}$  inch would free a large portion of the iron oxide and the gangue. By testing, it was found that crushing to  $\frac{3}{4}$  inch liberated a large portion of the iron oxide, but that a small portion of the ore had to

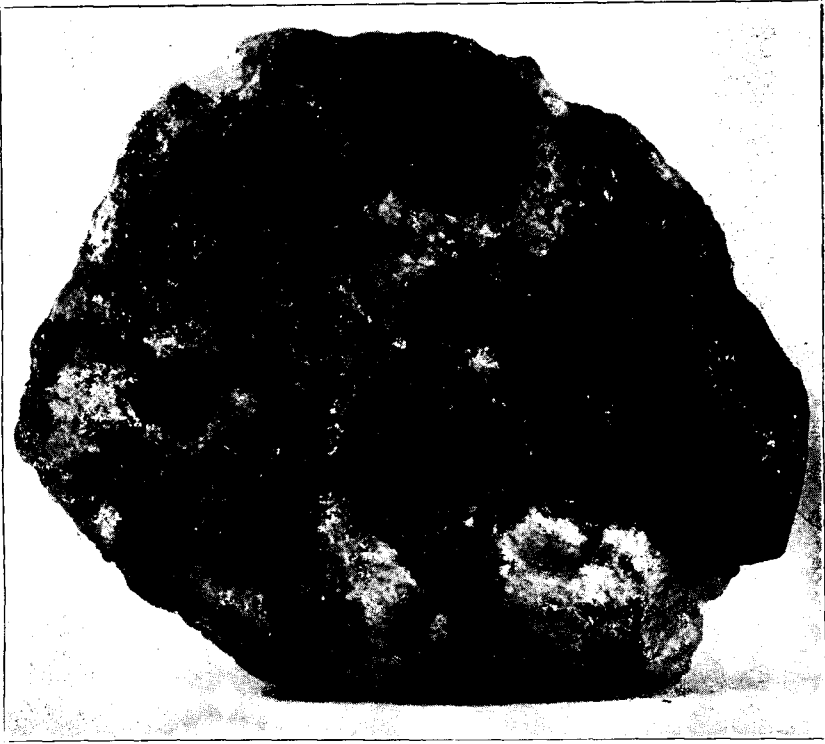


FIGURE 1. COARSELY CRYSTALLINE  
MAGNETITE ORE

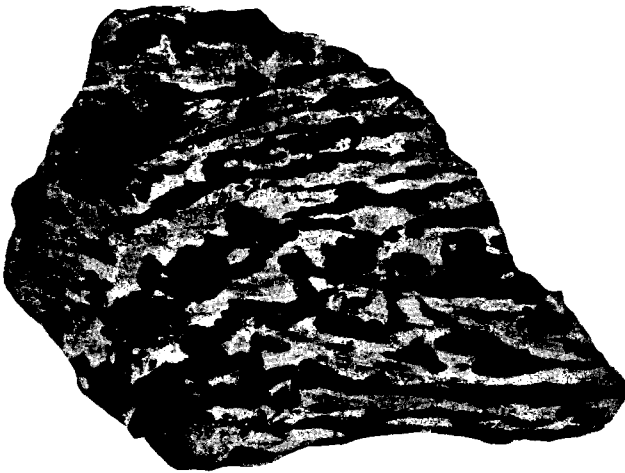
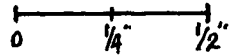
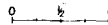


FIGURE 2. COARSELY BANDED HEMATITE ORE



be crushed to 10 mesh<sup>1</sup> before the particles were freed from one another.

Figure 3 is a photograph of a specimen of rather coarsely banded hematite ore. Comparison with the scale indicates that crushing to  $\frac{1}{8}$  inch would liberate a large portion of the iron oxide and the gangue.



FIGURE 3. BANDED HEMATITE ORE

<sup>1</sup> The following table gives the mesh and the corresponding size of the opening in inches of the screens used at the Mines Experiment Station.

Mesh Openings per lineal inch	Openings Length and width, in inches
4	.185
6	.131
8	.093
10	.065
14	.046
20	.0328
28	.0232
35	.0164
48	.0116
65	.0082
100	.0058
150	.0041
200	.0029
300	.0017

The notations "crushed to 10 mesh," "through 10 mesh," "minus 10 mesh," and "-10 mesh" indicate that all or practically all of the ore was of such a size that it passed through the openings in a 10 mesh screen. Some of the particles of this material would be dust, while other particles would be just sufficiently small to pass through the screen openings. Materials of this kind in which the size of only the largest particles is limited is called "unsized."

The notations "on 10 mesh," "plus 10 mesh," or "+10 mesh" indicate that the material is of such size that it will not pass through the openings in a 10 mesh screen.

The notations "through 10 on 20 mesh," "minus 10 plus 20 mesh," or "-10+20 mesh" indicate that the particles of ore are of such a size that they will pass through the openings in a 10 mesh screen but are too large to pass through the openings in a 20 mesh screen. Material of this kind in which both the maximum and minimum size of particles is limited, is called "sized."



FIGURE 4. FINELY BANDED MAGNETITE ORE

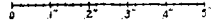
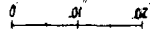


FIGURE 5. THIN SECTION OF FINELY CRYSTALLINE MAGNETITE ORE



In actual tests made on ore similar to this, it was found that a clean separation could be made after the ore was crushed through an 8 mesh screen (.093-inch opening).

Figure 4 is a photograph of a specimen of rather finely banded magnetite ore. Comparison with the scale indicates that at about .02 inch a clean separation could be made. At —48 mesh (.0116-inch opening) it was found possible to produce a satisfactory concentrate and tailing from ore of this variety.

Figure 5 is a photomicrograph of a thin section of finely crystalline magnetite ore. Comparison with the scale indicates that the ore should be crushed to about .01 inch in order to liberate the particles of iron oxide. Tests on material similar to this produced satisfactory results at —100 mesh (.0058-inch opening).

Figure 6 is a photomicrograph of a thin section of very finely crystalline magnetite ore. Comparison with the scale indicates that crushing to .002 inch would not free any considerable amount of the iron oxide. Tests made on material similar to this indicate that at —300 mesh (.0017-inch opening) a good separation could not be made.

These photographs illustrate the fact that the first step in any attempt at concentrating iron ore is to crush or grind the material sufficiently fine to liberate at least part of the gangue or iron oxide. The size to which ore must be crushed varies considerably, but machines are available for efficiently crushing ore of any variety to any desired size.

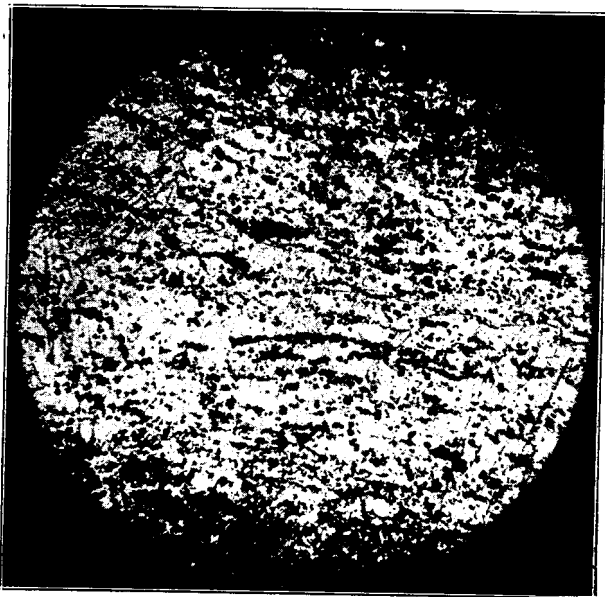


FIGURE 6. THIN SECTION OF VERY FINELY CRYSTALLINE MAGNETITE ORE



PART II  
STANDARD ORE-DRESSING PRACTICE  
CRUSHING

There are several types of machines for crushing ore preparatory to concentration. These may be classified as primary breakers, secondary crushers, and fine grinders. The primary breakers suitable for crushing iron ore are jaw crushers, gyratory crushers, and knobbed rolls. These machines are built in sizes suitable for receiving ore at steam-shovel size and crushing it to 1 inch or possibly finer. Secondary crushers may be classed as rolls, gyratory crushers, and disc crushers. These machines can crush ore from 3 to 4 inches down to possibly 10 mesh (.065-inch opening). The fine grinders include a large variety of ball mills, rod mills, pebble mills, Chilean mills, and stamps. These machines are capable of crushing ore from 3 or 4 inches down to the finest powder. The primary breakers nearly always operate on dry ore, or ore as mined, the secondary crushers on wet or dry ore, and the fine grinders usually on wet, but sometimes on dry, ore.

A study of the structure and hardness of the rock containing the ore to be concentrated usually gives a definite idea of the method of crushing best suited to the work. If the rock is very hard, and is delivered to the crusher at steam-shovel size, jaw crushers are usually preferred for the primary breakers. Softer ores, and ores mined underground are often sent to primary breakers of the gyratory type. Both of these machines are rugged and have large capacities. They are about equally popular as primary breakers. The knobbed or slugger rolls are seldom used on hard rock.

For secondary crushers, smooth rolls are probably in most general use. These machines are often operated in connection with screens or trommels which return the coarse particles of ore to the same or subsequent rolls for further reduction in size. Disc crushers, which have recently become popular in some lines of work, produce particles of more nearly uniform size than the rolls, but are not in such universal use.

The fine grinding machines of the rotary shell type are available in greater variety than any other type of crushing machine. Some of these mills are capable of crushing ore from 4-inch lumps to 200 mesh (.0029-inch opening) in one operation. Tho such immediate crushing is not usually considered economical, its possibility serves to show the great reduction in size of which such mills are capable.

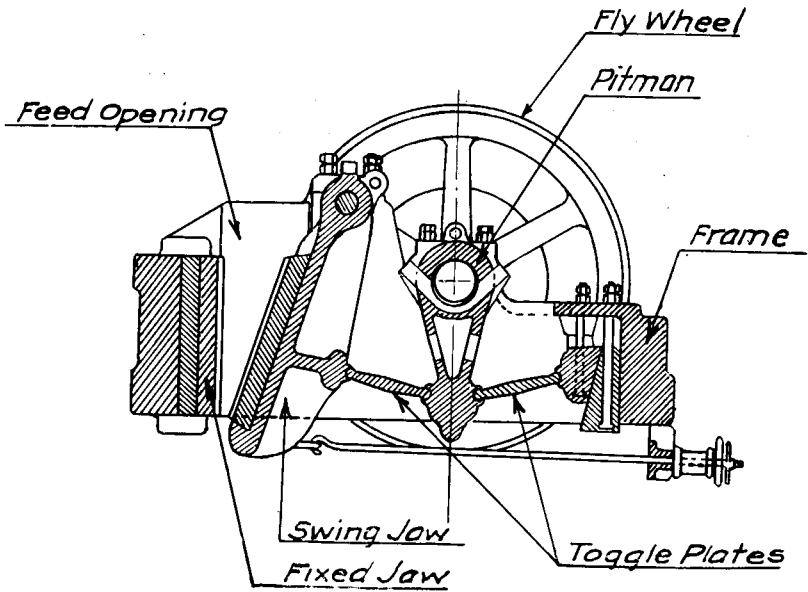


FIGURE 7. DIAGRAMMATIC DRAWING OF A JAW CRUSHER

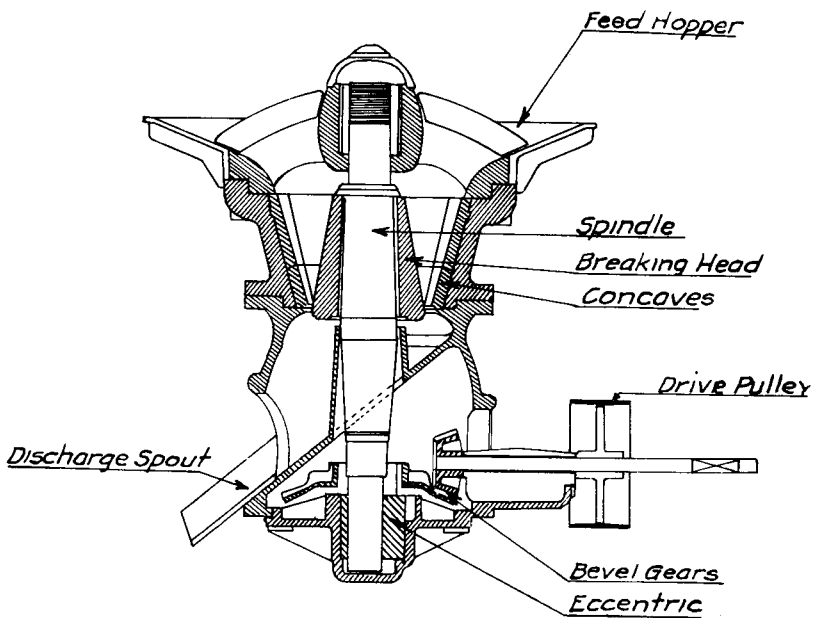


FIGURE 8. DIAGRAMMATIC DRAWING OF A GYRATORY CRUSHER

These mills are usually named according to the nature of the grinding medium within the rotary shell. Thus there are (1) rod mills, using as the crushing medium steel rods, in some cases as large as 6 inches in diameter; (2) ball mills, using as the grinding medium iron or steel balls, in some cases as large as 6 inches in diameter; and (3) pebble mills, using as the grinding medium rocks or pebbles. The shape of the rotary shell also serves as a means of classification. The tube mills are cylindrical shells in which the length is several times the

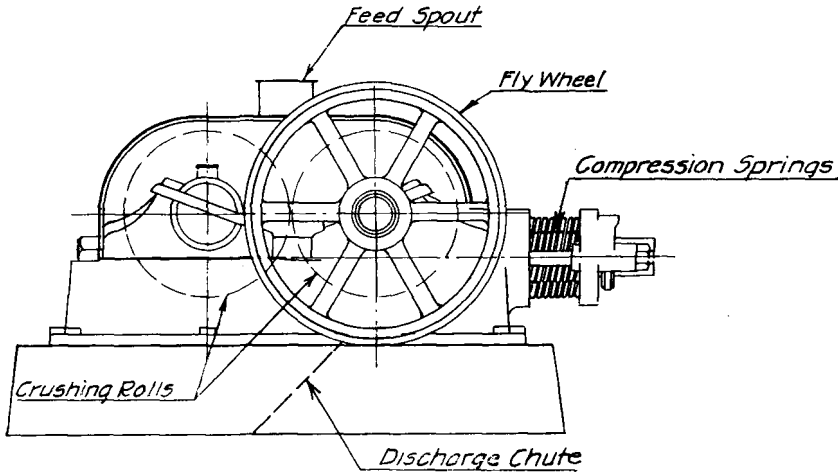


FIGURE 6. DIAGRAMMATIC DRAWING OF CRUSHING ROLLS

diameter. Cylindrical mills are cylindrical shells in which the length is often less than the diameter. Conical mills are made up of a cylindrical section in the center with a conical section at each end. In all cases these mills operate at speeds that cause considerable agitation of the grinding medium within the shell. The coarse ore, usually with a great deal of water, is fed into one end of the cylinder. After being crushed by the moving rods, balls, or pebbles, the fine ore is carried out of the other end of the mill by the excess water.

#### SIZING

There are in general use two distinct types of machines for sizing ore particles. These are (1) machines in which the ore is passed over a surface having perforations through which the finer particles may fall, and (2) machines in which the ore enters a moving liquid which carries away the smaller and lighter particles and allows the larger and heavier particles to settle. Machines of the first class are commonly known as grizzlies, trommels, and screens; and those of the

second class as classifiers. It is evident that machines of the first class are strictly sizing machines, whereas those of the second class make a separation governed not only by the size, but by the shape and weight of the particles as well. Machines of the first class are subjected to a considerable amount of wear as the ore is necessarily brought into direct contact with the screening surface.

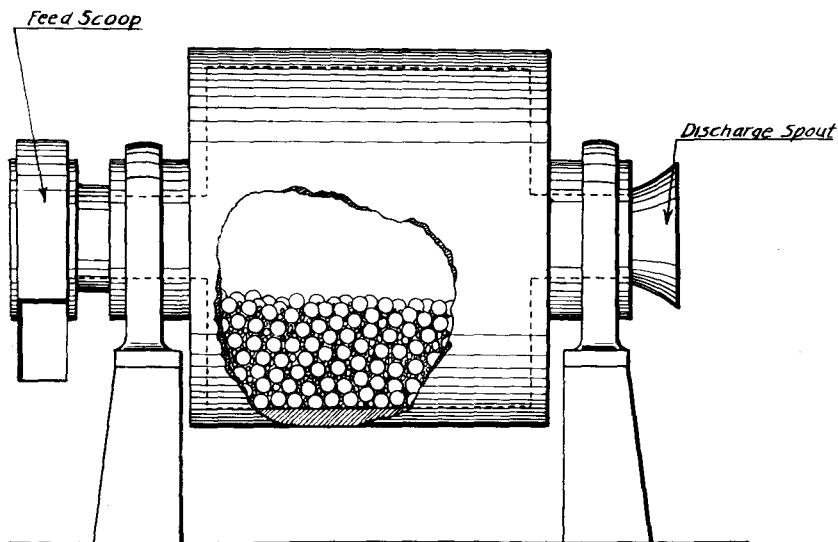


FIGURE 10. DIAGRAMMATIC DRAWING OF BALL MILL

For coarser separations there are available grizzly bars, made of heavy, hard steel which gives service over a long period of time. Stationary grizzlies, sizing finer than 2 or 3 inches, however, do not ordinarily produce good results. For sizing between 2 inches and  $\frac{1}{4}$  inch there may be employed hard alloy steel plates, punched with holes of various sizes and shapes. For sizing between  $\frac{1}{2}$  inch and 20 mesh (.0328-inch opening), woven wire screens are usually employed. In the finer screens, the size of the wire is necessarily small, and the life of the screen is therefore short. In general, it may be stated that the finer the separation made by machines of the first class, the more expensive and troublesome the undertaking becomes.

For machines making separations coarser than 3 inches, no moving parts are necessarily required. For the finer sizes down to  $\frac{1}{4}$  inch the revolving type of trommel is in general use. From 1 inch to 20 mesh (.0328-inch opening) or finer, various screening machines are available. In these machines the screen is given a shaking or vibrating motion which causes the ore to flow down over the surface and permits

the finer particles to fall through the openings. The recently developed vibrating screens have made possible considerable improvement in screening practice. In these machines, the screens are made to vibrate at a high rate, several thousand vibrations per minute. These screens have large capacities and are capable of screening damp sticky ore successfully.

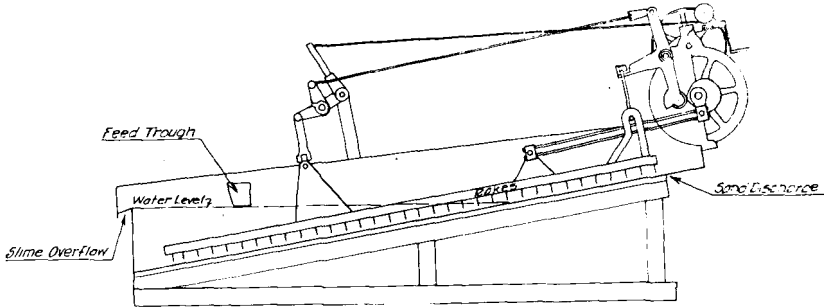


FIGURE 11. DIAGRAMMATIC DRAWING OF RAKE TYPE CLASSIFIER

When separations finer than, say, 20 mesh (.0328-inch opening) are to be made, classifiers are usually employed. In hydraulic classification the ore is placed in a moving current of water. This current is so directed that it carries away the finer and lighter particles and leaves the larger and heavier particles to be drawn off as a separate product. There are a great variety of these machines on the market, but when simple sizing is the primary requirement, the drag type of classifier is possibly most generally used. In this type, the finer and lighter particles of ore overflow with the excess water, while the coarser and heavier particles settle to the bottom of the tank and are raked out by moving scrapers. In hydraulic classifiers there are no parts that are liable to rapid wear. For this reason, separations can be made with classifiers at a small fraction of the cost necessary if screens were to be used. The separation made by the use of screens is more efficient, but for many ore-dressing problems sufficiently accurate sizing can be done with classifiers.

#### DEWATERING

Some type of dewatering machine is nearly always necessary when wet concentration is employed. Possibly the simplest method for dewatering concentrate is to allow the pulp to stand in a tank or pond until the solids settle, whereupon the water may be drawn off. It is then necessary to dig out the settled concentrate with some type of excavating machine. This intermittent operation is not always desirable

or economical, and for this reason mechanical dewaterers of various types have been developed.

These mechanical dewatering machines may be divided into two classes: (1) those in which merely the excess water is removed, and (2) those in which a comparatively dry ore is produced. There are many machines of the first class which are in many respects similar to the classifier. In these machines the solids in the pulp are given time to settle in a tank sufficiently large to allow only clear water to overflow.

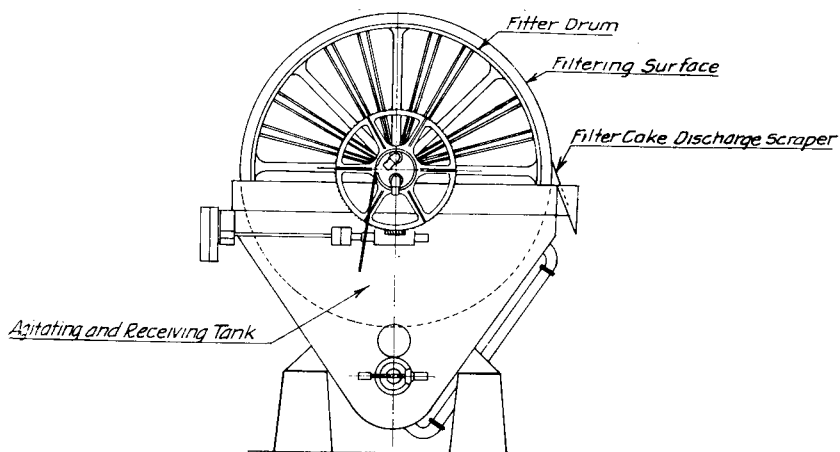


FIGURE 12. DIAGRAMMATIC DRAWING OF ROTARY DRUM FILTER

The partially thickened ore which settles is continuously drawn off through openings in the bottom of the tank, or it is conveyed out of the tank by moving scrapers. Following these machines it is sometimes necessary to use dewaterers of the second class which are commonly known as filters. The rotary type of filter has been developed into a machine having a large capacity and requiring little power and attention for operation. The rotary drum type of filter is possibly in most general use. In this machine a partial vacuum is maintained inside of a hollow, rotary cylinder which is covered with canvas or fine woven wire cloth. This drum is partially submerged in the pulp.<sup>2</sup> As it revolves through the tank, the ore is drawn against the porous drum covering and appears above the level of the pulp as a thin cake, covering the entire surface of the drum. After the drum emerges from the pulp in the tank, air is drawn through this thin cake. By the time one complete revolution of the drum has been completed, the cake is

<sup>2</sup> Pulp is a term applied to a mixture of ore and water, usually of such a consistency and of such a size of ore particles that the mixture behaves like a homogeneous liquid.

sufficiently dry to be scraped or blown from the drum as a comparatively dry product. If a product is required containing still less moisture than can be secured by the use of filters, driers must be employed. There are many of these machines on the market, but they are used principally for drying coal, cement, sand, etc.

### AGGLOMERATING

If it is necessary to crush iron ore before concentration, the concentrate produced may be too fine for use in the blast furnace. It then becomes necessary to agglomerate this fine ore into hard substantial lumps that will not disintegrate as a result of rough handling or the heat in the top of the blast furnace. There are three generally recognized methods of agglomerating iron ore known as (1) briquetting, (2) nodulizing, and (3) sintering.

In the briquetting process the damp ore, with or without a binder, is pressed into bricks or lumps. These briquettes are then subjected to the action of heat, which causes them to become hard and firm. This process is not in general use in this country, but is standard practice in Germany and Sweden.

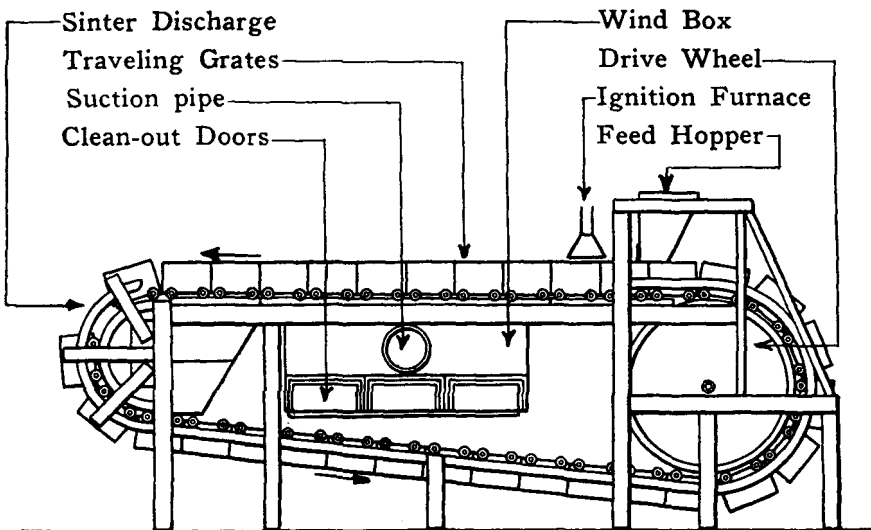


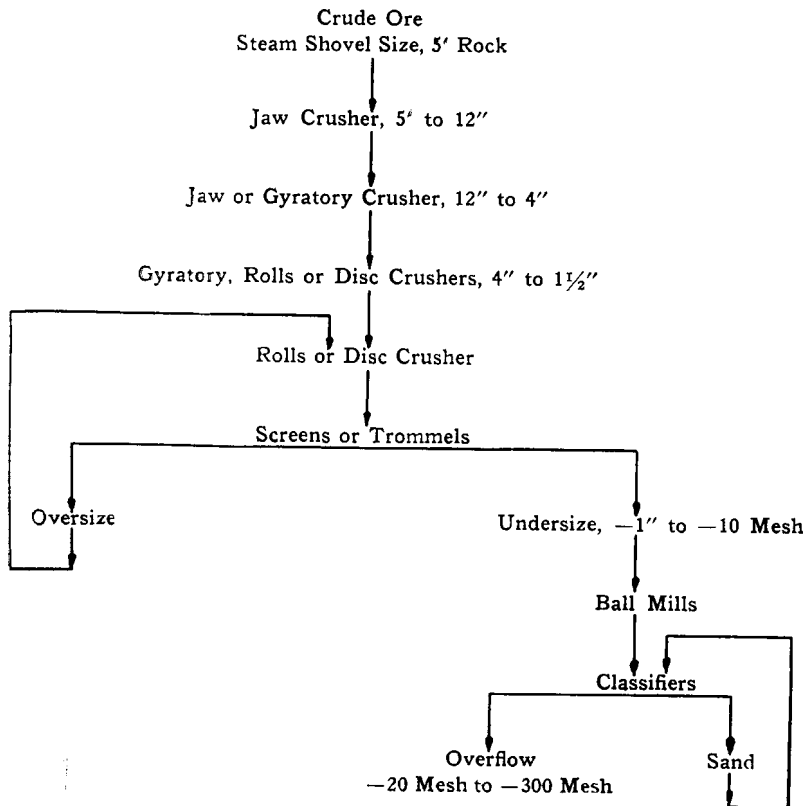
FIGURE 13. DIAGRAMMATIC DRAWING OF CONTINUOUS SINTERING MACHINE

In the nodulizing process the ore is fed into the upper end of a long inclined rotary cylindrical kiln lined with fire brick. At the lower end of the kiln atomized fuel is introduced, and as the ore passes through this cylinder it continually reaches zones of higher temperatures.

It eventually reaches a point at which fusion begins and the rotary action of the kiln causes it to roll up in small balls, or nodules, as they are called. These nodules are discharged from the lower end of the kiln, and, after cooling, are ready for shipment to the blast furnace. Several nodulizing kilns are in operation in this country.

The sintering process has probably been developed more rapidly in the last few years than any other method of agglomeration. It is in general use, and many sintering machines are in constant operation in this country and abroad. The process consists in mixing from 4 to 10 per cent by weight of finely crushed coal, coke, or any other fuel with the damp concentrate. This mixture is placed in a pan or on a traveling grate having openings in the bottom connected with an exhausting machine of some type which draws air down through the bed of ore, which is from 4 to 12 inches thick. The surface of the charge is then brought into contact with a flame and the fuel takes fire. The intimate contact between the fuel and ore particles produces

FIGURE 14. FLOW SHEET SHOWING CRUSHING IN STAGES





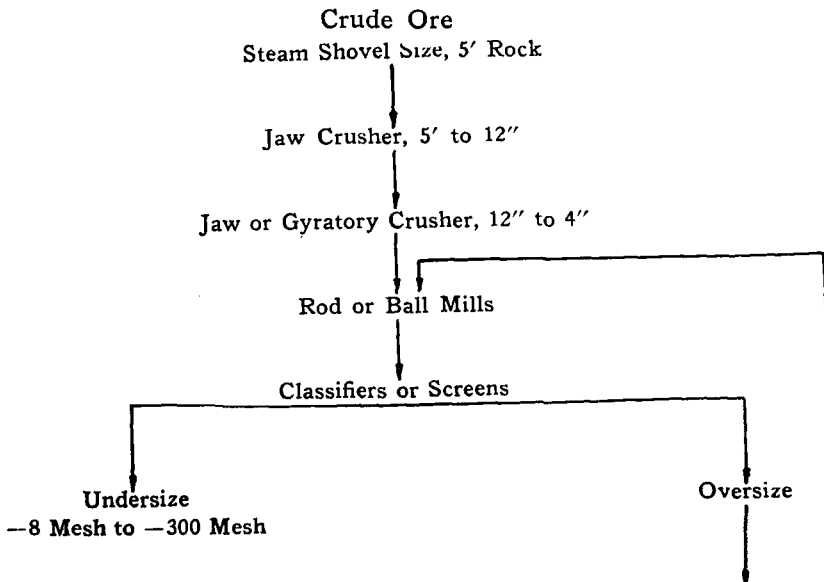
a very high temperature which fuses the ore particles together into a porous, spongy mass. When the fuel has been completely burned, the cake of sinter is discharged from the machine and is ready for use in the blast furnace.

The different agglomerating processes produce ore products of various chemical analyses and physical structures. Just which variety is best for blast furnace use has not been completely demonstrated, but it is possible by any of these processes to produce iron ore free from dust and in good condition for smelting purposes.

#### STANDARD CRUSHING FLOW SHEETS

Experience has established the fact that in treating ores certain arrangements of machinery ordinarily produce the most satisfactory results. In Figure 14 a standard crushing flow sheet or map of operations is shown. This flow sheet shows reduction in stages, or step reduction as it is called, which is generally recognized as being most efficient. Each machine is expected to reduce the diameters of the largest particles of ore which it receives, from  $\frac{1}{2}$  to  $\frac{1}{5}$  of the original size. The cost of constructing a plant for this style of crushing is rather large but when it is once properly installed, the operating cost is low. In contrast, the flow sheet in Figure 15 shows a method of crushing in which the first cost of the plant will be low, but in which

FIGURE 15. FLOW SHEET OF A SIMPLE CRUSHING PLANT



the operating cost will ordinarily be greater than when step reduction is used. In this flow sheet there is but one primary breaker, and even this machine may be eliminated if pieces of rock larger than 18 inches are broken by hand. The 4-inch product of the secondary crushers enters the ball mill. If a final product, ready for concentration, coarser than 20 mesh (.0328-inch opening) is desired, the ball mill is operated in closed circuit\* with screens, and if a final product finer than 20 mesh is desired, it is operated in closed circuit with classifiers.

These two flow sheets will give some idea of the possible arrangement of machines for reducing ore to any desired size. The manufacturers of the various crushers claim wide crushing ranges for their particular machines. It is usually conceded, however, that the best practice consists in employing several primary and secondary crushing machines, each of which makes only a small reduction in the size of the ore particles. In the ball and rod mills, larger reductions are ordinarily made. Hard ore is not usually sent to the ball mills coarser than 1 or 2 inches, and the finer feeds from 1 inch to  $\frac{1}{4}$  inch are preferable. Wet crushing in ball mills or rod mills makes concentration by wet processes necessary. If crushing no finer than 10 mesh (.065-inch opening) is required, rolls can often be used and dry concentrating machines may then be employed.

\* When a ball mill is operated in closed circuit with screens, the ore, after passing through the ball mill, is conveyed to the screens. That portion of the ore which is coarser than the openings in the screens is returned to the same ball mill for further grinding. The screens and ball mill work together in a closed cycle, the ore passing from the ball mill to the screens, from the screens to the ball mill, from the ball mill to the screens, etc. Any individual particle of ore, therefore, continues to traverse this closed circuit until it has been crushed sufficiently fine to pass through the openings in the screen. After the particles of ore have once entered this closed circuit the only means of exit is through the openings in the screens. The original feed may be added either at the mill or at the screens.

There are several types of closed circuits systems in ordinary use in milling operations. One which is in quite common use consists of a ball mill and a classifier operating together. In another type of closed circuit, rolls and screens work together. There are also many arrangements of concentrating machines which form closed circuits. In all closed circuits, at least one of the machines is of a type that divides the circulating stream of ore into at least two parts, one of which is retained in the closed circuit. The value of this system when applied to crushing machinery, lies in the fact that the finished product of the closed circuit is always of the desired size, regardless of the condition within the circuit itself.

PART III  
MAGNETISM

Magnetism may be defined as a property possessed by certain bodies by virtue of which they attract or repel one another according to definite laws. These laws may be summarized by the statement that the attracting force between unlike magnetic poles and the repelling force between like magnetic poles are directly proportional to the strength of the poles and inversely proportional to the square of the distance between them. Magnetism may be considered as a pure force, like the force of gravity, and is the physical property of certain bodies just as weight is a physical property of all bodies. When a body has been raised a certain distance, a definite amount of work has been done, but no work is required to maintain the body at its elevated position. Likewise, when a body is magnetized, a certain amount of work is done upon it but no additional work is required in order to maintain the body in its magnetized condition.

When a body is magnetized, the condition manifests itself most strongly at the two points on the body that are the greatest distance

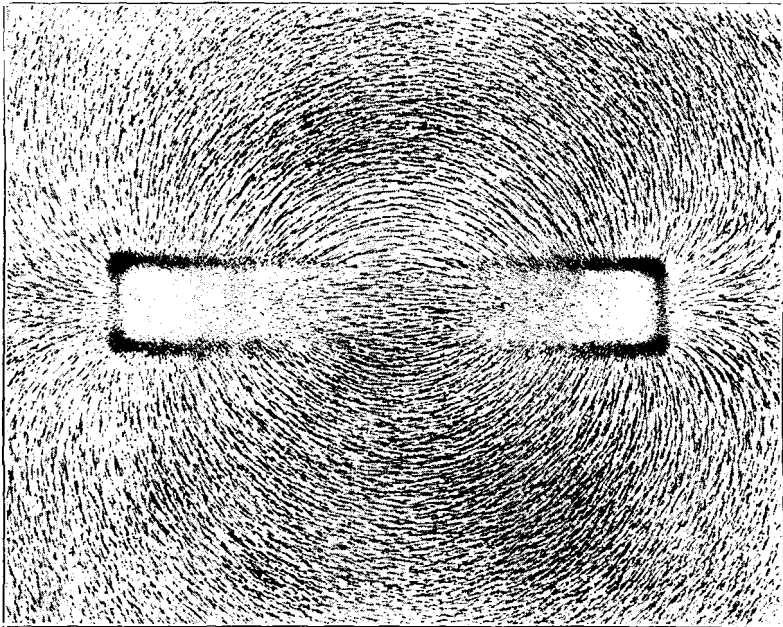


FIGURE 16. MAGNETIC FIELD OF A BAR MAGNET

apart. These points, called poles, possess the property not only of attracting the opposite poles of similarly magnetized bodies, but also of forming new poles in certain other bodies that previously were not magnetized. These newly magnetized bodies may retain or lose their magnetic properties when removed from the magnetizing force. There are then, in general, two classes of magnets, permanent and temporary. Temporary magnets are of the greater importance in connection with the magnetic separation of iron ores because, (1) the strength of the magnetic poles can be varied by changing the magnetizing force, and (2) the strength of the poles can be made much greater than in permanent magnets.

The ordinary temporary magnet is formed by winding a coil of insulated copper wire around a bar of soft iron. By changing the strength of the electric current that may be made to flow through the wire, the strength of the poles may be varied. The strength of the magnetizing force in such a magnet is directly proportional to the product of the current and the number of turns of wire. This product is called the ampere turns. For any given magnetizing force, the electric current necessary may be decreased if the number of turns

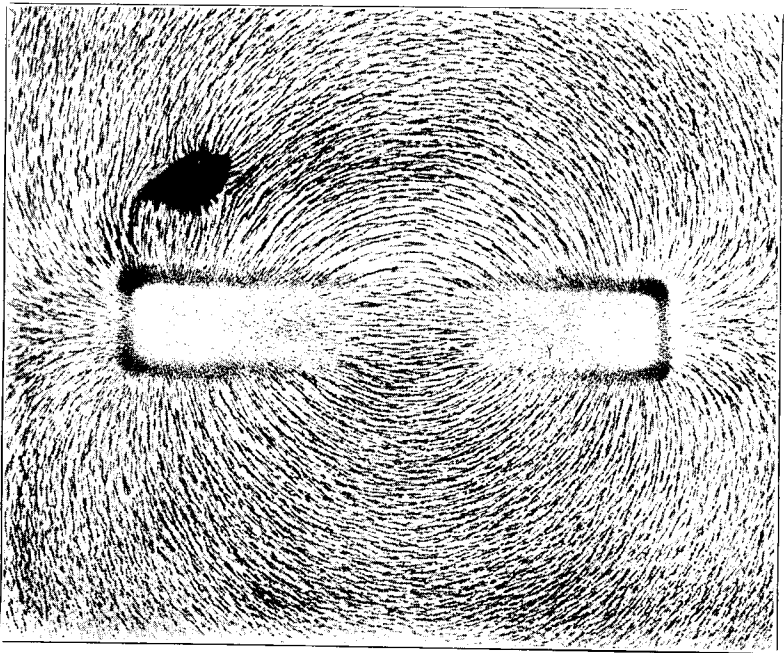


FIGURE 17. MAGNETIC FIELD CONTAINING A LARGE PARTICLE OF MAGNETITE

of wire is increased correspondingly. If a magnet is formed by passing 10 amperes of current through a coil of wire having 100 turns, the magnetizing force is  $10 \times 100 = 1000$  ampere turns. This magnet would be of the same strength if it had 1000 turns and 1 ampere of current were passed through the coil, since  $1 \times 1000 = 1000$  ampere turns, as in the first case. By indefinitely increasing the number of turns of wire about a magnet, the amount of electric current necessary in order to produce a given magnetizing force may be made as small as desired. In other words, the energy necessary in order to maintain any given magnetic field may be made as small as desired, approaching zero as the theoretical limit. This fact corresponds with the former statement that magnetism is a force and not a form of energy. In designing an electromagnet, it is usually most economical to provide for the use of a large amount of wire and a small amount of electric current. Increasing the amount of wire used can be carried to the extreme, however, as certain other definite requirements which establish the limits of efficiency must be taken into consideration.

It is convenient to think of magnetism in terms of "lines of force" which emerge from the north pole of the magnet, and after traversing curved paths enter the south pole of the magnet. The reason for this analogy is apparent when the field of a magnet is examined. Figure 16 is a photograph of a bar magnet that has been dusted over with fine particles of magnetite. The appearance of the lines connecting the two poles accounts for the analogy. It also appears that as the lines of force emerge from one pole of the magnet, they rapidly diverge and again converge as they enter the opposite pole. This appearance accounts for the customary statement that the lines of force repel one another. Figure 17 is the same as Figure 16 with the exception that a large particle of magnetite has been placed in the magnetic field. It appears that the lines of force tend to crowd together and pass through this large particle of magnetite, forming poles where they enter and emerge. In other words, this particle has become a magnet and possesses the characteristics of the original magnet. Figure 18 is an enlargement of a small portion of the field shown in Figure 16. This photograph illustrates the fact that each particle of magnetic material within the field becomes a magnet and attracts the particles near it exactly as does the large particle of magnetite shown in Figure 17.

It is a well-recognized fact that while an ordinary horseshoe magnet will attract particles of iron, nickel, magnetite, etc., it will not pick up pieces of brass, wood, or glass. Careful measurements, however, indicate that nearly all materials are influenced to some extent by the



FIGURE 18. PHOTOMICROGRAPH OF PARTICLES OF ORE IN A MAGNETIC FIELD

magnet. A measure of the force by which a magnet will attract minerals of different kinds is given in Table I. In this table the force by which a magnet will attract iron is taken as 100, as it is the most magnetic material. The figures in the table, therefore, show the relative force by which a magnet will attract the different minerals. From this table it is seen that if iron is attracted by a force of 100, magnetite will be attracted by a force of 40.18, hematite by a force of 1.32, and pyrite by a force of .23. The reasons for the great difference in the magnetic properties of different materials are not well understood. It may be said, however, that the magnetic property of a material is probably due to the structure of its molecules and not to its chemical composition.

Table I has been computed from the results of tests made by Walter Crane<sup>8</sup> in which the samples of minerals were crushed through 190 mesh. This table represents a recasting of his results in order to show the magnetic properties of the various minerals based upon iron as 100. As minerals secured from different localities vary considerably in their magnetic properties, the figures in the table should not be considered as exact, but as approximately locating each mineral in relation to the other minerals.

Magnetite, franklinite, and ilmenite are considerably more magnetic than any of the other minerals. These may be classified under the head of ferro-magnetic minerals and may be described as those minerals which are perceptibly influenced by an ordinary horseshoe magnet. The other minerals in this table will not be influenced appreciably by

<sup>8</sup> Walter R. Crane, Investigations of magnetic fields, with reference to ore concentration. *Trans. A. I. M. E.* 31:405.

TABLE I  
RELATIVE MAGNETIC ATTRACTIVE FORCE OF VARIOUS MINERALS

Material	Attractive Force—	
	Iron=100	
Iron	100.00	
Magnetite	40.18	
Franklinite	35.38	
Ilmenite	24.70	
Pyrrhotite	6.60	
Siderite	1.82	
Hematite	1.32	
Zircon	1.01	
Limouite	.84	
Corundum	.83	
Pyrolusite	.71	
Manganite	.52	
Calamine	.51	
Garnet	.40	
Quartz	.37	
Rutile	.37	
Cerussite	.30	
Cerargyrite	.28	
Argentite	.27	
Orpiment	.24	
Pyrite	.23	
Sphalerite	.23	
Molybdenite	.23	
Dolomite	.22	
Bornite	.22	
Apatite	.21	
Willemite	.21	
Tetrahedrite	.21	
Talc	.15	
Arsenopyrite	.15	
Magnesite	.15	
Chalcopyrite	.14	
Gypsum	.12	
Fluorite	.11	
Zincite	.10	
Celestite	.10	
Cinnabar	.10	
Chalcocite	.09	
Cuprite	.08	
Smithsonite	.07	
Orthoclase	.05	
Sibnite	.05	
Cryolite	.05	
Enargite	.05	
Senarmontite	.05	
Galena	.04	
Niccolite	.04	
Calcite	.03	
Witherite	.02	

an ordinary magnet, and an extremely high-power magnet is necessary in order to attract hematite, for example, to the same extent as a horse-shoe magnet will attract magnetite. These high-power magnets are expensive to operate when a magnetic field is involved sufficiently large and powerful to be commercially applicable to so cheap a commodity as iron ore. There are several machines on the market specially designed for high intensity separations, among which the Wetherill and the Dings are possibly in most general use. At the present time these machines can hardly be considered as commercially applicable to the concentration of iron ore. The possibility exists, however, of modifying and improving these machines so that at some future time they may be of considerable value for this purpose.

Because of the very low magnetic attracting force of the weakly magnetic minerals as compared with the ferro-magnetic minerals, magnetic separators have very small capacities when working on weakly magnetic material. This difference in attractive force is illustrated by the photographs, Figure 19 to Figure 26. Figure 19 shows a high-power electromagnet suspended in such a manner that samples of finely crushed mineral may be brought into contact with the lower end of the bar, which has been made pointed in order to increase the strength of the magnetic field. This magnet was energized by a constant current, and finely pulverized samples of various minerals were brought into contact with the pointed pole piece. The magnet was allowed to pick up and hold all of the mineral that would remain attached to the point. The photographs show the amount of mineral that was held in each case. As the strength of the field was the same under all conditions, the quantity of material attached to the magnet gives a good idea of the relative attractive force of the various minerals. It is seen that the quantity of magnetite held is possibly 50 times as great as the quantity of hematite. These photographs illustrate the natural relative capacities of magnetic separators working upon strongly and weakly magnetic minerals.



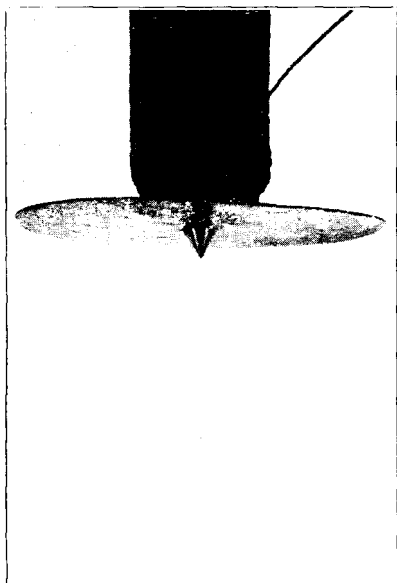


FIGURE 19. HIGH-POWER ELECTRO-MAGNET



FIGURE 20. HIGH-POWER ELECTRO-MAGNET WITH HEMATITE

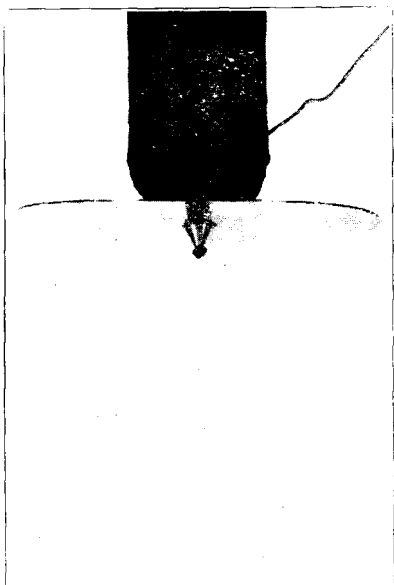


FIGURE 21. HIGH-POWER ELECTRO-MAGNET WITH SIDERITE

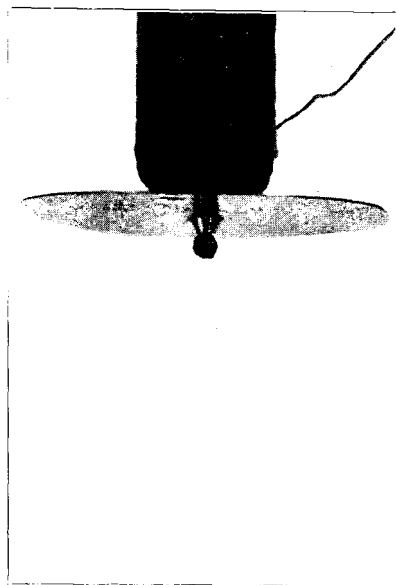


FIGURE 22. HIGH-POWER ELECTRO-MAGNET WITH PYRRHOTITE

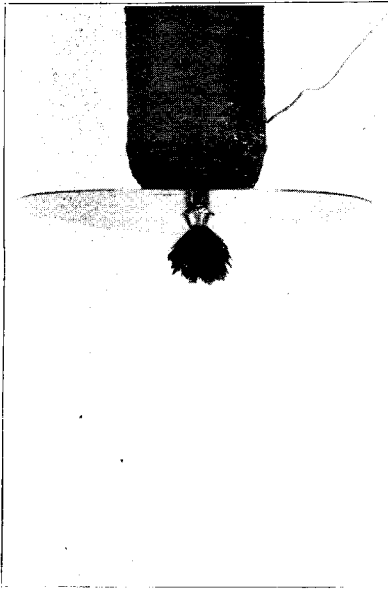


FIGURE 23. HIGH-POWER ELECTRO-MAGNET WITH ILMENITE

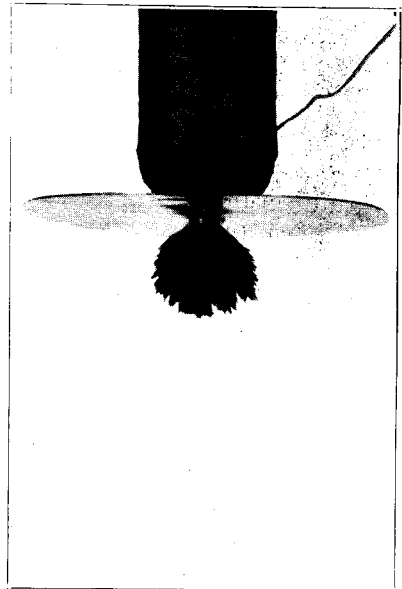


FIGURE 24. HIGH-POWER ELECTRO-MAGNET WITH FRANKLINITE

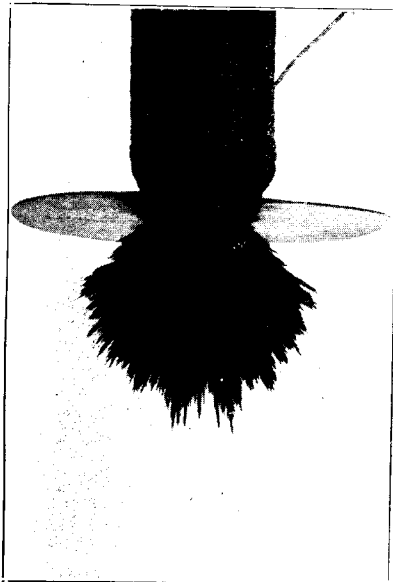


FIGURE 25. HIGH-POWER ELECTRO-MAGNET WITH MAGNETITE

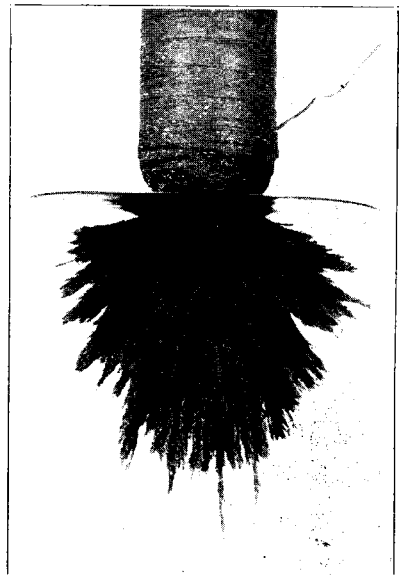


FIGURE 26. HIGH-POWER ELECTRO-MAGNET WITH IRON FILINGS

## PART IV

### THE OXIDES OF IRON

The three primary oxides of iron are ferric oxide or hematite, magnetic oxide or magnetite, and ferrous oxide. Limonite is a hydrated form of hematite and is not an independent oxide. Intermediate oxides between hematite and magnetite also exist, some of which are classified under the name of martite, and these intermediate oxides of iron, together with the limonites, form the great bulk of the iron ore now used in the blast furnaces.

#### HEMATITE

Hematite, commonly known as the red oxide of iron, has the chemical formula  $\text{Fe}_2\text{O}_3$ , which indicates that a molecule of this oxide is made up of two atoms of iron and three atoms of oxygen. As each atom of iron has an atomic weight of 56 and each atom of oxygen an atomic weight of 16, it is found by substituting these weights in the formula that the weight of the entire molecule is 160, of which 112 is the weight of the iron and 48 the weight of the oxygen. Pure hematite, then, will assay 70 per cent iron and 30 per cent oxygen. This oxide is seldom found in the pure state in nature. It usually occurs chemically combined or mechanically mixed with impurities such as water, silica, lime, alumina, sulphur, etc. The red oxide of iron is called the ferric oxide and has a specific gravity of about 5.2.

#### MAGNETITE

Magnetite, commonly known as the black oxide of iron, has the chemical formula  $\text{Fe}_3\text{O}_4$ , a molecule being made up of three atoms of iron and four atoms of oxygen. The iron has a total weight of 168 and the oxygen of 64, making the weight of the molecule 232. In other words, 72.4 per cent of the weight is iron and 27.6 per cent oxygen. Pure magnetite occurs as black, glassy crystals having a specific gravity of about 5.2. It sometimes occurs in nature in practically a pure state, but is usually found intimately mixed or chemically combined with silica, ilmenite, pyrite, alumina, etc. When heated in air it absorbs oxygen and forms hematite.

The chemical formula for magnetite is sometimes written  $\text{FeO}$ ,  $\text{Fe}_2\text{O}_3$ . This is seen to be the same as  $\text{Fe}_3\text{O}_4$  except that the formula is divided into two parts one of which is  $\text{FeO}$  and the other  $\text{Fe}_2\text{O}_3$ . It therefore appears that magnetite may be considered as a combination of 1 molecule of ferrous oxide with 1 molecule of ferric oxide. Con-

sidered thus, magnetite is regarded as being made up of 31.04 per cent ferrous oxide and 68.96 per cent ferric oxide. There are very good reasons, however, for believing magnetite, like hematite, to be a primary oxide of iron.

#### FERROUS OXIDE

The ferrous oxide of iron is never found free in nature. Its chemical formula being  $\text{FeO}$ , it is composed of 56 parts of iron and 16 parts of oxygen, or 77.8 per cent iron and 22.2 per cent oxygen. This oxide can readily be made in the laboratory, but when heated to a relatively low temperature, takes fire and with the absorption of oxygen, forms magnetite or hematite. Ferrous oxide is a black, non-magnetic material, having a specific gravity of about 5.9. It occurs combined with a great variety of minerals, but its great affinity for oxygen makes it a rather unstable compound when existing as a free oxide.

#### MARTITE

Martite is iron oxide of an indefinite chemical composition. It is described by Dana as "an iron susquioxide under an isometric form . . . believed to be pseudomorphous after magnetite." It is a black lustrous crystalline mineral resembling magnetite. When scratched it shows a red or dark brown streak resembling hematite and does not show the strong magnetic properties peculiar to magnetite. The chemical formula may be written  $n\text{Fe}_2\text{O}_3$ ,  $m\text{Fe}_3\text{O}_4$ , with certain limitations upon the values of  $n$  and  $m$ . Analyses of various samples of this mineral indicate that it contains from a fraction of 1 per cent to as high as 50 per cent of  $\text{Fe}_3\text{O}_4$ . It is quite abundant in nature and can be distinguished from magnetite by its reddish or brownish streak or by its low magnetic susceptibility.

#### INTERMEDIATE OXIDES

In a recently published article by Sosman and Hostetter,<sup>4</sup> the oxides of iron lying between hematite and magnetite are discussed at some length. One conclusion at which these investigators arrive is that solid solutions of  $\text{Fe}_3\text{O}_4$  in  $\text{Fe}_2\text{O}_3$  exist in nature quite generally as the common iron ores. In their study, many natural and artificial oxides of iron were examined and were found to be solid solutions of magnetite and hematite which contain from a fraction of 1 per cent to 100 per cent  $\text{Fe}_3\text{O}_4$ . In some of the earlier work conducted by L. Hilpert and J. Beyer,<sup>5</sup> artificially made iron oxides lying between

<sup>4</sup>R. B. Sosman and J. C. Hostetter, The ferrous iron content and magnetic susceptibility of some artificial and natural oxides of iron. *Trans. A. I. M. E.*, 58:409.

<sup>5</sup>S. Hilpert and J. Beyer, Über eisenoxyduloxyside und eisenoxydul. *Berichte Deutschen Chemischen Gesellschaft*: (1911), 44:1608-10.

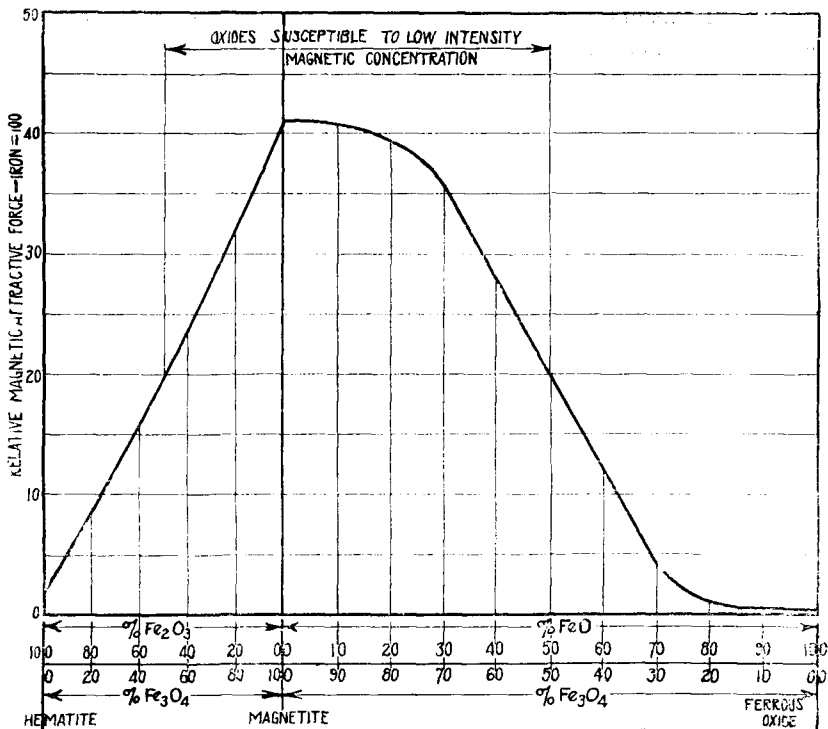


FIGURE 27. CURVE SHOWING MAGNETIC CHARACTERISTICS OF THE OXIDES OF IRON

Fe<sub>3</sub>O<sub>4</sub> and FeO were examined. As a result of these investigations the curve shown in Figure 27 has been drawn. This curve is shown in order to give an idea of the magnetic properties of the oxides of iron. The curve is a compilation and can not be considered as scientifically accurate or in all cases as definitely determined.

This curve is plotted on the basis of iron having a magnetic attractive force of 100. The height of the curve therefore shows the relative magnetic properties of the iron and oxygen compounds indicated. From hematite with a relative attractive force of 1.32 to magnetite with a relative attractive force of 40.18, the curve is nearly a straight line. This indicates that the more Fe<sub>3</sub>O<sub>4</sub> the oxide contains, the more magnetic it becomes. This curve is based on the fact that the Fe<sub>2</sub>O<sub>3</sub> and the Fe<sub>3</sub>O<sub>4</sub> are combined in solid solutions, the mixture, in other words, being homogeneous. An example of a homogeneous mixture is that of sugar and water. They form a solution, and no matter how small a portion of the solution is examined, it is found to be identical with all other portions. Sugar and sand together

form a mechanical mixture, and no matter how fine they may be crushed, grains can be selected that are either sand or sugar. If  $\text{Fe}_2\text{O}_3$  and  $\text{Fe}_3\text{O}_4$  were not combined as solid solutions but were mechanical mixtures, the curve shown in Figure 27 would be a straight line between  $\text{Fe}_2\text{O}_3$  and  $\text{Fe}_3\text{O}_4$ . Similarly, if  $\text{Fe}_3\text{O}_4$  and  $\text{FeO}$  were combined as mechanical mixtures, the curve joining these two points would be a straight line. It is seen that the deviation from a straight line is small between  $\text{Fe}_2\text{O}_3$  and  $\text{Fe}_3\text{O}_4$  and is large between  $\text{Fe}_3\text{O}_4$  and  $\text{FeO}$ . The difference indicates that the intermediate oxides between hematite and magnetite have approximately the same magnetic properties whether they are mechanical mixtures or solid solutions. This is of considerable importance when it is observed that practically all natural oxides of iron lie between  $\text{Fe}_2\text{O}_3$  and  $\text{Fe}_3\text{O}_4$ , and whether these oxides are mechanical mixtures or solid solutions affects their magnetic properties but little. The artificial oxides of iron between magnetite and  $\text{FeO}$  are readily produced when hematite is roasted in a reducing atmosphere. It is therefore seen from the curve that in preparing the non-magnetic oxides by roasting for magnetic concentration, over-roasting is much better than under-roasting.

The complete curve shows the relative magnetic attractive force of the entire range of oxides from hematite to  $\text{FeO}$ . Between  $\text{Fe}_2\text{O}_3$  and  $\text{Fe}_3\text{O}_4$  solid solutions occur which represent practically all of the oxides in nature. Between  $\text{Fe}_3\text{O}_4$  and  $\text{FeO}$  solid solutions occur which are not found in nature but which may be formed during magnetic roasting. It is evident that in any sample of ore under consideration two or more solid solutions may exist as mechanical mixtures. If these mechanical mixtures are intimate, it becomes very difficult to distinguish the separate oxides. If fine crushing will free the intermediate oxides that are mechanically mixed, they may be separated and distinguished by their magnetic and chemical qualities.

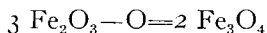
It has been found that in order to produce a satisfactory separation of minerals with low intensity magnetic concentrators, the mineral should show a relative magnetic attractive force above 20. The vertical lines on the curve, Figure 27, show the limits of low intensity magnetic separation. If the oxide contains less  $\text{Fe}_3\text{O}_4$  than is included between the vertical lines, low intensity magnetic concentration can not be successfully carried on. It is therefore apparent that an oxide may contain a considerable amount of  $\text{Fe}_3\text{O}_4$  in solid solutions or as a very intimate mechanical mixture, and still not be sufficiently magnetic for low intensity magnetic concentration. On this account, the assay for iron existing as  $\text{FeO}$  can not be used to compute the amount of magnetic material that can be recovered with ordinary concentrating machines.

A chemical analysis will show all of the iron existing as FeO whether it is combined in such a way as to form a magnetic oxide or a non-magnetic oxide. In many ores a considerable amount of iron is present, existing as a soluble iron silicate. A chemical analysis will show this material as FeO, but it is obviously not magnetic, and soluble iron silicates are therefore another source of possible error when an attempt is made to determine the magnetic qualities of a mineral from a chemical analysis.

PART V  
MAGNETIC ROASTING

While magnetic concentration may be generally applied to the magnetite ores in a natural state, it can not be generally applied to the concentration of the hematite ores. For several hundred years it has been known, however, that when a piece of ordinary hematite ore is raised to a red heat in the presence of carbon, it is completely changed to magnetite. More recently the chemical reactions involved in the magnetic roasting of hematite ores have been investigated and very definite information is available regarding this process.

The chemical formula for magnetite is  $\text{Fe}_3\text{O}_4$  and for hematite  $\text{Fe}_2\text{O}_3$ . It is therefore seen that if one atom of oxygen be removed from three molecules of hematite, two molecules of magnetite are formed. This may be written :



The removal of this oxygen will decrease the weight of the hematite by only 3.33 per cent. This small percentage of oxygen may be made to leave the hematite by strongly heating the ore in air. If the air is excluded, however, a lower temperature will produce the desired reaction. If the ore is mixed with some material having a strong affinity for oxygen, a still lower temperature will cause the hematite to change to magnetite. Hydrogen and carbon are the most common elements having strong affinities for oxygen, and by mixing the ore with either of these elements or their gaseous compounds, the oxygen in the ore is rapidly removed at a low temperature. It is necessary to heat the hematite in a reducing atmosphere to a temperature of about  $900^\circ \text{F}$ . in order to produce rapidly and efficiently the reaction shown in the above formula, and in order to heat a pound of hematite from  $60^\circ \text{F}$ . to  $900^\circ \text{F}$ . 225 B. T. U.'s of heat are required. In order to change one pound of hematite to magnetite after it has been heated to this temperature, 97 B. T. U.'s additional heat are required, making a total for the complete operation of 322 B. T. U.'s. This heat can be supplied by the combustion of .023 pounds of carbon. The combustion of .023 pounds of carbon will require .061 pounds of oxygen, of which .033 pounds will be given off by the hematite when it changes to magnetite. These figures are accurate for pure iron oxides. If they are applied to a hematite iron ore containing 40 per cent natural iron and 20 per cent total moisture, it may be computed that approximately .035 pounds of carbon will be required for reducing one pound of the ore to magnetite. This would amount to 77.4 pounds of carbon



per long ton of ore or 3.5 per cent of the weight. There will be certain heat losses in the stack gases and due to radiation which can hardly be estimated at this time but it would seem that the combustion of 155 pounds of coal or equivalent fuel would produce sufficient heat to completely roast one ton of ore. This would amount to approximately 7 per cent of the weight of the ore roasted. These figures are given so that some idea may be formed as to the amount of fuel required for magnetic roasting. By utilizing the heat remaining in the ore after roasting, a considerable saving in fuel, over the figures shown, may be made. If all of the heat in the roasted ore were conserved, and there were no radiation or other heat losses, only 23 pounds of carbon would be required per long ton of ore, which is about 1 per cent of the weight. This is the maximum theoretical economy obtainable and could, of course, never be reached in practice. It may be stated, however, that raw hematite ore can be roasted to magnetite with a consumption of carbon or equivalent fuel, of from 5 to 10 per cent of the weight of the ore.

While this process of magnetic roasting is easily carried on in the laboratory, its commercial value has not been demonstrated. The possibility of roasting non-magnetic oxides of iron preparatory to magnetic concentration has been recognized for many years.<sup>6</sup> In 1867 a United States patent was granted to Mr. E. L. Seymour for roasting iron ores preparatory to magnetic concentration. Mr. Ellis Clark reports<sup>7</sup> that in 1876 in Pribram, Bohemia, he saw the process of roasting and magnetic separation of iron ore being carried on commercially. At Allevard, Savoy, the roasting and magnetic separation of iron ore was in progress in 1894. It is therefore evident that the idea of magnetic roasting of iron ores is an old one, and the process has been carried on commercially for many years. It is true that the earlier attempts were made in connection with the concentration of more valuable minerals such as copper and zinc, but later attempts have been made to concentrate the ore for the value of the iron concentrate produced.

Mr. Clemens Jones<sup>8</sup> in 1890 applied for a United States patent for the magnetic roasting of iron ores. His process consisted in heating the ore to a red heat in the presence of carbon or carbon-monoxide gas. He made experiments on the southern brown ores and succeeded in roasting and concentrating magnetically a number of samples. His tests all appear to have been made on a small scale, however, and his cost estimates in connection with mining, crushing, roasting, and con-

<sup>6</sup> Percy, *Metallurgy of iron and steel*. (1864). Page 17.

<sup>7</sup> Ellis Clark, Jr., *Ore dressing and smelting at Pribram, Bohemia*. *Trans. A. I. M. E.* 9:461.

<sup>8</sup> Clemens Jones, *The magnetization of iron ore*. *Trans. A. I. M. E.* 19:289-96.

centrating these brown ores were obviously too low. He was of the opinion that the removal of the combined water from the ore was the real cause of the change to the magnetic oxide, and made various attempts to roast anhydrous iron ores, all of which were unsuccessful. He suggested the idea that anhydrous ores can not be rendered magnetic by roasting. There seems to be no evidence that the process suggested by Mr. Clemens Jones was ever commercially attempted.

In 1893 some experimental work was carried on by the Tennessee Coal, Iron and Railroad Company at Ensley and Bessemer, Alabama, using a process developed by McCormack and Barton.<sup>9</sup> For these tests a semi-commercial plant was built for the roasting and magnetic concentration of the southern brown ores. The magnetic roasting kiln had a capacity of 110 tons, and several hundred tons of ore were treated in this plant under the direction of Dr. W. B. Phillips. The great difficulty in connection with the process seemed to be the inability to secure uniformly roasted ore. At times the ore was perfectly roasted and at other times it was not roasted at all. Dr. Phillips was of the opinion that a proper kiln would solve the problem. The cost of operating was high, however, and this process could not successfully compete with the natural ores.

Another attempt at concentration of the brown ores was made at Waukon, Iowa, by use of the Goltra process. This consisted in drying the ore at a high temperature in a current of air sufficiently strong to remove the fine dust. The finer portion of the clean, dry ore was then heated to a high temperature in the presence of reducing gases, and after cooling was concentrated magnetically. Dr. W. B. Phillips made a test by this process for the Missouri Iron Company.<sup>10</sup> In the test, Texas brown ore was used, 338 tons being treated through the kiln and over magnetic separators of the Ball-Norton type. Again incomplete magnetic roasting seemed to be the difficulty and caused large tailing losses. The fuel consumption at that time was considered low, but would make the process expensive under present conditions.

From the above description it is apparent that magnetic roasting and concentration is an old process which has been applied with little commercial success to various low-grade iron ores. From the available information it would seem that all attempts had failed, due to the fact that effective magnetic roasting was not accomplished commercially. In all of these attempts a considerable portion of the ore passing through the roasting furnace was not rendered magnetic. This seems to be a fault of the furnace rather than of the process.

<sup>9</sup> W. B. Phillips, Notes on magnetization and concentration of iron ore. *Trans. A. I. M. E.* 25:399-423.

<sup>10</sup> W. B. Phillips, Concentration by the Goltra process. *Iron Age* 94:1148.

After the Mesabi Range started large scale production in 1900, all attempts at magnetic roasting and concentration seem to have ceased. The process was, at best, expensive and apparently could not compete with the raw ores. Little seems to have been done in connection with magnetic roasting of iron ores since 1900, but considerable improvement has been made in the process of drying and roasting other materials such as coal, copper ore, lead ore, etc. Whether or not any of these more recently developed furnaces are capable of producing a uniformly roasted iron ore with sufficient economy to insure a low operating cost, has not been as yet determined.<sup>11</sup> Some of the roasting work carried on in the western smelters in connection with copper ores closely approximates the practice necessary in connection with low-grade iron ores.

At the Calumet and Arizona smelter at Douglas, Arizona,<sup>12</sup> the copper ore before smelting is dried and partially desulphurized in a six-hearth furnace, 21 feet 6 inches inside diameter. The fuel used is crude oil, burned through a special type of revolving burner. Modifications of this variety of furnace are in use throughout the west for drying and desulphurizing copper ores, but at Douglas, Arizona, the ore before roasting contains a considerable amount of non-magnetic iron. The ore entering the furnace assays .22 per cent magnetic iron, but after roasting it contains 23.60 per cent magnetic iron. No attempt is being made to produce a complete magnetic roast, and therefore the efficiency of the roast is rather low, only about 80 per cent of the iron in the ore being changed to the magnetic oxide. In all probability by making slight modifications in operating conditions very much more efficient magnetic roasting could be secured. This furnace has a capacity of 80 to 100 tons of minus 1-inch feed per 24 hours, and the total operating cost for 1919 and 1920, exclusive of the cost of preparing the ore and depreciation of the plant was 31 cents per ton. This cost was made up of 8 cents for fuel, 2 cents for power, 10 cents for operating labor, and 11 cents for repair labor and supplies.

The ore which is being roasted at Douglas contains a considerable amount of sulphur, which is oxidized in the furnace and produces heat. In order to modify the above cost figures to represent the costs for magnetic roasting an ordinary hematite ore, the cost of the fuel must be increased. As previously noted, 155 pounds of coal will supply the necessary heat and reducing conditions for completely changing one ton of hematite ore into magnetite. The cost of this

<sup>11</sup> Experiments along this line are now being carried on at the Mines Experiment Station.

<sup>12</sup> Information furnished by H. A. Clark, smelter superintendent, and Carl H. Cole, metallurgist, for the Calumet and Arizona Mining Co., of Douglas, Arizona.

155 pounds of coal properly prepared for the roasting furnace will be approximately 52 cents. Substituting this figure for the 8-cent fuel cost given above, gives a total roasting cost of 75 cents per ton. This figure represents the cost of roasting hematite ore into magnetite, using equipment such as is found in the western smelters. Some additional expense might be necessary when roasting hematite ores, however, as it is necessary to cool the roasted ore out of contact with air. In order to prevent reoxidization to hematite, the temperature of the ore should be reduced below  $100^{\circ}$  C. before it is exposed to the air. This makes some form of cooler necessary. There are several of these mechanical coolers on the market requiring very little power or attention. If wet concentration is to follow the roasting process, the hot ore may be discharged from the furnace into a tank of water. Quenching cools the ore so rapidly that reoxidization does not take place to any considerable extent.

In citing the above figures, it is assumed that all of the heat contained in the roasted ore is lost when the ore is discharged from the furnace. If some type of furnace can be devised in which the heat contained in the roasted ore is conserved, the cost of fuel can be considerably reduced. It seems safe to say that at the present time, using standard western smelter practice, the hematite ores can be reduced to magnetic ores for less than 85 cents per ton of roasted product. The possibility also exists of materially reducing this cost by the use of furnaces designed exactly to fit the conditions necessary for magnetic roasting and cooling.

#### MAGNETIC ROASTING EXPERIMENTS

In order to determine definitely some of the factors governing the speed and efficiency of magnetic roasting, a series of experiments have been carried on at the Mines Experiment Station.<sup>13</sup> Figure 28 is a drawing of the apparatus used in these experiments; Figure 29 a photograph of it. It consists of a hollow rotary cylinder, heated from the outside by a gas flame. Both trunnions which support the drum are hollow. To one of these is attached a rubber hose leading to a supply of gas, and in the other a thermocouple is so arranged that the temperature within the drum may be observed.

Hematite ore was placed in the drum and a gas flame was applied to the outside. The drum was rotated by means of a small motor at the rate of 20 r.p.m., and the temperature was observed on the pyrometer. When the temperature had reached the desired point, the

<sup>13</sup> Tests made by the regular staff of the Mines Experiment Station, assisted by F. B. Wenger, E. M. Adams, C. E. Erdmann, G. W. Hezzlewood, R. H. Swart, J. W. Clay, and K. H. Sung.

gas was allowed to flow into the drum at the rate of 25 cubic centimeters per minute. This flow of gas was continued for a given length of time, during which the temperature was kept constant. The heat was then removed and the gas feed to the drum was stopped. The drum was cooled as rapidly as possible and the ore was removed and examined. The tests were carried on with a variety of temperatures,

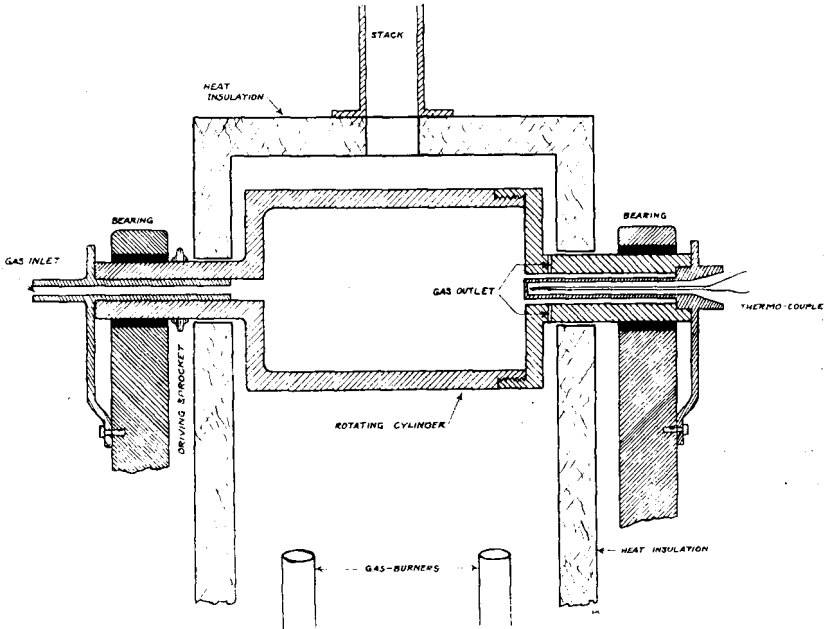


FIGURE 28. DIAGRAMMATIC DRAWING OF CYLINDRICAL MAGNETIC ROASTING FURNACE

sizes of particles, and roasting times. The amount of magnetic iron\* contained in the ore was determined before and after each test. In this way it was possible to determine the percentage of non-magnetic iron that was changed to magnetic iron. This figure is called the efficiency of the roast.

Table II shows the efficiencies secured under various conditions of time, temperature, and size of particles. These results are shown graphically as curves in Figure 30. In general it appears that the

\* For definition of magnetic iron, see Part VII.

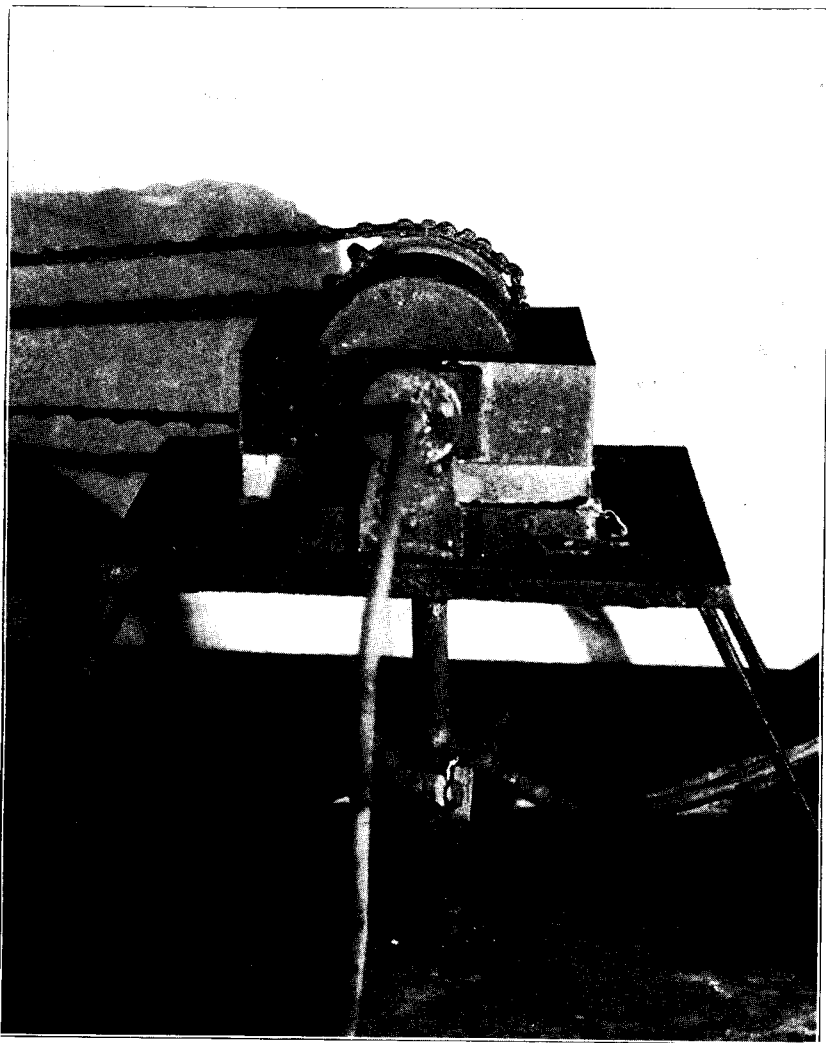


FIGURE 29. PHOTOGRAPH OF CYLINDRICAL MAGNETIC ROASTING FURNACE

efficiency of the roast varies directly with the time and temperature and inversely with the size of the particles. Table III shows the temperature and time necessary in order to produce a roast of 95 per cent efficiency. As this is approximately the efficiency that would be required for commercial operation, this table shows the conditions that should be met in practice. The results of this table are shown graphically in Figure 32. In Figure 31 curves are plotted to show

TABLE II  
RELATION BETWEEN TEMPERATURE, TIME, SIZE OF ORE PARTICLES, AND  
EFFICIENCY FOR MAGNETIC ROASTING

Temp. deg. C.	Time min.	Efficiencies at Different Sizes			
		- $\frac{3}{4}$ " + $\frac{1}{2}$ "	- $\frac{1}{2}$ " + 8M.	-8M. + 300M.	-300M.
300°	15	10.2	27.5	34.3	39.1
	30	25.5	57.0	62.4	65.0
	45	49.5	75.0	80.0	82.8
	60	73.4	87.0	90.0	93.5
	120	86.4	95.0	95.8	99.0
350°	15	17.0	52.0	63.0	69.0
	30	43.7	74.5	84.8	86.5
	45	68.0	86.0	90.5	93.0
	60	87.2	93.0	95.0	97.0
	120	94.3	97.0	97.7	99.3
400°	15	23.2	67.5	85.4	91.0
	30	59.2	84.5	94.3	95.2
	45	80.9	92.0	95.3	97.0
	60	93.5	95.5	97.0	98.2
	120	97.0	97.5	98.0	99.3
450°	15	30.2	77.0	91.5	94.5
	30	74.5	90.5	95.1	96.2
	45	89.0	95.5	96.3	97.2
	60	95.0	96.8	97.5	98.4
	120	98.0	98.1	98.4	99.3
500°	15	37.5	83.2	94.0	95.5
	30	85.8	94.0	95.5	96.5
	45	93.1	96.5	96.8	97.5
	60	95.2	97.5	97.8	98.5
	120	98.5	98.5	98.6	99.3
550°	15	42.8	86.5	95.0	96.0
	30	90.7	95.5	96.0	97.0
	45	94.0	96.7	96.9	97.8
	60	95.5	97.7	97.8	98.6
	120	98.7	98.8	98.8	99.3
600°	15	45.0	89.5	96.0	96.8
	30	92.4	96.0	96.9	97.5
	45	94.7	97.0	97.0	98.7
	60	95.6	98.2	98.4	98.8
	120	99.0	99.1	99.2	99.4

the efficiency of the roast for particles of various diameters. As would be expected, the larger the particles the longer the time and the higher the temperature necessary in order to secure high efficiency. All of the above results were secured by using Minneapolis city illuminating gas as the reducing agent. The analysis of this gas is as follows:

Carbon dioxide .....	3.1 per cent	Methane .....	24.0 per cent
Illuminates .....	9.7 per cent	Hydrogen .....	32.0 per cent
Oxygen .....	1.7 per cent	Nitrogen .....	8.0 per cent
Carbon monoxide .....	21.5 per cent	B. T. U. ....	589 per cubic ft

TABLE III  
RELATION BETWEEN TIME, TEMPERATURE, AND SIZE OF ORE PARTICLES FOR  
MAGNETIC ROAST AT 95 PER CENT EFFICIENCY

Roasting time min.	Size of ore particles and temperature in degrees Centigrade			
	$-\frac{3}{4}'' + \frac{1}{2}''$	$-\frac{1}{2}'' + 8M.$	$-8M. + 300M.$	$-300M.$
11				600
12			600	550
15				487
20		600	508	440
25		554	477	407
30		528	453	384
35		487	431	368
40		462	410	355
45	600	440	391	345
50	525	420	375	333
55	465	400	360	323
60	425	385	349	312
65	405	370	339	305
70	393	360	328	297
75	383	348	320	292
80	377	338	315	286
85	374	330	305	282
90	370	323	300	277
95	368	315	297	273
100	366	308	295	270
105	365	305	294	267
110	363	302	292	264
115	362	301	291	262
120	360	300	290	260

In order to secure some idea of the relative efficiencies of different reducing agents, tests were made upon duplicate samples of ore with exactly the same roasting conditions, but with various reducing agents. Magnetic iron determinations were made as usual and the efficiencies of the roasts were computed. Table IV shows the results secured from these tests.

TABLE IV  
EFFICIENCIES OF VARIOUS GASES FOR MAGNETIC ROASTING

Reducing agent	Efficiency or per cent of iron changed to magnetic state
Alcohol vapor	99.57
Carbon monoxide	98.90
Hydrogen	98.43
Illuminating gas (Minneapolis)	97.37
Gasoline vapor	84.15
Acetylene	65.70
Methane	11.70
Air	.74

From Table IV it is seen that simply heating hematite ore in air to the low temperature used causes a slight change to the magnetic oxide. Methane appears to be a very poor reducing agent and the



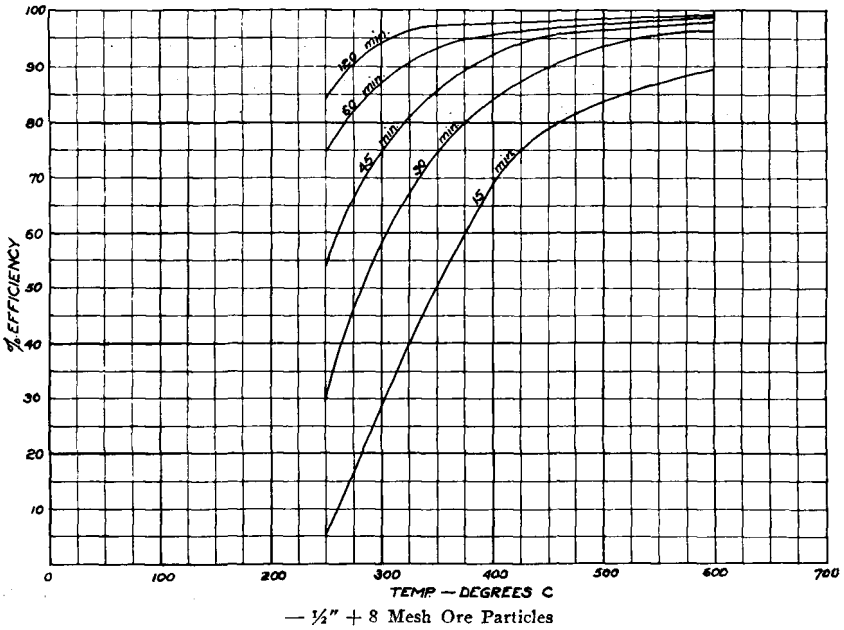
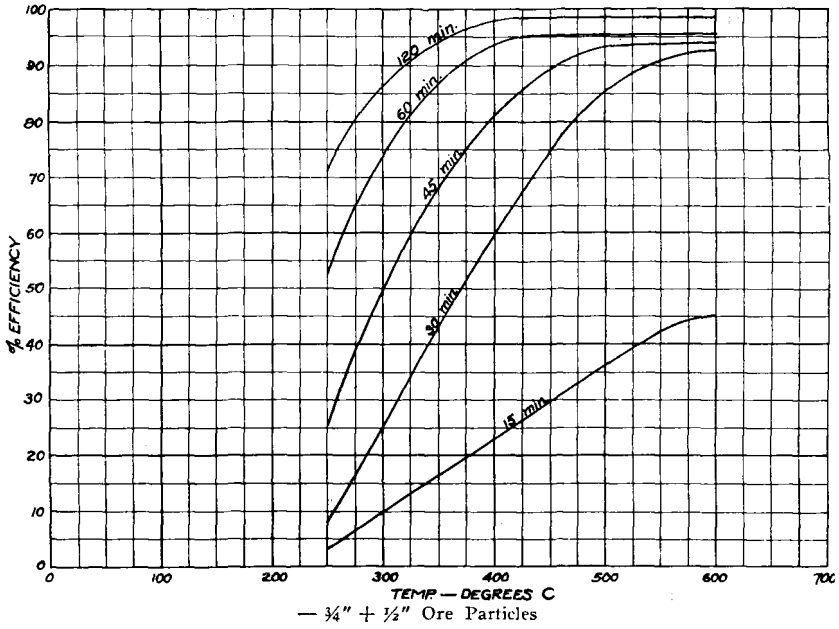


FIGURE 30. MAGNETIC ROASTING EFFICIENCY CURVES

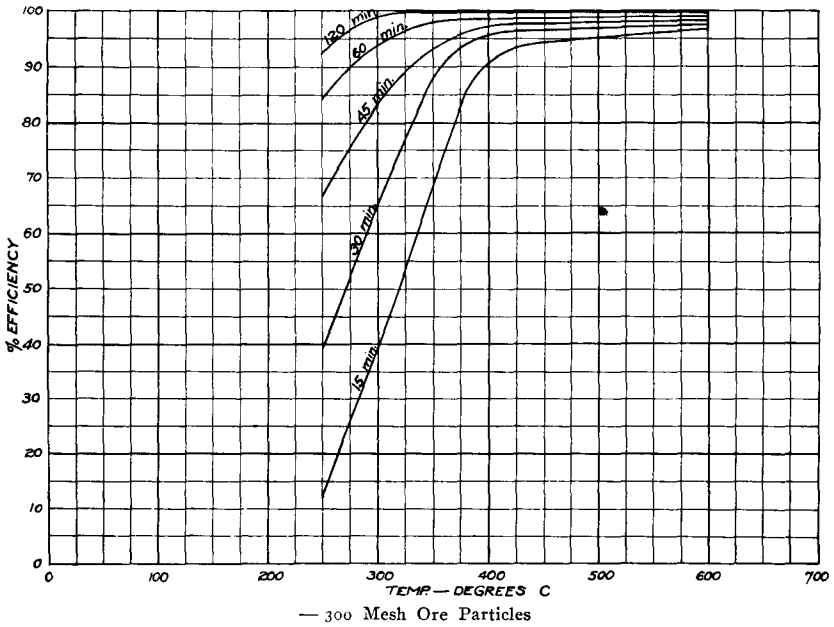
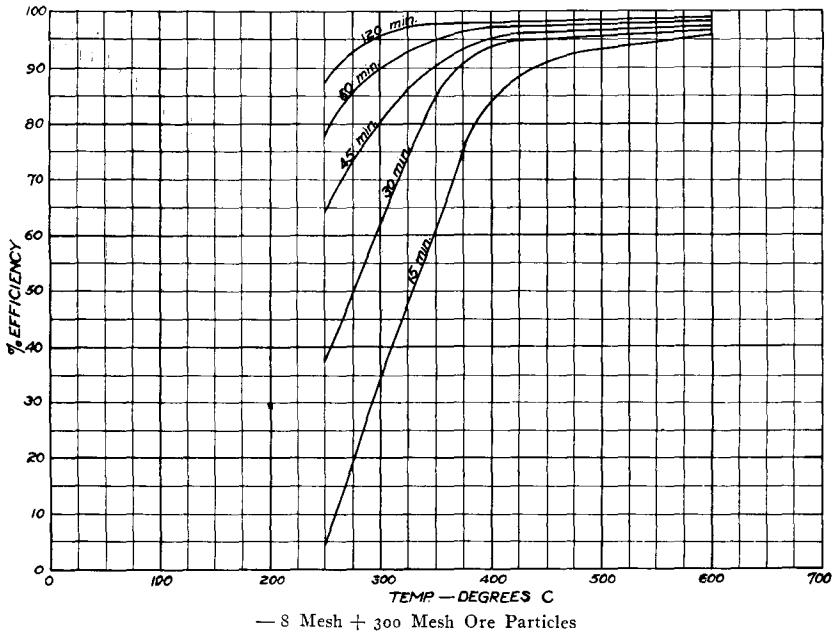


FIGURE 30. MAGNETIC ROASTING EFFICIENCY CURVES

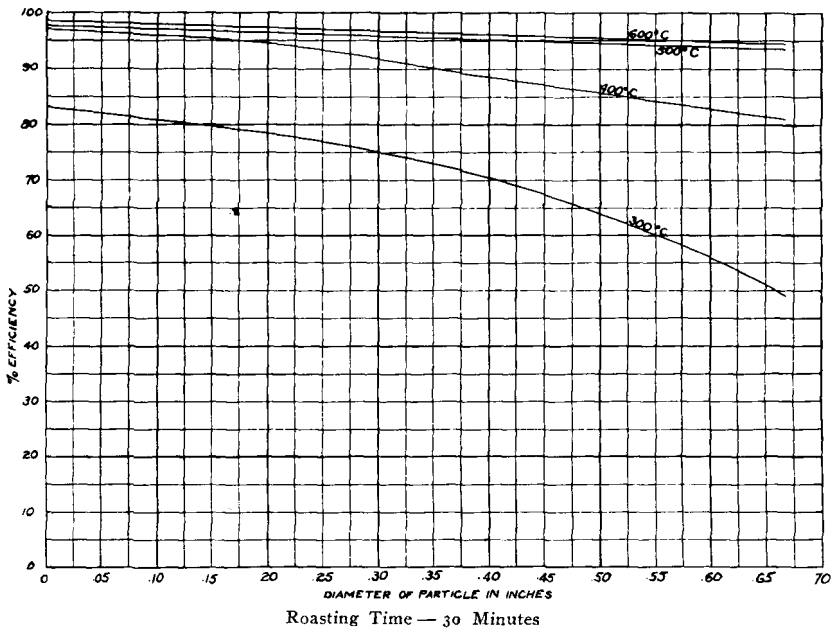
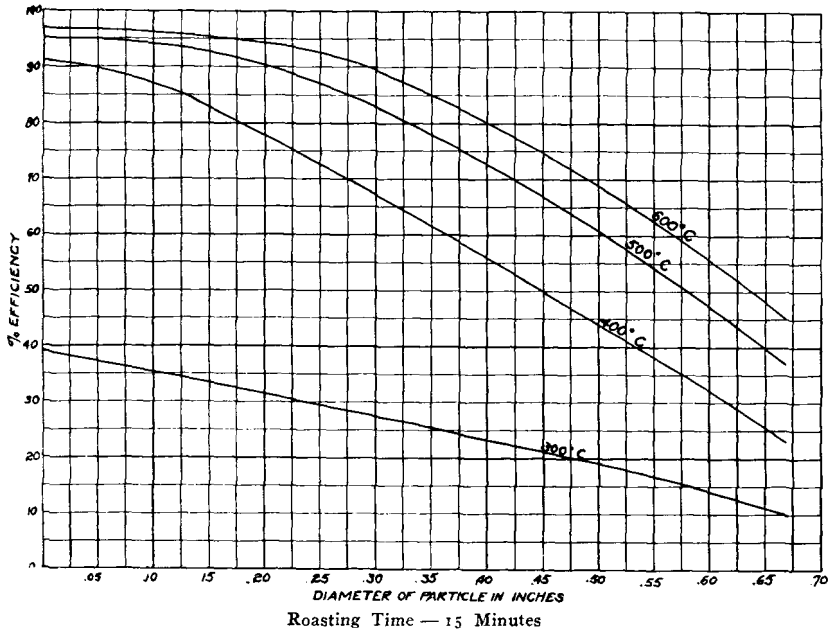


FIGURE 31. MAGNETIC ROASTING EFFICIENCY CURVES

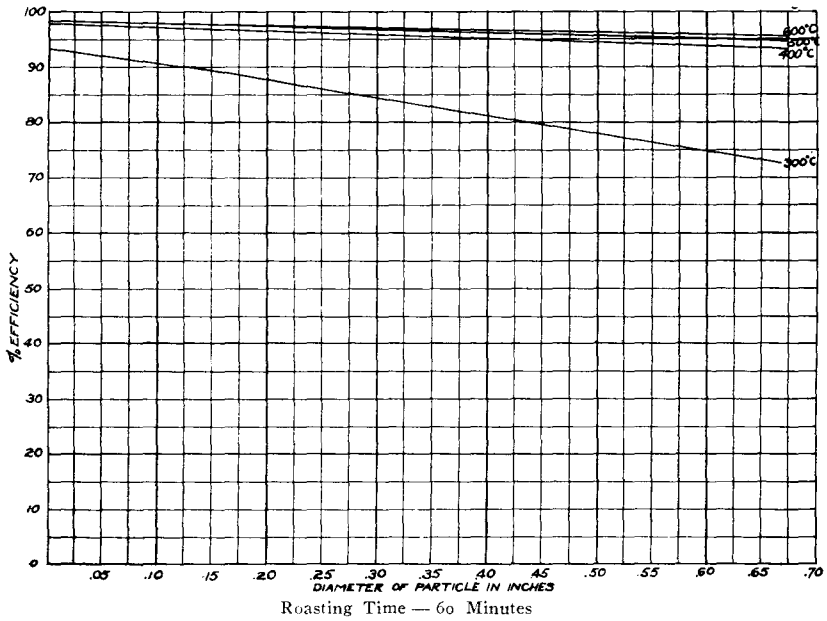
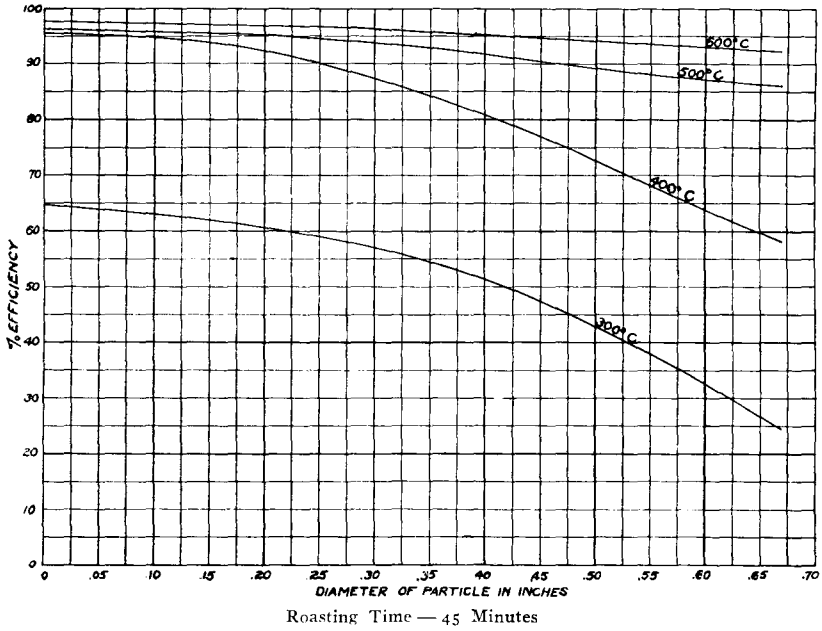


FIGURE 31. MAGNETIC ROASTING EFFICIENCY CURVES

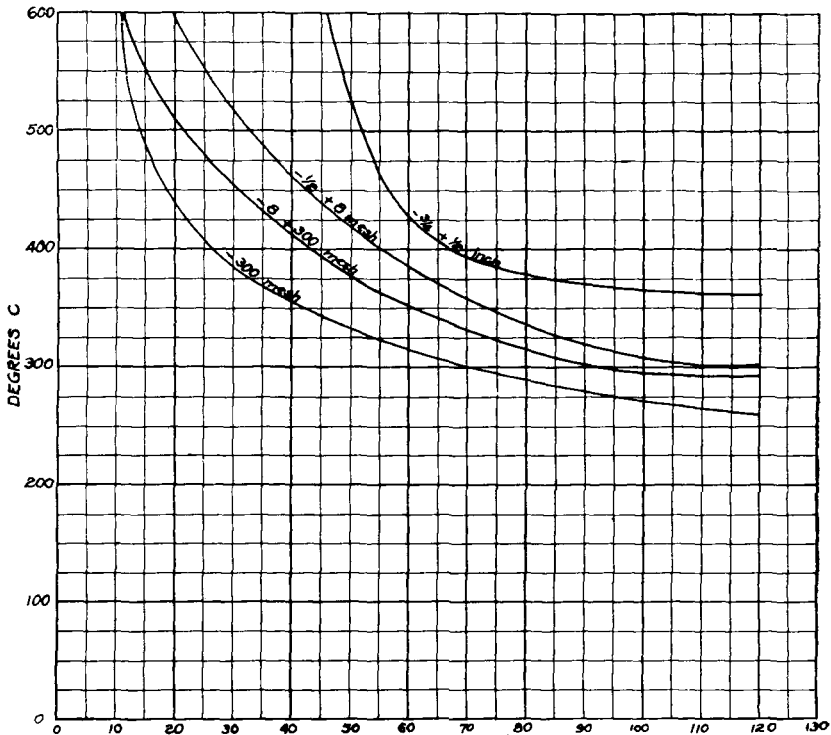


FIGURE 32. CURVES SHOWING CONDITIONS NECESSARY FOR 95 PER CENT EFFICIENCY IN MAGNETIC ROASTING

efficiency secured by use of this gas was so low as to make it practically useless for magnetic roasting. All of the other reducing agents used show high efficiencies and by making slight modifications in the time and temperature of the roast, all of the reducing agents tested with the exception of methane produced satisfactory results. It appears, therefore, that the gas used in reducing the ore should contain as little methane as possible. Carbon monoxide and hydrogen are comparatively cheap gases to manufacture and a mixture of these two will produce very satisfactory results.

In all of the tests made by use of this laboratory apparatus, the duration of the test was taken as the total time the gas was flowing into the drum. At the beginning of the test the drum was full of air and the first gas entering the cylinder was burned by the oxygen in the air. As the test proceeded, the atmosphere within the drum gradually changed from oxidizing to reducing. The rate of flow of the gas was so slow, however, that 30 minutes were required in order to drive all of the air from the cylinder and fill it completely with the

reducing gas. For this reason, if the ore had been heated to the temperature shown and then brought into immediate contact with the undiluted gas, the roasting time would have been very much shorter than indicated in these tests. In actual practice with the continuous roasting processes the ore passes through the furnace and is gradually heated by the burning gases. After it has reached the required temperature it passes to a region of the furnace in which it meets at first very dilute reducing gases and finally practically the pure gas. The conditions in the laboratory tests were, therefore, similar to the conditions met in practice.

As a result of the tests made on the small laboratory equipment the following conclusions may be stated:

1. For efficient and rapid roasting, a temperature above  $400^{\circ}$  C. should be used.
2. A comparatively small increase in temperature changes the efficiency of the roast considerably.
3. By increasing the length of roasting time, the efficiency of the roast is, in general, improved.
4. By decreasing the size of ore particles, the efficiency of the roast is improved but the size of the particles of ore seems to affect roasting conditions less than either of the other two variables.
5. Simple heating of hematite ore to a low temperature in air will not cause any considerable change to the magnetic oxide.
6. The reducing agent used in magnetic roasting should contain as little methane as possible, as this gas produces very inefficient roasting results.

## PART VI

### PRINCIPLES OF MAGNETIC CONCENTRATION

Standard iron ores are generally classed as magnetite, hematite, and limonite. From the previous chapters, it appears that it is possible by simple and effective means to change hematite and limonite into magnetite. Magnetic concentration is therefore applicable not only to the natural magnetic ores, but also to the artificial magnetites which may be produced by roasting hematite and limonite. The concentrating process is the same for either the natural or artificial magnetites and the following description applies to ores of either variety.

The fundamental principles of magnetic concentration are very simple. In order to secure a magnetic separation it is only necessary to bring a magnet into close proximity to particles of ore and then remove the particles that adhere to the magnet. By making the magnet stronger and bringing it nearer the particles of ore, more weakly magnetic material may be drawn to the magnet. In order to apply this process to commercial operations it is necessary to bring the particles of ore continuously under the influence of the magnet and continuously collect the products attached to and discarded by the magnet. A very simple machine will produce satisfactory results if all of the particles of ore are of the same size and if each particle is either clean mineral or clean gangue. Unfortunately this is not usually the condition encountered in ore-dressing problems. When the particles are neither pure mineral nor pure gangue, and when they differ radically in size and shape, the problem of producing a satisfactory separation becomes more complex.

In crushing ore it is not usually possible to produce particles of mineral, a considerable proportion of which are not attached to various sized particles of gangue. In some cases the particles of gangue are very small compared to the particles of mineral, and in some cases the reverse is true. Ordinarily, crushing produces all of the intermediate products ranging from pure mineral to pure gangue. It is therefore not usually desirable to recover all of the mineral as this would necessitate including with the concentrate a large quantity of gangue. It is necessary to decide upon the mineral content of the material that is to be discarded as tailing. The strength of the magnetic field can then be so adjusted that all of the particles rejected as tailing will contain not to exceed the prescribed amount of mineral. The strength of the magnetic field is under such absolute control that this can be accomplished if all of the particles of ore are of the same size.

As the strength of a magnetic field varies directly with the *square* of the distance from the pole, the force with which a particle of ore is attracted by a magnet decreases very rapidly as its distance from the magnet is increased. If it is attracted by a force of 1 pound when it is  $1/32$  of an inch from the magnet, it will be attracted by a force of only  $1/64$  of 1 pound if it is  $1/4$  of an inch from the magnet. When a large particle of ore made up of magnetite and silica is brought into a magnetic field, the magnetic material on the side of this particle farthest from the magnet will not be attracted by the same force as the magnetic material on the side near the magnet. The magnet may not be sufficiently strong to hold this large particle of ore, but a smaller particle containing much less magnetic material may be retained. Increasing the strength of the magnetic field will overcome this difficulty, but this also tends to cause more of the middling to be included with the concentrate. Careful sizing of the ore particles will materially improve the results that may be secured, but this is expensive and troublesome, especially in connection with ores crushed to the finer sizes. In general it may be stated that the greater the range of size of ore particles to be separated by any machine, the poorer will be the metallurgical results. This is not only due to the difference in the force by which particles of different sizes are attracted by the magnet, but is also due to what has been called the mutual attraction between the magnetized particles.

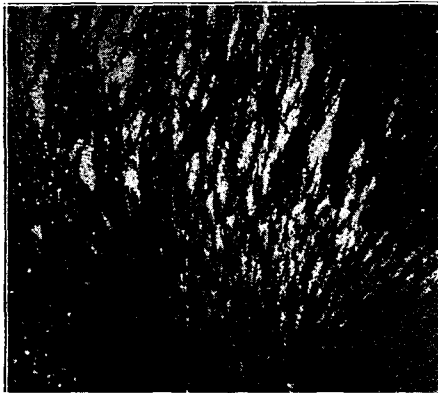


FIGURE 33. MAGNETIC FIELD CONTAINING MAGNETITE AND SILICA

It has been shown that each particle of strongly magnetic mineral in a magnetic field tends to act like a magnet itself and collect a number of smaller particles around it. Each particle tends to attach itself to a number of other particles with the result that the whole magnetic field is filled with a network of fine magnetized particles, all attached





FIGURE 34. ORE PARTICLES OF MAGNETITE AND SILICA

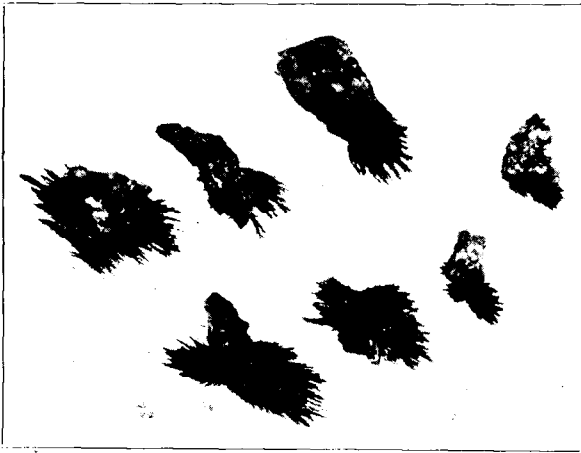


FIGURE 35. MAGNETIZED PARTICLES OF MAGNETITE AND SILICA WITH FINE MAGNETITE ATTACHED

to one another. In Figure 33 the magnetic field contains particles of silica as well as magnetite. It appears that much of the silica is completely surrounded by particles of magnetite, and that if the particles of silica are to be removed, the chains of magnetic particles surrounding the silica must first be broken. This tendency for the magnetic particles in a field to entrain the non-magnetic particles, seriously interferes with the magnetic separating process. Furthermore, the strongly magnetic particles tend to retain their magnetic characteristics

when removed from the field. These particles become permanent magnets, and even the removal from the magnetic field will not cause them to separate sufficiently to liberate the non-magnetic particles. Figure 34 shows a number of particles of ore that have not been crushed sufficiently fine to free the magnetite from the silica. Figure 35 shows these particles after they have been magnetized and dusted over with fine particles of magnetite. A large amount of fine magnetite is seen to be attached to the magnetic portions of each of the larger particles. It will be seen that the original particles appear to be about one-half magnetite and one-half silica, but because of the collection of the smaller particles of magnetite, the mass of particles has become possibly three-fourths magnetite and one-fourth silica. The large particles of ore that are one-half silica can not easily be discarded by the magnet without losing the attached particles of fine magnetite.

When crushed ore containing magnetic and non-magnetic minerals is brought into a magnetic field, there are two important effects: first, the magnetic particles mutually attract one another and entrain considerable non-magnetic material; and second, each magnetic particle, and therefore the mass of entrained non-magnetic particles, tend to move toward the controlling magnetic pole. When the majority of the particles are small, mutual attraction causes the mass as a whole to act as a single particle. There are, therefore, two primary methods for effecting magnetically a separation of the magnetic from the non-magnetic particles. The first is by use of the attraction of the individual particles by the controlling magnets, the non-magnetic particles being allowed to drop away. This method is primarily applicable to ore in which fine material does not predominate. The second method is by use of the mass-action principle, the whole mass of material being held by the controlling magnet while the particles are agitated sufficiently to allow the non-magnetic material to free itself. This method of concentration is primarily applicable to material all of which has been crushed fine. This discussion applies particularly to the more strongly magnetic minerals. In attempting to separate magnetically the more weakly magnetic minerals the magnetic fields are not usually sufficiently strong to make the mass action important, and therefore the direct attraction method is usually employed.

## PART VII

### MAGNETIC CONCENTRATING MACHINERY

There are two general types of magnetic concentrating machines, namely, (1) those in which the particles are acted upon more or less separately by the magnets, the magnetic particles being retained and the non-magnetic particles being allowed to fall away; and (2) those in which the mass action predominates and in which the non-magnetic material is freed by strongly agitating the mass of particles in the magnetic field.<sup>14</sup> The first type is used on coarsely crushed ores or upon ores from which the fine material has been removed by screening and classifying, and the second type is used almost exclusively on finely crushed ores.

Machines of the first class in general use in this country are similar to the magnetic cobber and grader illustrated in Figures 47 and 49. If the ore is coarse and the particles are of nearly uniform size, satisfactory results may be secured by using machines similar to the magnetic grader in which the magnets revolve. The magnetic head pulley, largely used for removing tramp iron from material being fed to crushers, is a machine of this type. In this kind of machine there is no relative motion between the particles of ore and the magnetic fields. In the magnetic cobbers the magnets are stationary and the ore is drawn across the magnetic poles on the surface of a drum or conveyor belt. As the particles of ore pass the magnetic poles, they receive a shaking action which tends to free the entrained and adhering particles of gangue from the magnetic material. This shaking action is due entirely to the rapid movement of the particles of ore from one polar region to another and no mechanical agitation is usually required. On account of this motion of the particles in the magnetic field, ore can be concentrated successfully, without accurate sizing, on machines employing this principle. The capacity of these machines decreases rapidly as the amount of fine material in the feed increases, but satisfactory separations can be made upon ore crushed through 6 mesh (.131-inch opening) and in some specially designed machines still finer

<sup>14</sup> A third type of concentrator may be mentioned which includes those machines in which the polarity of the magnets is rapidly and continuously reversed. In these concentrators each particle of magnetic material is acted upon by a force which causes it to move independently in a definite direction out of the magnetic field. This movement is due to induced magnetism, caused by the rapidly reversing magnetic fields and is similar to the reaction which causes the rotor of an induced motor to revolve. These rapidly reversing magnetic fields are produced by using alternating electric currents for energizing the magnets. The operation of these alternating current magnetic separators is very spectacular and mystifying, but they have certain fundamental limitations which at the present time exclude them from consideration in the concentration of iron ore.

feeds are used. This principle of using alternately north and south magnetic poles to produce a shaking action of the particles of ore being concentrated is one of the most valuable additions to the art of magnetic concentration that has ever been made. The efficiency of this shaking action in cleaning the ore appears to depend upon the range of sizes rather than upon the actual size of the particles. As an example of this, it has been found that a satisfactory separation of minus 100 mesh material can not be made by machines of this type in which the particles of ore are agitated by the use of the alternating magnetic pole principle alone. If, however, the very fine slime is removed from this minus 100 mesh ore, the wet cobber illustrated in Figure 41 will effectively separate the magnetic from the non-magnetic minerals in the minus 100 mesh sand.

Machines of the second class, in which the mass action predominates, while not at the present time in such general use as those of the first class, are applicable to the concentration of a greater variety of ores. In these machines the ore is held in the magnetic field while it is violently agitated by streams of water or by mechanical agitators. This agitation is sufficiently violent to break up the chains of magnetic particles and allow the non-magnetic material to be carried away. In the magnetic log-washer illustrated in Figure 44 the agitation is entirely mechanical, whereas in the Gröndal separator as operated at some plants, the agitation is produced both by the use of the alternating pole principle and by use of strong water currents. Machines of the second class are of relatively small capacities when compared upon a tonnage basis with the machines of the first class but when compared upon the basis of the number of particles treated in a given time, machines of the second class have by far the greater capacities. The fineness of grinding does not limit the action of separators of this type. In general, the finer the ore is crushed the better the separation that can be made. In most concentrating processes the fine slimes can not be successfully treated, but the magnets will collect the particles of magnetite, no matter how finely they may be pulverized.

The possibility of magnetically separating various minerals has been recognized for many years, and at the present time over one thousand United States patents have been granted on magnetic concentration machines. A great many of these machines have never been manufactured, but there are now on the market a number of machines for performing various classes of work. No description of the various designs will be attempted in this bulletin, but the following list contains references to complete descriptions of some of the machines that have been used in this country. The general type of the machine is also noted in this list.

- Wetherill,—high intensity—dry. *Trans. A. I. M. E.* 26: 251.  
 Ball-Norton,—low intensity—dry. *Trans. A. I. M. E.* 19: 187.  
 Dings,—high and low intensity—dry. *E. and M. J.* 81: 749.  
 Edison,—low intensity—dry. *E. and M. J.* 46: 481.  
 Gröndal,—low intensity—wet. *I. T. R.* Feb. 11, 1909.  
 Knowles,—low intensity—dry. *Trans. A. I. M. E.* December, 1904.  
 Buchanan,—low intensity—dry. *Trans. A. I. M. E.* 18: 737.  
 Westrom,—low intensity—dry. *Trans. A. I. M. E.* 17: 737.  
 Monarch,—low intensity—dry. *Trans. A. I. M. E.* 17: 270.  
 International,—high intensity. *Canadian Mining Institute.* 7: 270.

See also

- Richards. *Ore Dressing*, 3: 1521.  
 Walter Ingalls, Report of the Zinc Commission of Canada, 1906, page 108.

#### MAGNETIC CONCENTRATING MACHINES AT THE MINES EXPERIMENT STATION

In order to investigate the possibility of magnetically concentrating the Minnesota low-grade iron ores, it was necessary for the Mines Experiment Station to provide itself with various magnetic concentrators and certain auxiliary machines. As the Station is called upon to make tests upon a great variety of ore samples, varying in size from a few ounces to several tons, it was necessary to provide machines of different capacities as well as of different types. Since some of these machines have unique features, and since the installation of them may be of interest, a complete description of each magnetic separator is given.

#### MAGNETIC TUBE CONCENTRATOR

This machine was constructed for the purpose of concentrating small, finely crushed samples of ore containing ferro-magnetic minerals. It consists of a strong "C" shaped electromagnet, between the poles of which a glass tube is supported at an angle of about 45°. Water flows through a rubber hose and a regulating valve into the upper end of the glass tube and is discharged from the lower end through a short rubber hose also provided with a regulating valve. After the tube has been filled with water and the sample of ore to be concentrated has been poured into the tube, a rubber stopper is placed in the upper end of the tube. The valve at the lower end of the tube may then be opened and the wash-water turned on. If the rubber stopper is air-tight, the water level in the tube will remain constant at all times. The tube is free to slide up and down between the poles of the magnet, this motion being imparted to it by a small motor-

driven actuating mechanism. Figure 36 is a diagrammatic drawing of the complete installation and Figure 37 is a photograph of the machine.

#### METHOD OF OPERATION

The operator pours the sample of ore to be concentrated into the glass tube as it rests between the poles of the magnet. The sample, weighing between 5 and 10 grams, is usually crushed to pass 100 mesh, but material as coarse as 8 mesh can be concentrated in this machine. The sample settles down through the water in the tube until it reaches the poles of the magnet; here it is held firmly against the sides of the glass tube by magnetic attraction. The rubber stopper is then placed in the upper end of the tube and the wash-water is turned on. Then by causing the tube to move up and down a few inches and at the same time to rotate through a small angle, the particles of magnetite are rolled over and over and the non-magnetic material is gradually liberated and carried away by the water. When the sample is seen to be clean, the tube is removed from the magnet and the concentrate is drawn off, dried, weighed, and assayed. The tailing is caught in an evaporating pan and is also dried and assayed. By making the poles of the magnet very strong, the magnetic particles are held so tightly against the sides of the tube that the possibility of error due to improper manipulation is small. Results can be checked with a fair degree of accuracy. At the Mines Experiment Station it has been found necessary to use distilled wash-water in this machine. The Minneapolis city water contained a sufficient amount of solids to cause considerable error in the results secured by its use. This was not found to be true in Duluth, however, where a great many samples were treated on machines of this type.

These machines are very satisfactory laboratory units and are almost indispensable where work is being done on finely ground magnetic ores. From the results secured by use of this machine it is possible to determine not only the amount of magnetic material in the sample of ore, but also the grade of concentrate that can be made when the ore is crushed to various sizes. The whole operation may be readily observed through the side of the glass tube and the washing may be continued until the desired separation has been completed. If a weighed sample is charged into the machine, practically all of the material can be accounted for by weighing the dry concentrate and tailing.

This apparatus was the result of a large amount of experimental work performed in an endeavor to secure a satisfactory method for quantitatively and qualitatively testing finely crystalline magnetite-bearing rock. The use of this machine brought out the fact that in the natural as well as the artificial magnetites some iron always exists in non-magnetic forms. This iron can not be recovered by magnetic concentration, and therefore a chemical analysis showing soluble or total iron may account for considerably more material than can actually be recovered magnetically. In all of the magnetite ores examined some iron has been found to exist as an iron silicate, and, as previously shown, a chemical analysis for iron existing as  $\text{FeO}$  can not be used to compute the amount of magnetic material recoverable by magnetic separators. The magnetic tube concentrator is a very valuable machine for the study of finely crystalline magnetic ores, as it may be used to produce what has been called the "magnetic iron assay" of a sample.

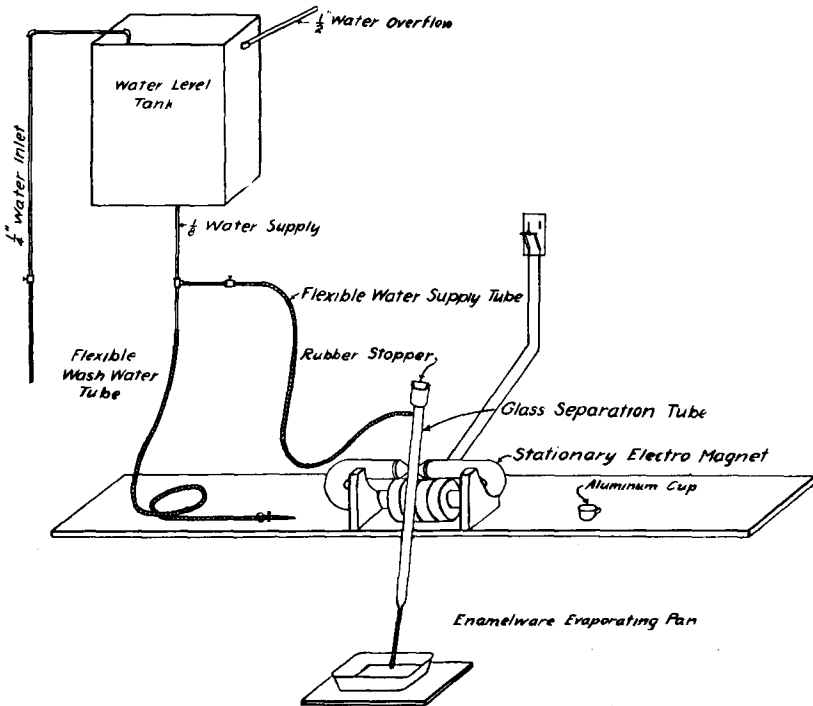


FIGURE 36. MAGNETIC TUBE CONCENTRATOR INSTALLATION

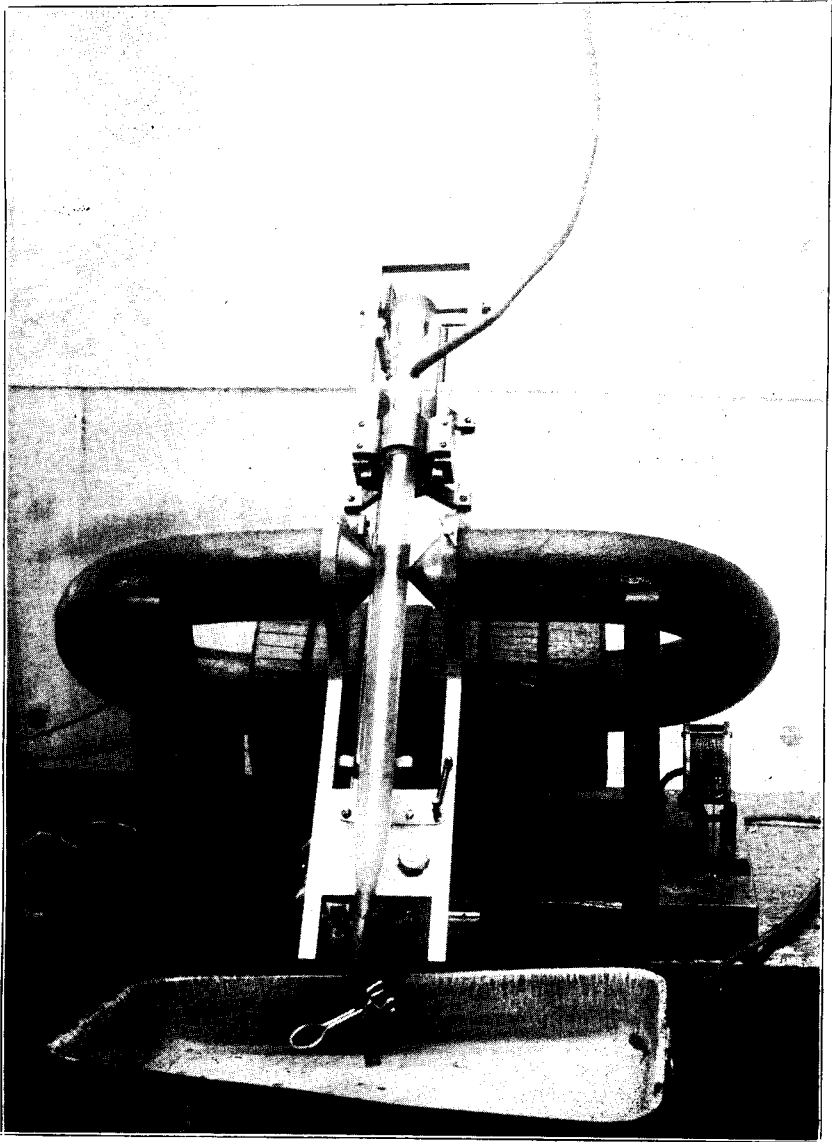


FIGURE 37. PHOTOGRAPH OF THE MAGNETIC TUBE CONCENTRATOR



## THE MAGNETIC IRON ASSAY

The total iron assay of a sample is represented by a number which shows the percentage by weight of the sample that is iron. The soluble iron assay of a sample is represented by a number which shows the percentage by weight of the sample that is iron in a state such that it is soluble in hydrochloric acid. In a similar way, the magnetic iron assay of a sample is represented by a number which shows the percentage by weight of the sample that is iron in a state such that it is attracted by an ordinary low-power magnet.

In order to determine the magnetic iron assay of a sample the ore is crushed to pass a 100-mesh screen and dried at 212° F. A 10-gram sample of this ore is then fed into a glass tube, in which it is carefully washed and freed from all non-magnetic material. The concentrate and tailing thus made are dried, weighed, and assayed for soluble iron as is also a sample of the original feed. It is then assumed that all of the soluble iron in the concentrate is in the magnetic state and all of the soluble iron in the tailing is in the non-magnetic state. This is not exactly true, for a small portion of the iron in the tailing will be magnetic and a small portion of the iron in the concentrate will be non-magnetic. Careful investigation, however, has proved that these portions of iron are exceedingly small and also that they tend to counteract one another in any computation. The assumption that the soluble iron assay of the magnetic tube concentrate accounted for all of the iron existing in the sample in the magnetic state has proved to be sufficiently accurate for all ordinary purposes.

The soluble iron assay of the magnetic portion of the ore which forms the concentrate must be recomputed to the basis of the whole original sample in order to show the proportion of the feed that is magnetic iron. This is done by multiplying the concentrate assay by the proportion of the original sample that appears in the concentrate. The result of this computation is called the magnetic iron assay of the sample. The portion of the original sample appearing in the concentrate may be computed from the weights, or may be computed from the chemical assays. This latter method is usually considered more accurate, and the actual weight recovered is used only as a check against the computed recovery. The formula for computing from the assays the per cent weight of the ore recovered as concentrate, may be written as follows:

(Per cent sol. Fe in the crude)—(per cent sol. Fe in the tailing)

---

(Per cent sol. Fe in the conct.)—(per cent sol. Fe in the tailing)

× 100 = per  
cent of ore  
recovered as  
concentrate(1)

The magnetic iron assay of the ore is computed from the formula:

$$\frac{(\text{Per cent conct. recovered}) \times (\text{per cent sol. Fe in the conct.})}{100} = \text{per cent magnetic iron assay (2)}$$

An illustration may make this method of analysis and computation better understood. Consider a sample of ore assaying 28.35 per cent soluble iron when crushed to —100 mesh. Ten grams of this sample are passed through the magnetic tube concentrator and a concentrate and tailing are produced. The concentrate when dried weighs 4.127 grams and assays 63.52 per cent soluble iron. The tailing assays 4.62 per cent soluble iron. Then by formula number (1):

$$\frac{28.35 - 4.62}{63.52 - 4.62} \times 100 = 40.32 \text{ per cent, which is the recovery of concentrate as computed from the assays.}$$

As the original sample weighed 10 grams, the concentrate recovered should weigh 4.032 grams, which figure should check the actual weight of concentrate recovered or 4.127 grams. The difference is seen to be .095 grams, a check which is considered fairly close. If the actual weight does not check the computed weight within .25 grams, the sample should be discarded and a new test made. As shown above, 40.32 per cent of the original sample assayed 63.52 per cent soluble iron and represented all of the magnetic iron in the original ore. Then

$$\frac{40.32 \times 63.52}{100} = 25.62 \text{ per cent, which is the magnetic iron assay of the original sample.}$$

This assay is used as the basis of all calculation, since it is only the iron represented by this assay that can be influenced by the magnetic separating machinery. The magnetic iron assay of the sample is always lower than the total or soluble iron assay of the sample, and no estimate of the magnetic iron can be made by considering only the soluble or total iron assay.

This method of securing the magnetic iron assay of a sample can not be applied indiscriminately. In some ore, crushing to 300 mesh (.0017-inch opening) or even finer may be necessary, but for ordinary iron ores that contain either natural or artificial magnetite this method has been found to be satisfactory and absolutely essential for the intelligent study of results. Many thousands of determinations on both natural and artificial magnetite ores have been made by this method, and manipulation has been reduced to a very simple process. The tube test not only determines the magnetic iron assay, but also shows the amount and grade of concentrate that can be made from the ore with 100-mesh (.0058-inch opening) grinding.

## DRY MAGNETIC SEPARATOR FOR LABORATORY TESTS

A dry magnetic separator was constructed for the purpose of testing small samples, one to twenty-five pounds, in order to determine the possibility of dry magnetic concentration at coarse sizes. This machine is a combination of the Ball-Norton belt and drum type machine. Figure 38 is a diagrammatic sketch showing the relation of the various magnets and the path of travel of the ore. The ore is conveyed past the magnets on a thin brass belt. These magnets are so arranged that the particles of ore are at first subjected to a very strong field, which allows only the ore containing no magnetic mineral to be discarded. These particles fall into the first compartment of the receiving box. The ore is then rapidly reversed in polarity as it passes beneath the different polar regions, each of which is a little weaker than the preceding one. Only the most strongly magnetic particles are carried to the last magnet and thence to the last compartment of the receiving box. The compartments in the receiving box, between the first and last, receive the middling products, graded in magnetic iron content from the very lowest to the very highest. By use of this machine, in one operation, a small sample may be divided into several parts of varying magnetic iron content.

Figure 39 is a photograph of this dry magnetic separator. It is adapted to work on samples of ore that do not contain a large amount of material finer than 100 mesh (.0058-inch opening). Ore crushed to one-half inch can be successfully treated on this machine, but it is not adapted to handle material of a much coarser size. The ore is fed by hand through the feed hopper, as evenly as possible, the feed being maintained at a low rate in order to allow the individual particles to separate on the belt. The object of the alternating poles is to impart to the particles a shaking motion, due to the attraction of first one pole and then another, as the ore is carried along on the underneath side of the belt. This shaking action tends to liberate the entrained particles of gangue and therefore to produce a more complete separation of the minerals. The machine is very convenient for determining the possibilities of magnetically concentrating dry ore at sizes between  $\frac{1}{2}$  inch and 100 mesh (.0058-inch opening). It also shows the amount of low-grade material that can be discarded after crushing to any desired size, altho a finished concentrate may not be produced. It may be necessary to recrush the partially concentrated material and re-treat it upon this machine or upon machines of a different type, in order to produce the desired grade of concentrate.

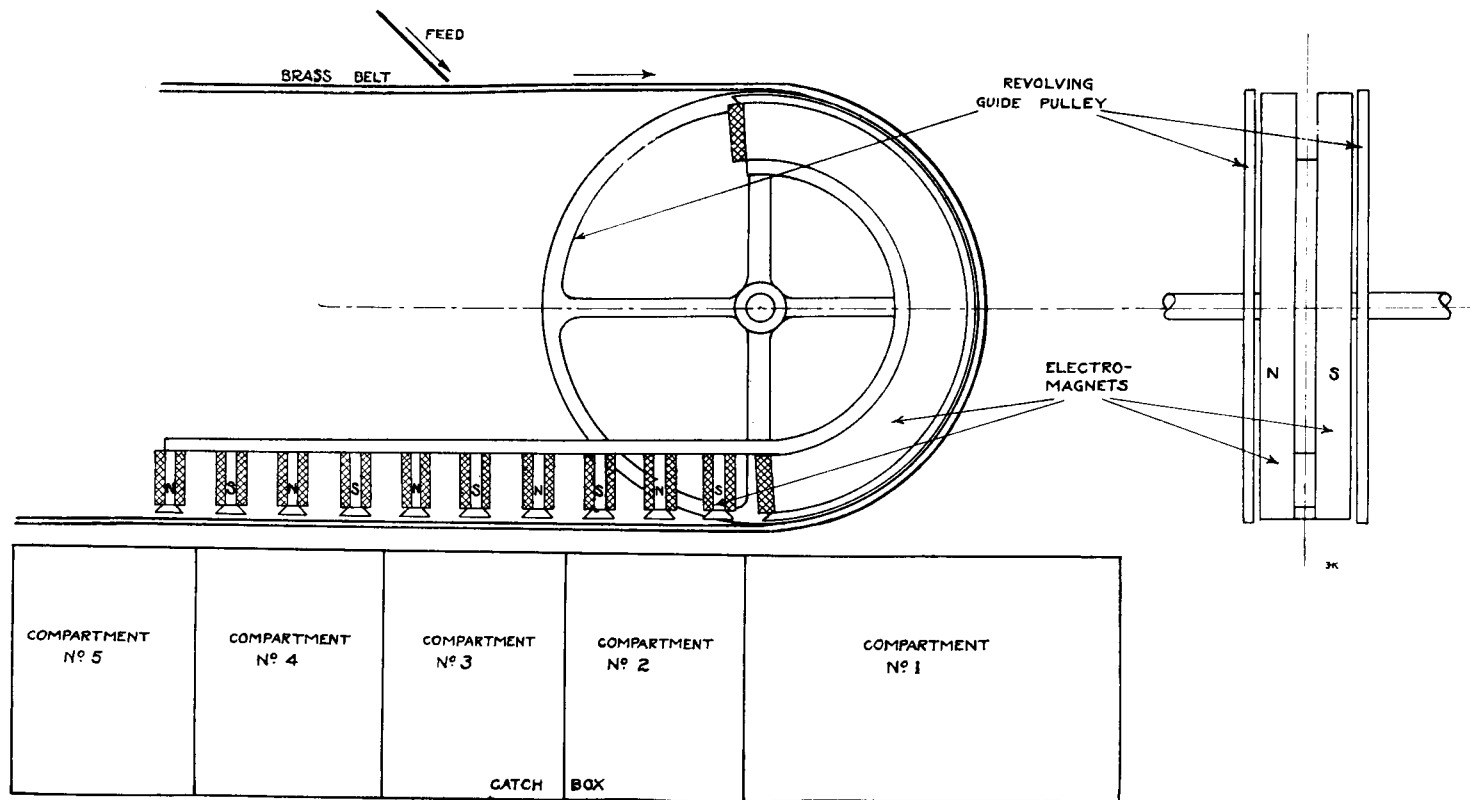


FIGURE 38. DIAGRAMMATIC DRAWING OF LABORATORY DRY MAGNETIC COBBER

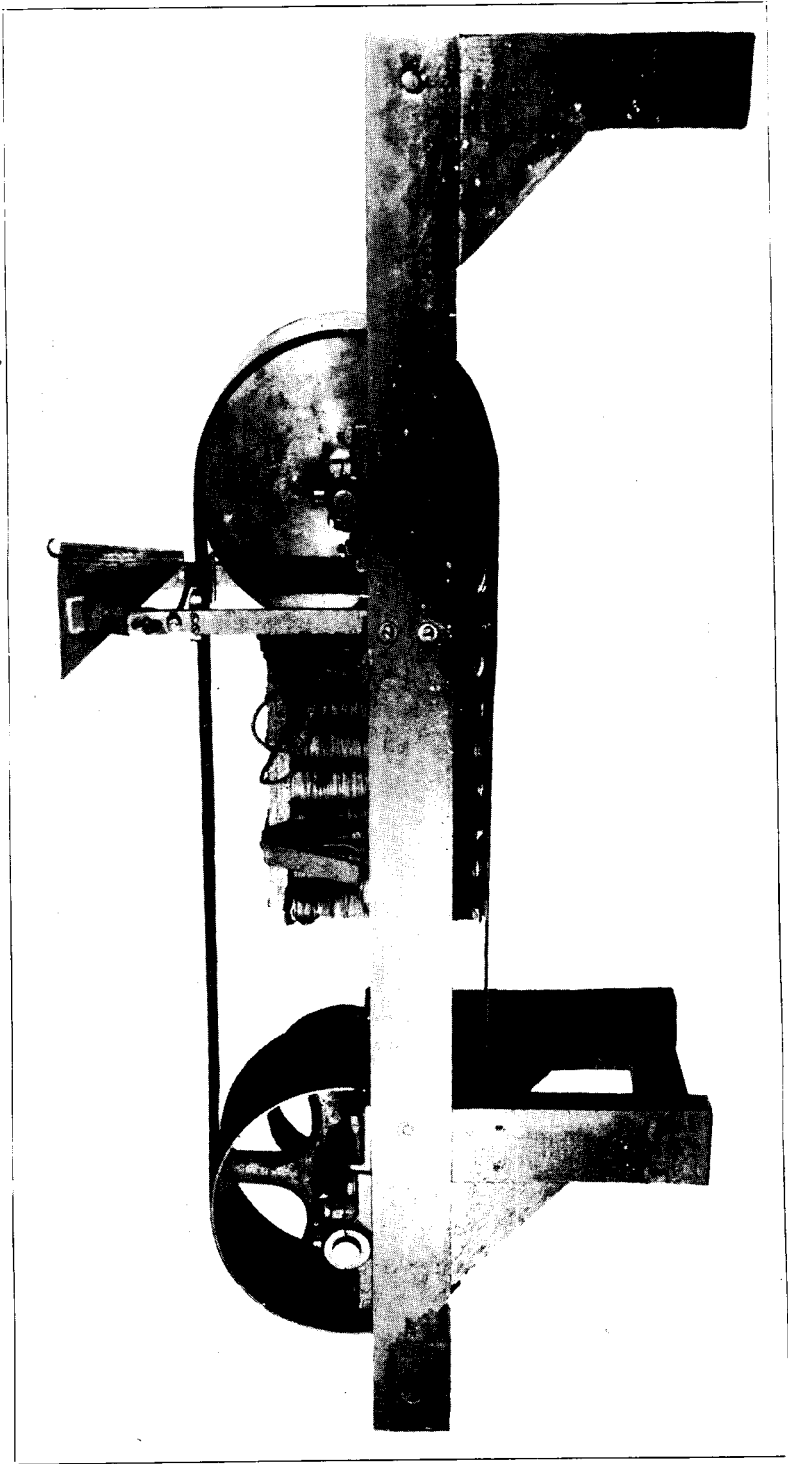


FIGURE 39. PHOTOGRAPH OF LABORATORY DRY MAGNETIC COBBER

## THE WET COBBER

When it is desired to make a magnetic separation of sandy magnetite-bearing material by a wet process the wet cobber is a very convenient and effective machine. This machine, like the dry cobber, works best on ore containing a minimum of material finer than 100 mesh (.0058-inch opening), but ore as coarse as  $\frac{1}{2}$  inch can be fed to it. It is best adapted, however, to work upon material between 8 mesh and 100 mesh (.0058-inch opening) from which the slimes have been removed.

This machine is a modification of the Ball-Norton drum type separator, the chief difference being that the lower one third of the drum is submerged in a tank of water. A diagrammatic sketch of this machine is shown in Figure 40. The ore is fed to the top of the revolving drum and at once enters the magnetic field. Because of the surface tension of the water no separation is made above the water level, but as soon as the ore enters the water the reversing poles cause the non-magnetic material to be liberated and washed away. After emerging

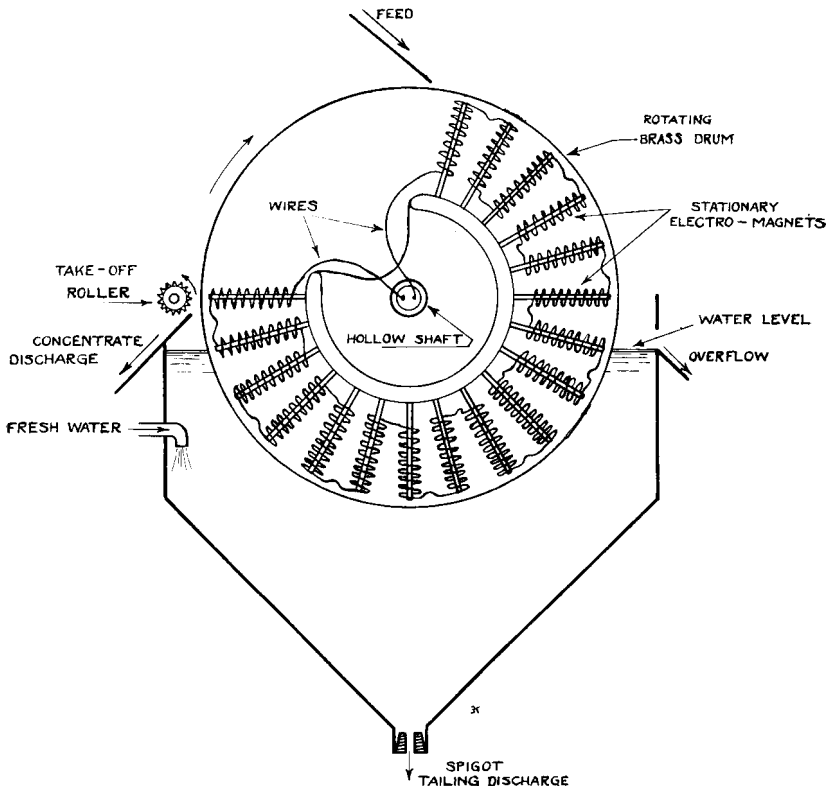


FIGURE 40. DIAGRAMMATIC DRAWING OF WET COBBER

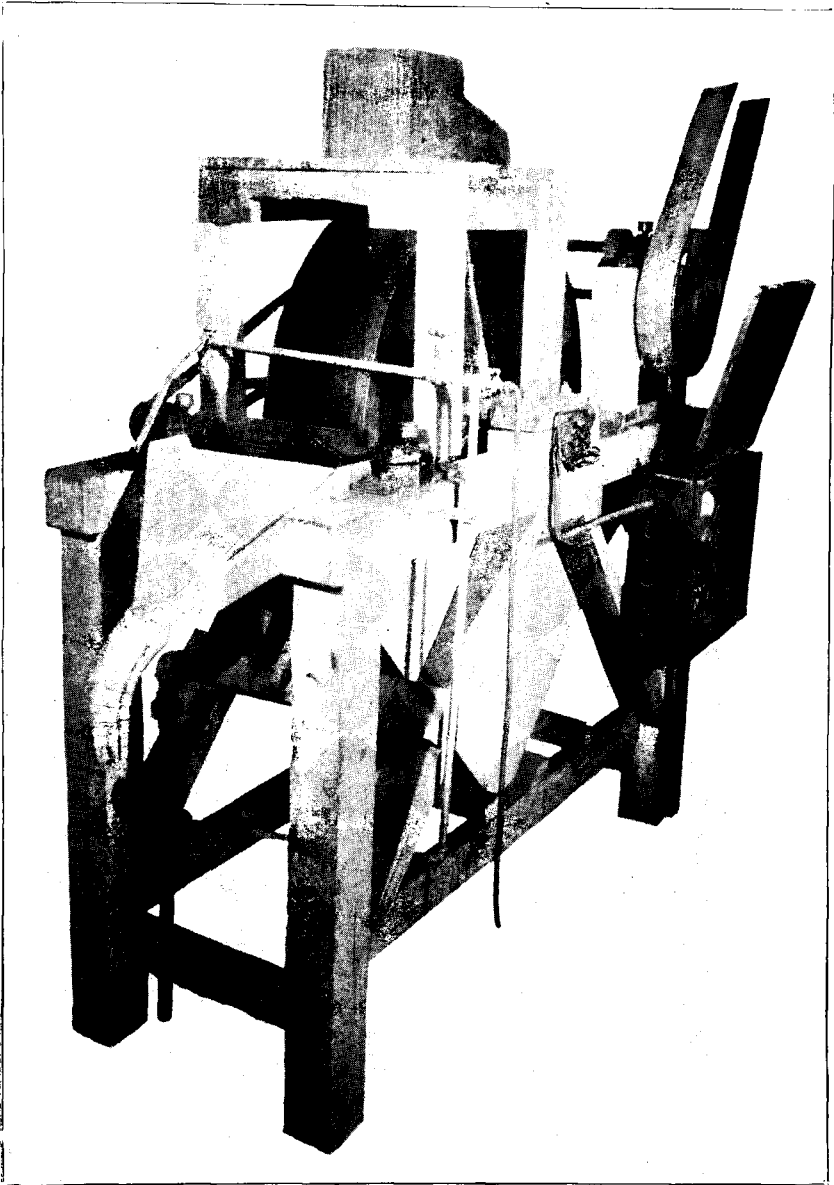


FIGURE 41. PHOTOGRAPH OF WET COBBER

from the water the ore is carried by the revolving drum to a position between the last magnet and the small roller. This roller, which is made of steel shafting carrying longitudinal slots, becomes a strong, induced magnet. This is due to the fact that it is of small diameter and is in rather close proximity to a strong magnet having a comparatively wide face. The result is that the particles of ore leave the drum and attach themselves to the roller. The roller is revolved at a rate of speed such that the centrifugal force immediately throws off the particles and they are collected, in a comparatively dry state.

Figure 41 is a photograph of this machine. Above the revolving copper drum the feed box is shown. Wet ore enters this feed box and flows evenly over the surface of the revolving drum. Water enters the tank at the concentrate discharge side and is discharged with the tailing through the spigot in the bottom of the tank or overflows at the opposite end of the machine. A little water is usually added to the surface of the drum above the "take off roller" in order to clear the drum of any accidental pieces of ore that may adhere to it. The drum of this machine has a 6-inch active face and is 36 inches in diameter. It revolves at about 40 revolutions per minute, and the "take off roller" runs at 400 revolutions per minute. The machine is adapted to work on samples weighing from 20 to 1,000 pounds.

#### MAGNETIC LOG-WASHER

As the name implies, this machine is similar to the log-washers now in common use in the Lake Superior district. Magnets have been applied to the lower side of the machine in such a manner as to place the whole bottom of the trough in a magnetic field. Figure 42 is a diagrammatic drawing of this machine. From this drawing its similarity to the log-washers may be easily recognized. This machine is

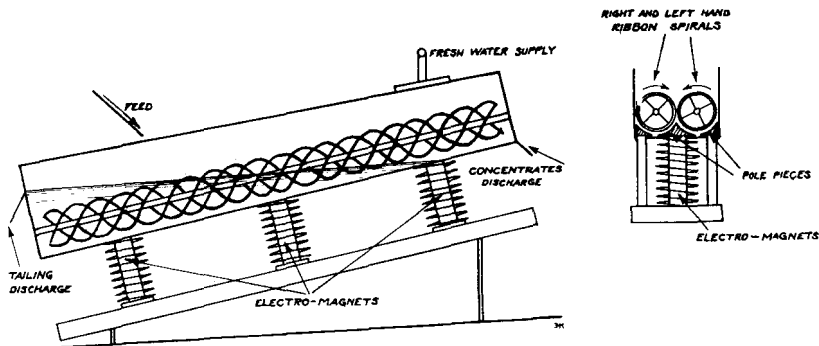


FIGURE 42. DIAGRAMMATIC DRAWING OF MAGNETIC LOG-WASHER



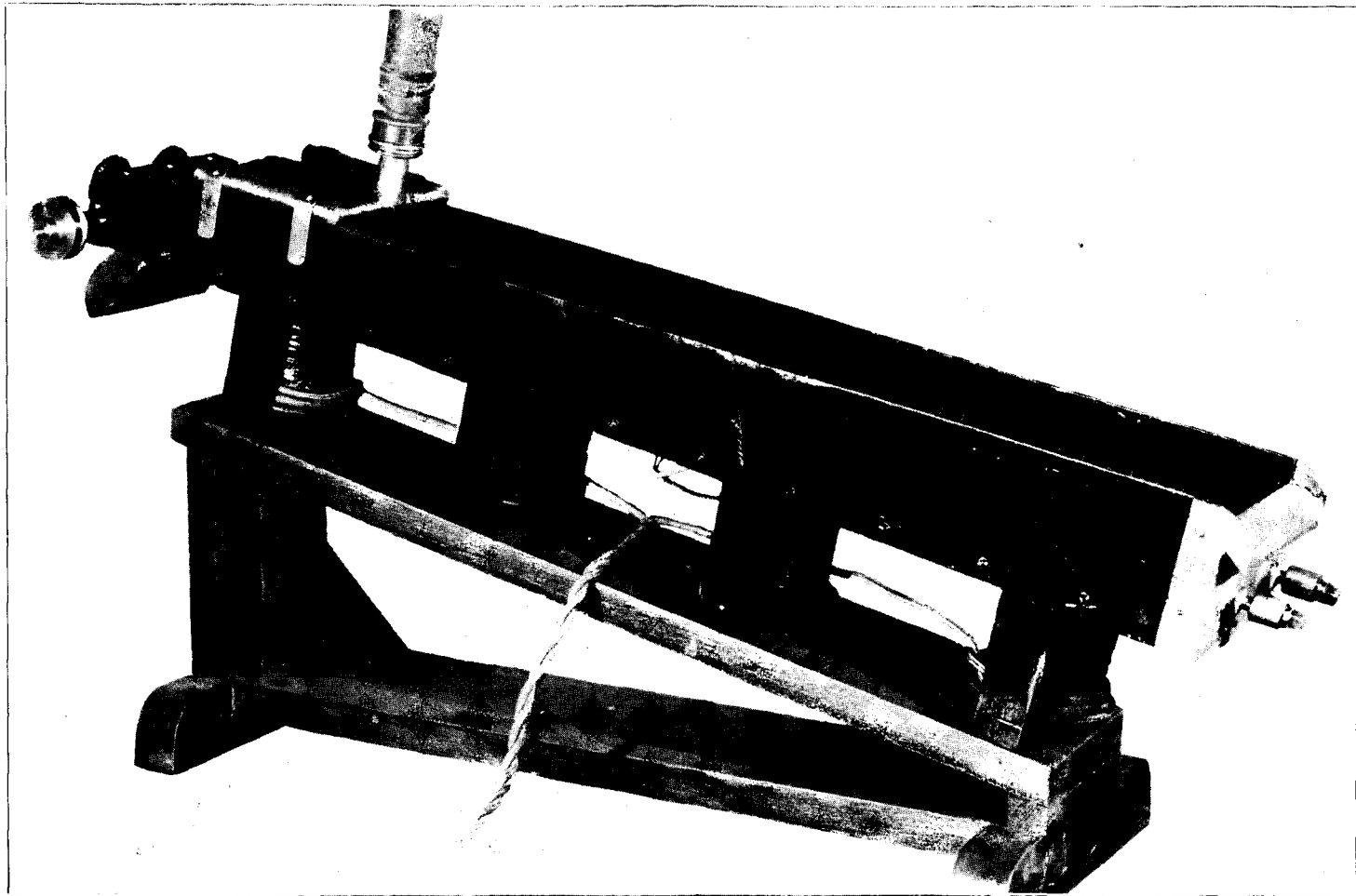


FIGURE 43. PHOTOGRAPH OF 24-INCH MAGNETIC LOG-WASHER

adapted to the concentration of finely ground ores, preferably 48 mesh (.0116-inch opening) or finer. The finer the ore is crushed, the better the machine operates. The ore in either a dry or wet state is fed to the machine at the point indicated in the drawing, and, after sinking into the water, at once enters the magnetic field. The magnetic particles, together with the entrained non-magnetic particles, are drawn to the bottom of the machine, where they cling not only to the magnets but to each other as well. As a result of mass action the screw conveyor readily stirs and conveys the ore, while the wash water added at the upper end of the machine flows through the mass toward the overflow at the lower end, carrying away the non-magnetic particles as rapidly as they are liberated. The clean concentrate is carried up the incline by the screw conveyor and is discharged from the upper end of the machine.

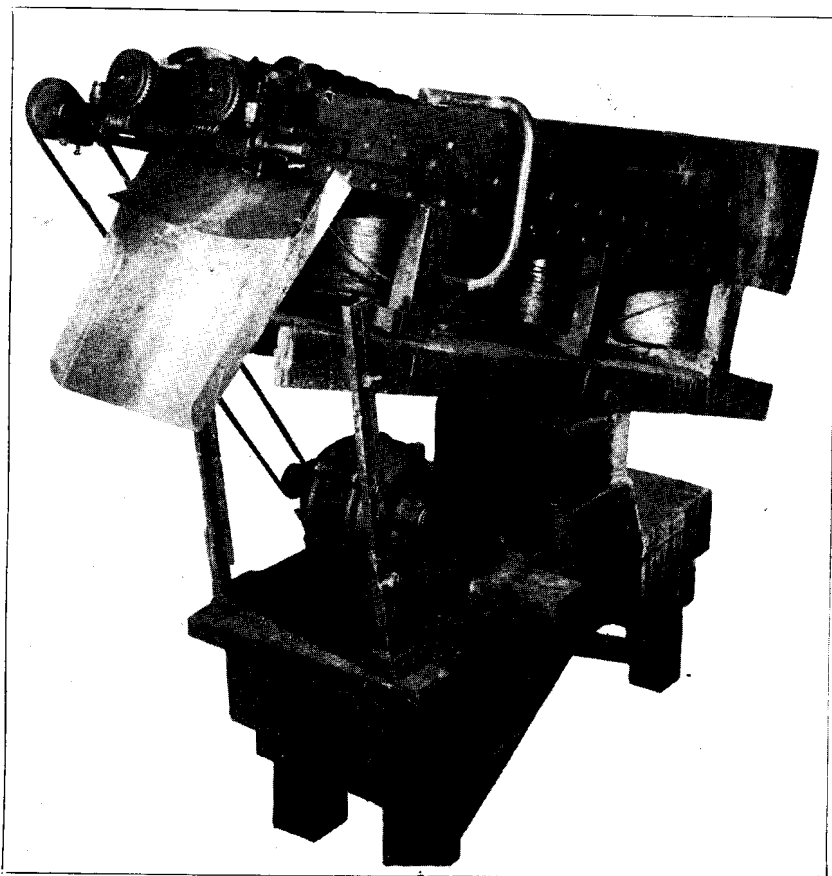


FIGURE 44. PHOTOGRAPH OF 60-INCH MAGNETIC LOG-WASHER

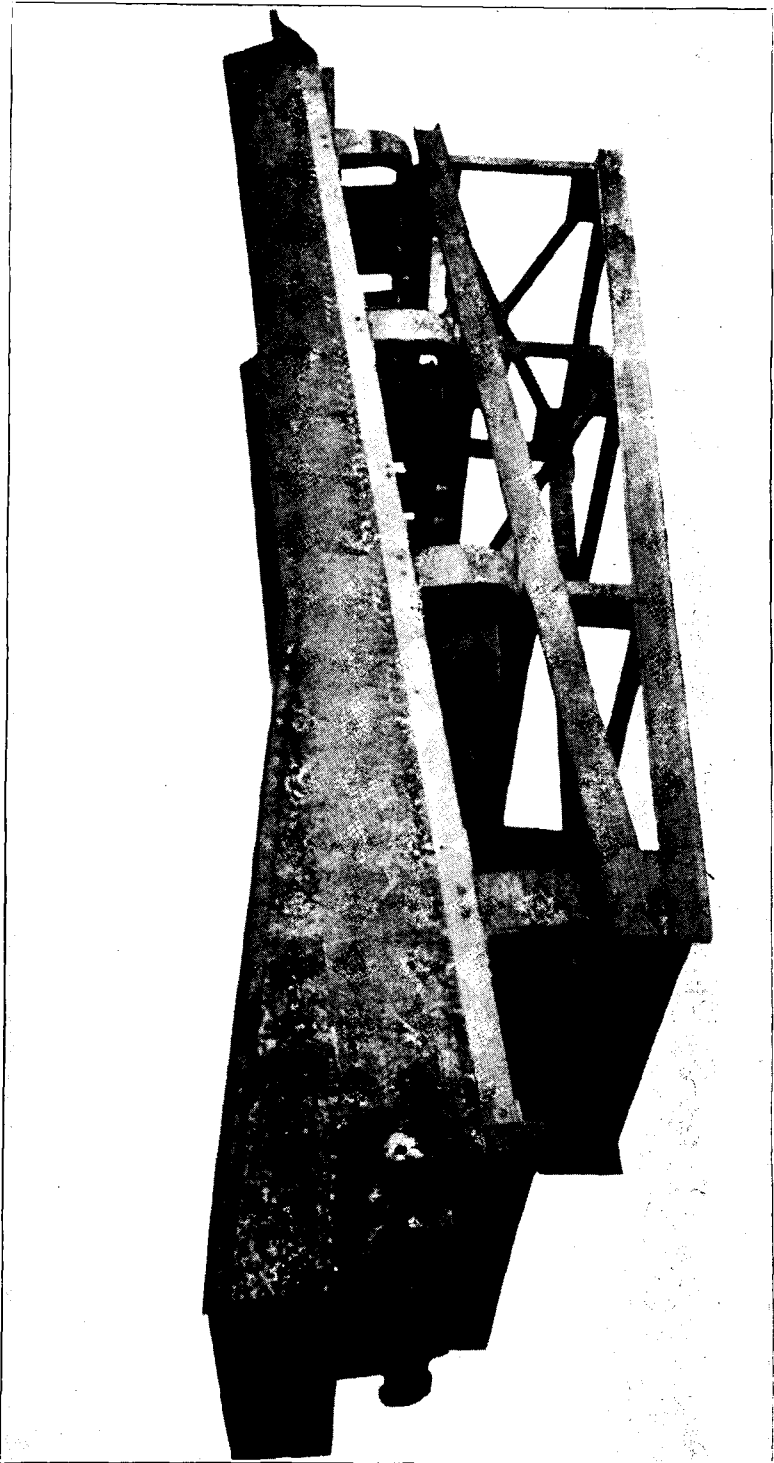


FIGURE 45. PHOTOGRAPH OF 18-FOOT MAGNETIC LOG-WASHER FOR THE MESABI IRON COMPANY

Figure 43 is a photograph of the 24-inch laboratory machine used for making tests on samples of from 5 to 25 pounds. Figure 44 is a photograph of a 60-inch machine having a continuous capacity of about one half ton per hour. The conveyors or logs of this machine are made of copper ribbon spirals wound around but spaced a short distance away from a central steel shaft. The spirals on each log constitute a four-thread worm of rather long pitch. Since the pitch is too rapid for the magnetized ore to follow continuously, it constantly cascades backward over the ribbons as it is conveyed forward. This cascading action supplies the necessary agitation to permit the non-magnetic material to be carried away by the water. This is a new type of magnetic concentrating machine, designed and originally built in the laboratory of the Experiment Station.

Two of these machines, 14 feet long and 2 feet wide, were constructed by Mr. W. G. Swart at Duluth, Minnesota, and successfully produced several thousand tons of high-grade iron-ore concentrate. These machines each had a capacity of from 50 to 75 tons per day, required one quarter of a kilowatt for field excitation, and one-half horsepower for mechanical operation. A great many tests have been made upon these machines and the results have been quite satisfactory. Figure 45 is a photograph of the new machines now being installed by the Mesabi Iron Company. These machines are 6 feet wide and 18 feet long and are equipped with four spiral conveyors.

#### BALL-NORTON TYPE DRUM COBBER

This machine is a modification of the standard Ball-Norton drum cobber, in which stationary magnets are placed within a revolving brass drum. The ore is carried on the belt around the drum through the reversing magnetic fields. The non-magnetic portion of the ore drops away and is collected in one compartment, while the magnetic portion is carried to the point at which the belt leaves the drum, and is deposited in a separate compartment. Figure 46 is a diagrammatic drawing of this separator. The strength of the magnetic field is governed by a rheostat in the power line that enters the drum, and by means of this rheostat it is possible to adjust the strength of the magnets so that material of any desired magnetic iron content can be carried into the concentrate compartment. Figure 47 is a photograph of this machine. While this cobber is a full-sized commercial unit, it is equipped in such a manner as to be convenient for testing purposes. The drum, which is 30 inches in diameter and 30 inches wide, runs at 30 revolutions per minute, and by adjusting the position of the dividing partition and alternating the field strength, the sample may be divided

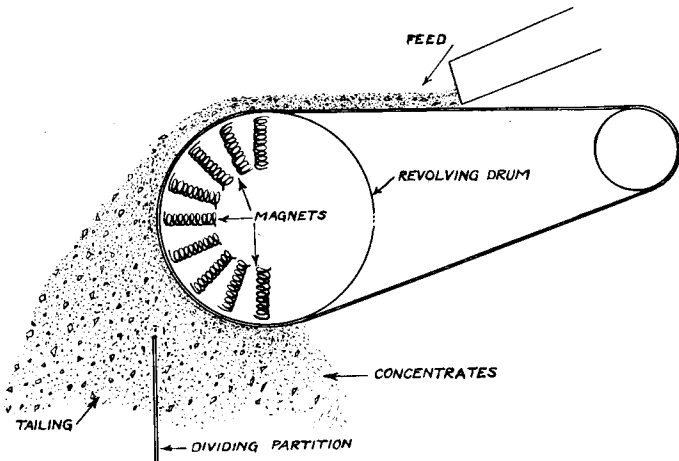
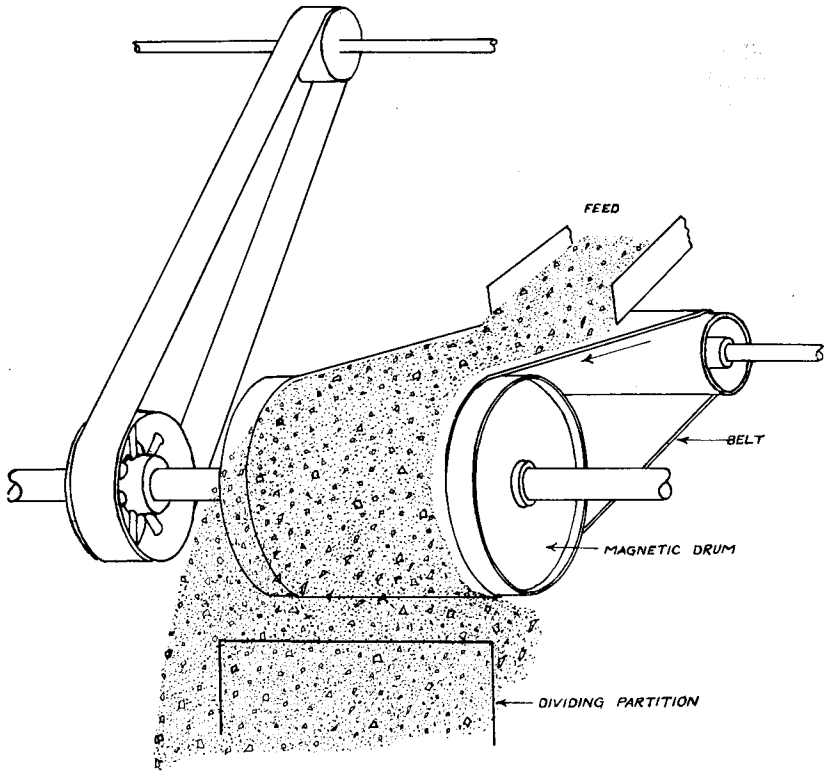


FIGURE 46. DIAGRAMMATIC DRAWING OF BALL-NORTON TYPE DRUM COBBER

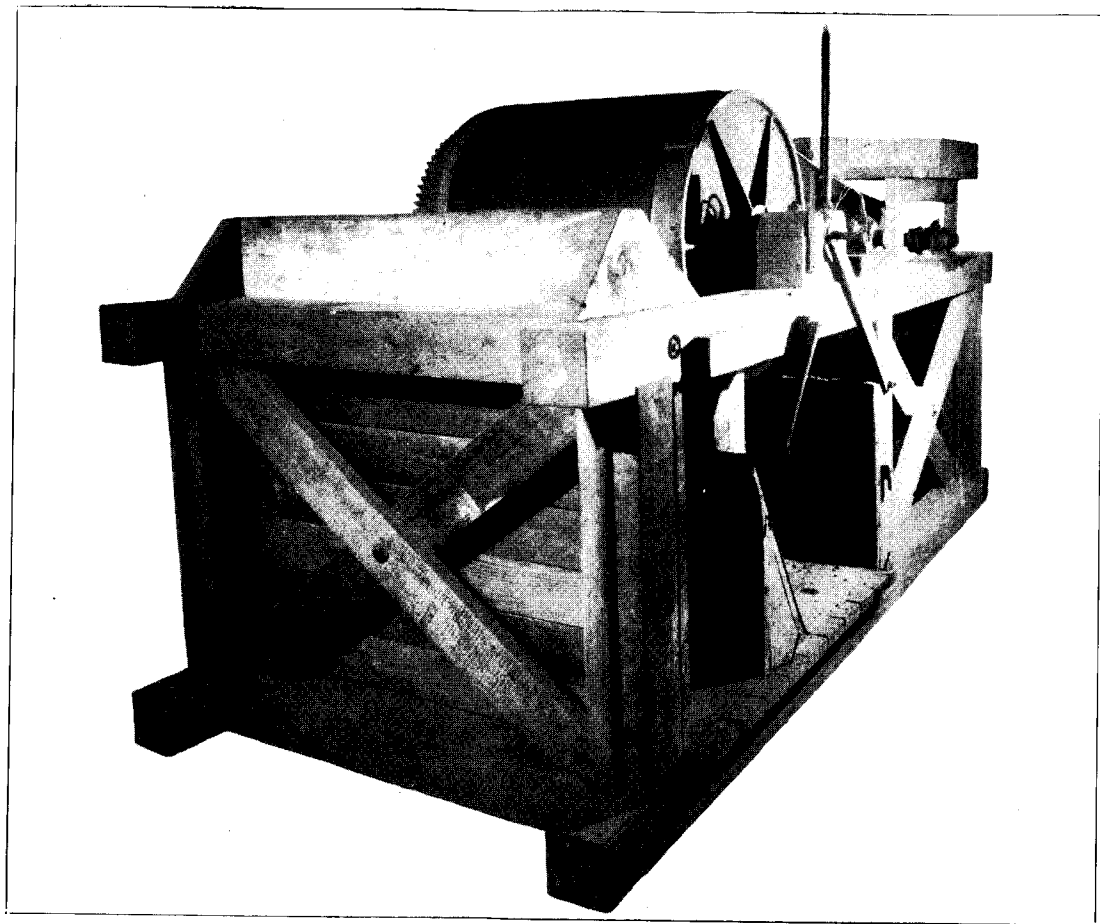


FIGURE 47. PHOTOGRAPH OF BALL-NORTON TYPE DRUM COBBER

into products as desired. The machine has a large capacity, 20 to 50 tons per hour, and will operate satisfactorily on material as coarse as 2 inches and as fine as 48 mesh (.0116-inch opening). The feed should contain a minimum of ore finer than 100 mesh (.0058-inch opening), however, in order to prevent the mechanical entangling of non-magnetic materials. The ideal feeding conditions for this machine involve arranging the material on the feed belt one layer of particles deep. This allows the particles to follow their natural paths of travel without interfering with adjacent particles. This particular machine requires from 10 to 1,000 watts of electric energy for field excitation and about one horsepower of mechanical energy for operation. The electrical design of this machine is somewhat different from that of the standard Ball-Norton machines, a fact which accounts for the small amount of electric energy that it consumes.

#### MAGNETIC GRADER

The magnetic grader is a machine which bears a great resemblance to an ordinary magnetic pulley for removing tramp iron from material fed to crushers. Figure 48 is a diagrammatic sketch of this machine, showing the drum and belt. The unique feature about this machine is the studded belt. The rubber belt is studded with steel rivets spaced one inch apart. These rivets have the effect of localizing the strong magnetic field so that it extends only a small distance above the drum. In Figure 48 is a small diagrammatic sketch showing the belt and drum and the approximate spacing of the magnetic poles. The primary effect of treating ore containing magnetic materials by use of this machine is to remove all of the fine material containing any ferro-magnetic material. It is therefore a sizing machine as well as a magnetic concentrator, when applied to magnetic ores. The plan of travel or trajectory of the larger particles as they leave the rotating drum is somewhat influenced by the large, comparatively weak magnetic field which surrounds the whole machine. This causes the more strongly magnetic particles to fall nearer to the drum and the less magnetic particles to be thrown farther from the drum. By putting the dividing partitions in the proper places, the sample of ore being treated can be divided into several parts, containing particles of different sizes and chemical composition.

Figure 49 is a photograph of this machine as it appears in the Experiment Station for testing purposes. The material to be treated is fed to the top of the belt by hand and the various products are caught in the compartments beneath the drum. Samples of from 100 pounds to several tons can be treated by use of this machine, and it is adapted to make separations of ore crushed to 4 inches or finer.

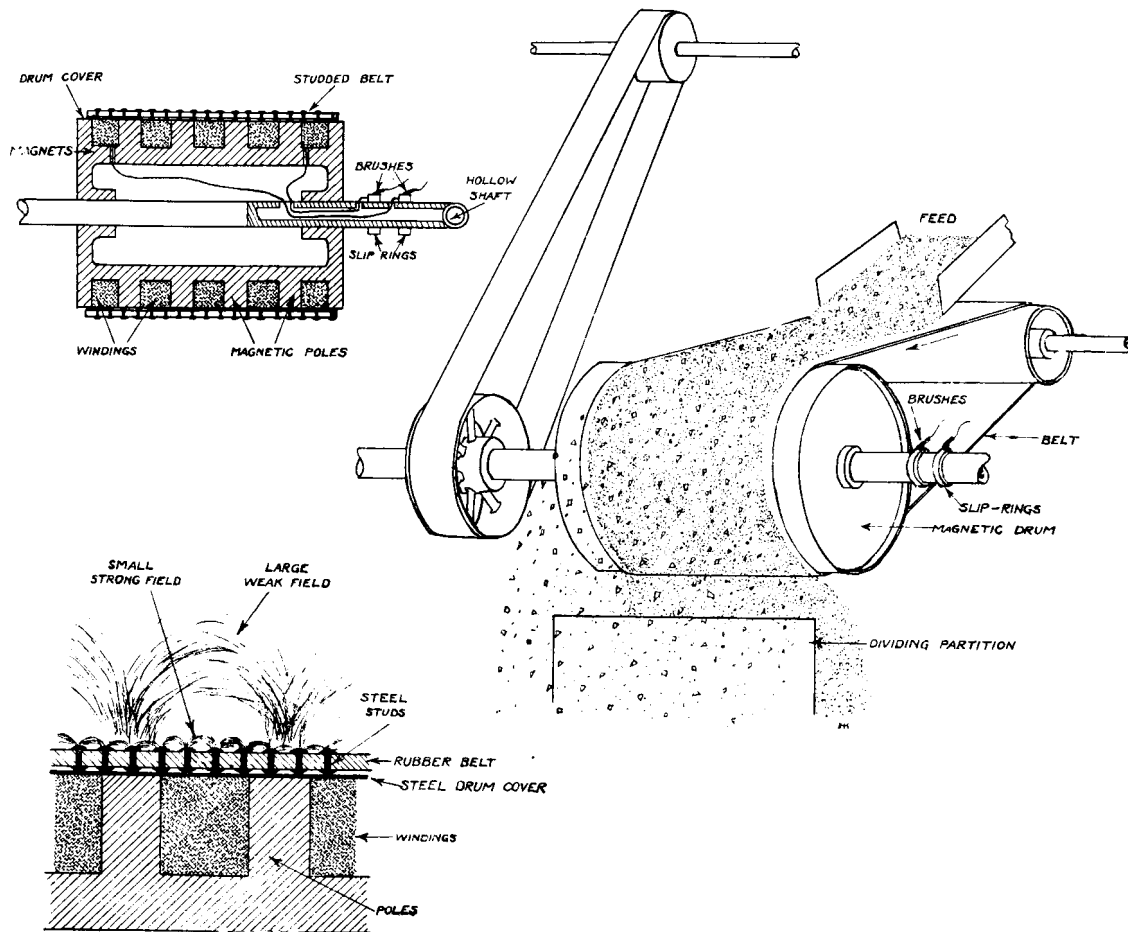


FIGURE 48. DIAGRAMMATIC DRAWING OF MAGNETIC GRADER



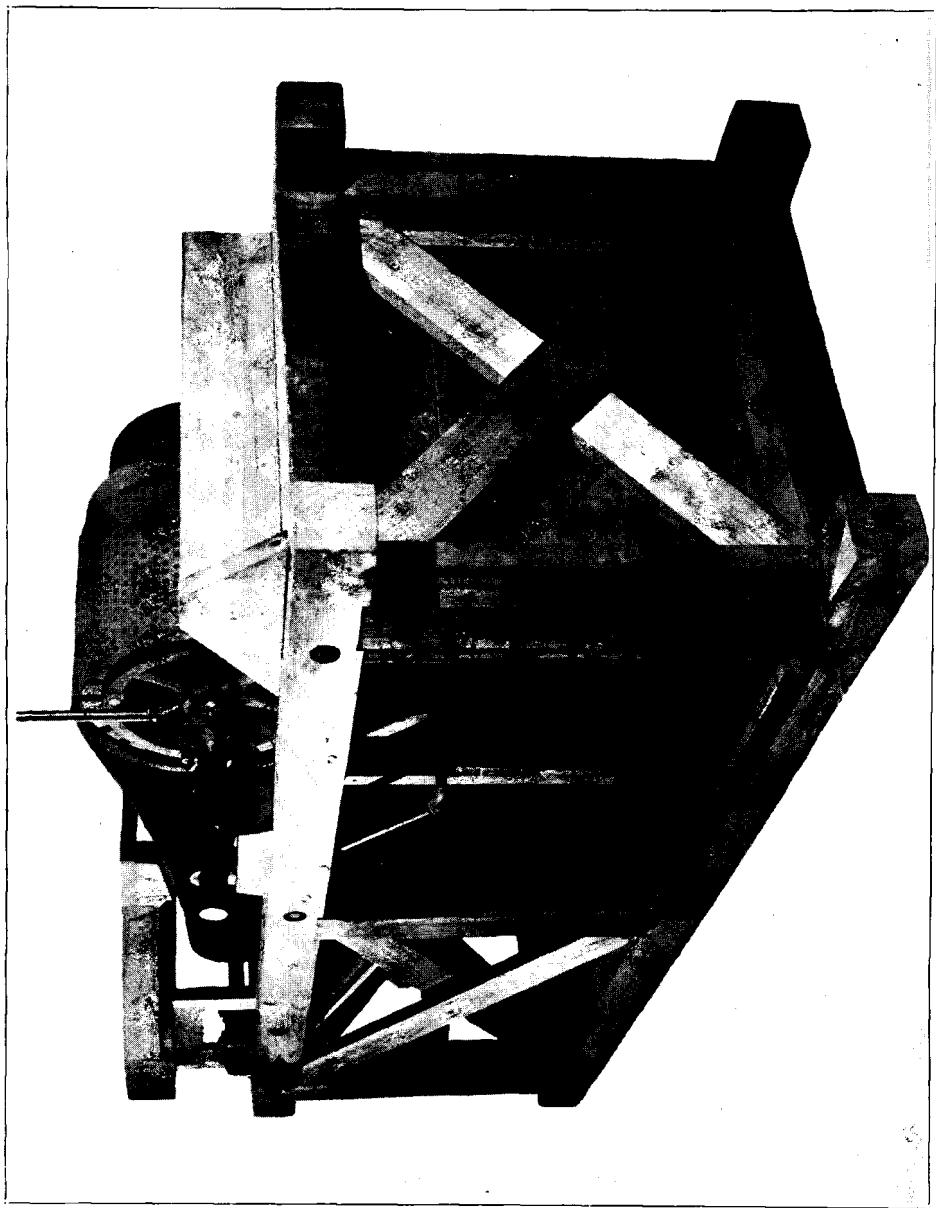


FIGURE 49. PHOTOGRAPH OF MAGNETIC GRADER

It is of little value when the material is all crushed finer than  $\frac{1}{4}$  inch. This machine should be placed in the mill flow sheet either before or after a Ball-Norton type drum cobber. If it is placed ahead of the drum cobber in the flow sheet, the fine magnetic material may all be removed from the ore. The separation made by the Ball-Norton type machine will then be very much improved, as a result of the elimination of the possibility of mechanical entangling by the finer particles. If the grader is placed in the flow sheet in such a position that it re-treats the drum cobber tailing, it will remove all of the fine ore of any considerable magnetic iron content, and thus prevent the possible loss of this material.

The grader is 24 inches in diameter, 24 inches wide, and runs at 37 revolutions per minute. As the magnets revolve in this machine, the current is supplied to the drum through slip rings located on the outer end of the shaft. Six amperes at 100 volts are required for the field excitation and about  $\frac{1}{4}$  horsepower is necessary for mechanical operation. The magnets are of cast iron and the drum is covered with No. 18 gage steel, which protects the windings.

#### DINGS MAGNETIC SEPARATOR

The Dings magnetic separator is the standard machine type HHL and was purchased directly from the Dings Magnetic Separator Company. Figure 50 is a photograph of this machine, showing the low-power and high-power magnets. By means of the high-power magnets, it is possible to make separations of the weakly magnetic minerals, and this is the chief use to which the machine is put in the laboratory of the Mines Experiment Station. As there is no reversal of polarity in this machine, it is necessary for an efficient separation to place the feed on the belt in a very thin layer. As in most of the other dry separating machines, a large amount of —100 mesh (.0058-inch opening) material in the feed tends to prevent a good separation. In making a separation of the weakly magnetic minerals it has been found advisable to size carefully the feed and to treat each size separately. This machine is adapted to test samples of from 5 to 100 pounds and the largest particles should not be coarser than  $\frac{1}{4}$  inch.

#### THE DEMAGNETIZER

The demagnetizer is a simple piece of electrical apparatus originally designed and built at the Mines Experiment Station and now in use in several magnetic concentrating plants. It operates on the same principle as the instrument for demagnetizing watches. A diagrammatic drawing of a demagnetizer is shown in Figure 51. It may be

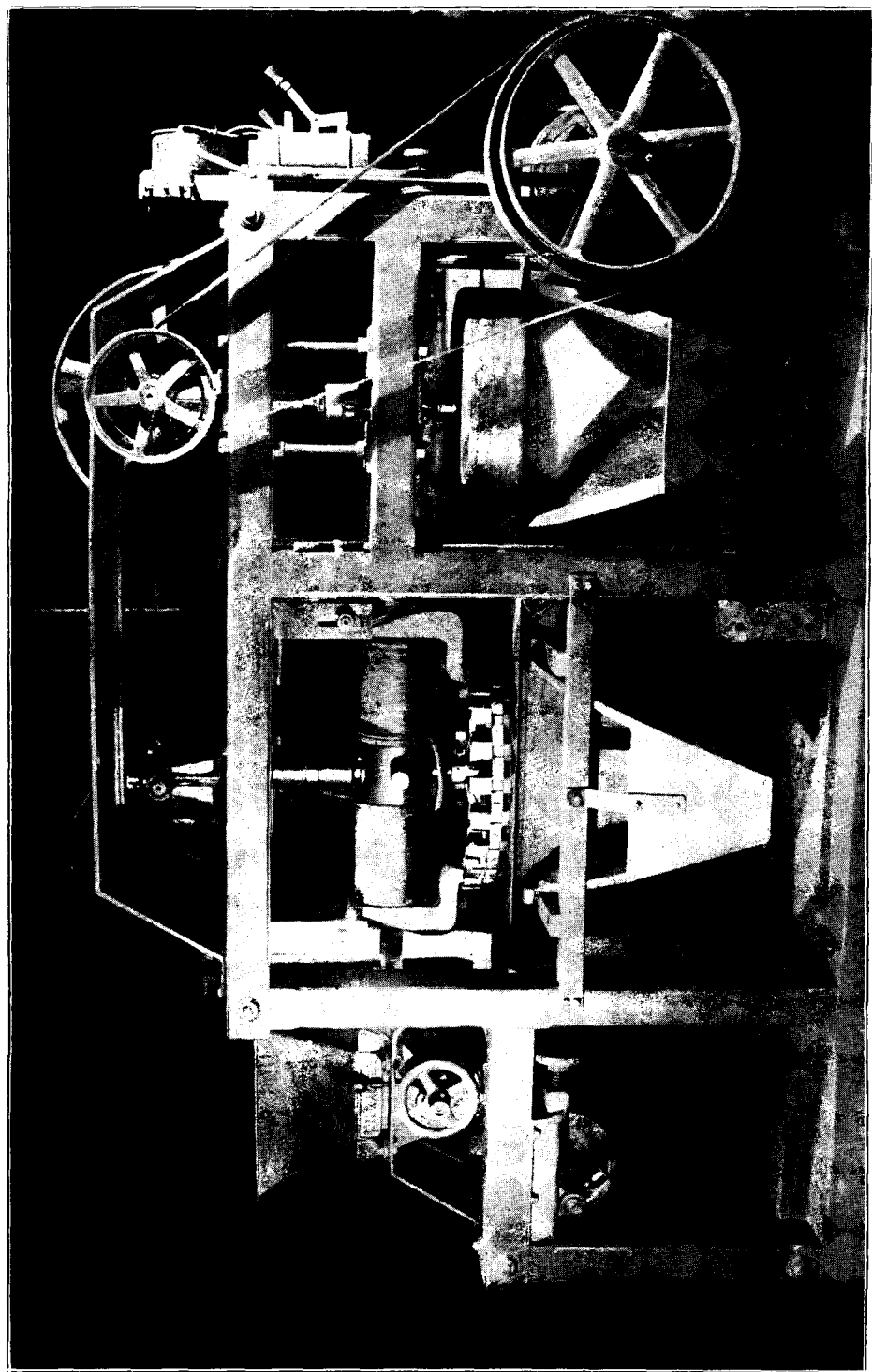


FIGURE 50. PHOTOGRAPH OF DINGS MAGNETIC SEPARATOR

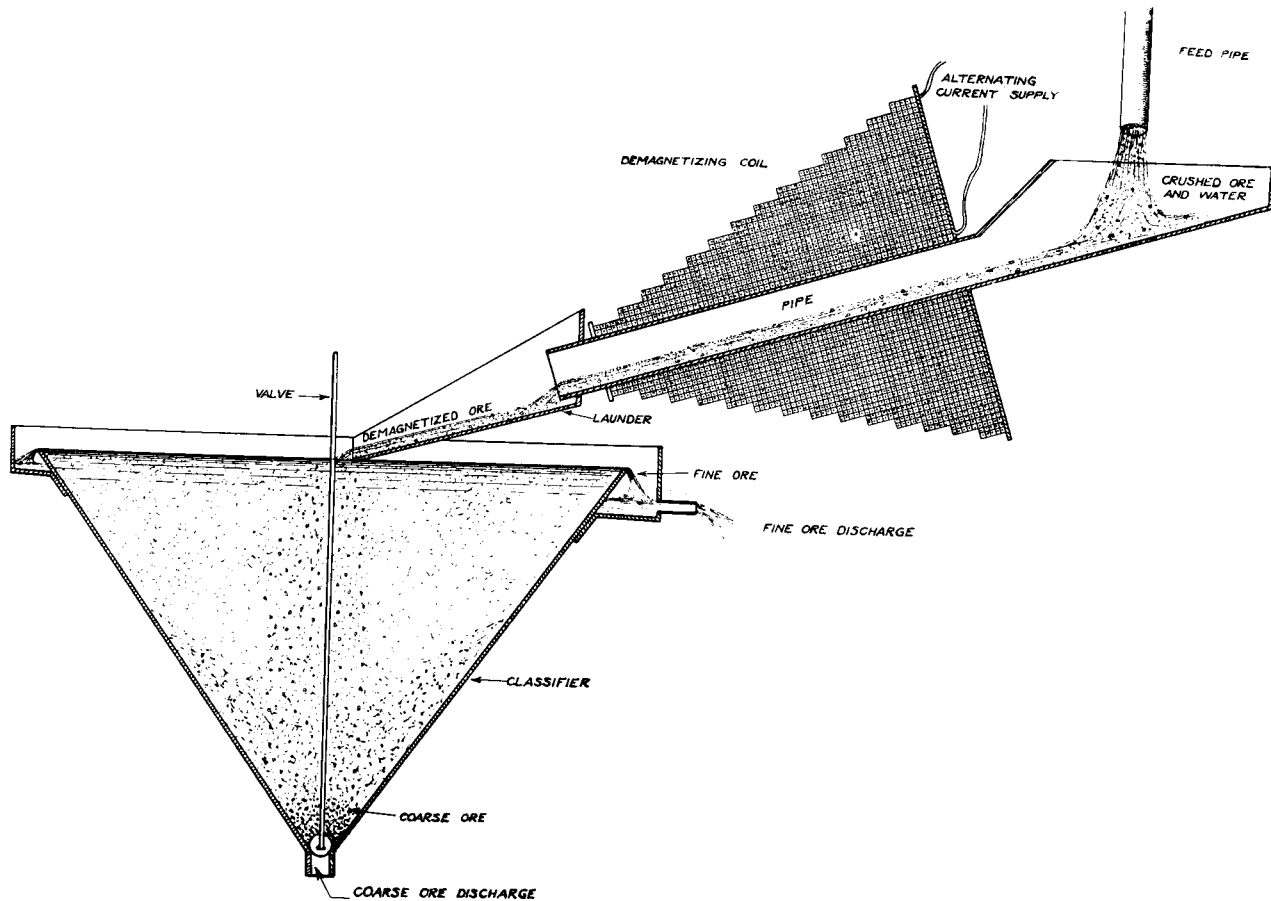


FIGURE 51. DIAGRAMMATIC DRAWING OF DEMAGNETIZER INSTALLATION

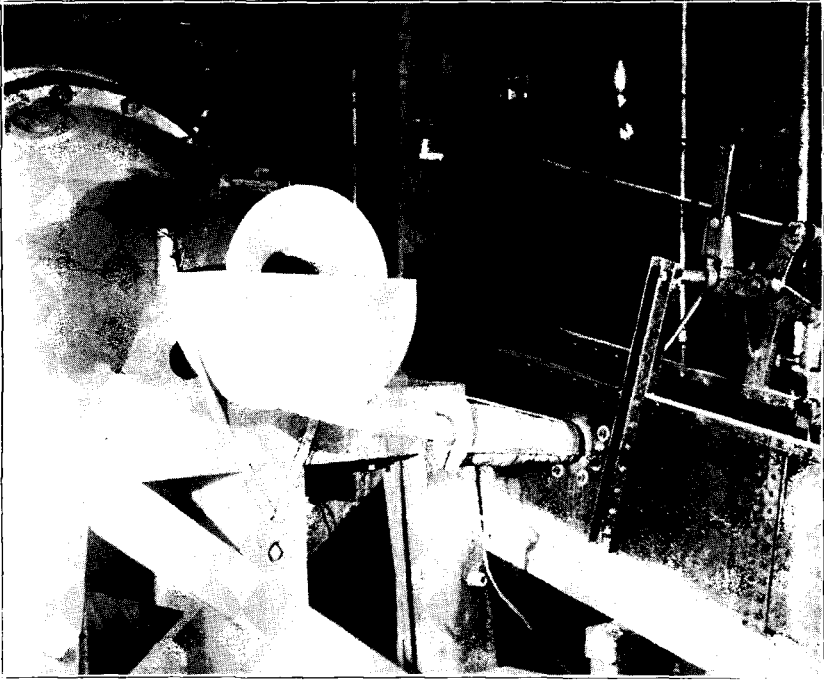


FIGURE 52. PHOTOGRAPH OF DEMAGNETIZER BETWEEN BALL MILL AND CLASSIFIER

seen from this drawing that the apparatus consists simply of a conical shaped coil of wire surrounding a pipe. Supplying an alternating electric current to this coil of wire results in the production of an alternating magnetic field within the pipe. As the ore passes through the pipe in the direction shown, it loses its residual magnetism, because of the rapidly reversing magnetic field through which it passes.

A photograph of a small demagnetizer is shown in Figure 52. It is used for demagnetizing wet or dry ore preparatory for classification. When magnetized ore is put into a classifier the finer particles collect around the larger particles, and the resulting mass, being heavy, sinks to the bottom. Classification has been found to be practically impossible in connection with ores that have been strongly magnetized. This magnetized condition is sometimes observed in ores as mined, but is always apparent in magnetic ores that have been treated on magnetic concentrating machines. The finer the ore is crushed the more desirable it is to have complete demagnetization before classification. At —48 mesh (.0116-inch opening) demagnetization before classification is desirable but probably not essential, but at —100 mesh (.0058-inch opening) it is almost indispensable.

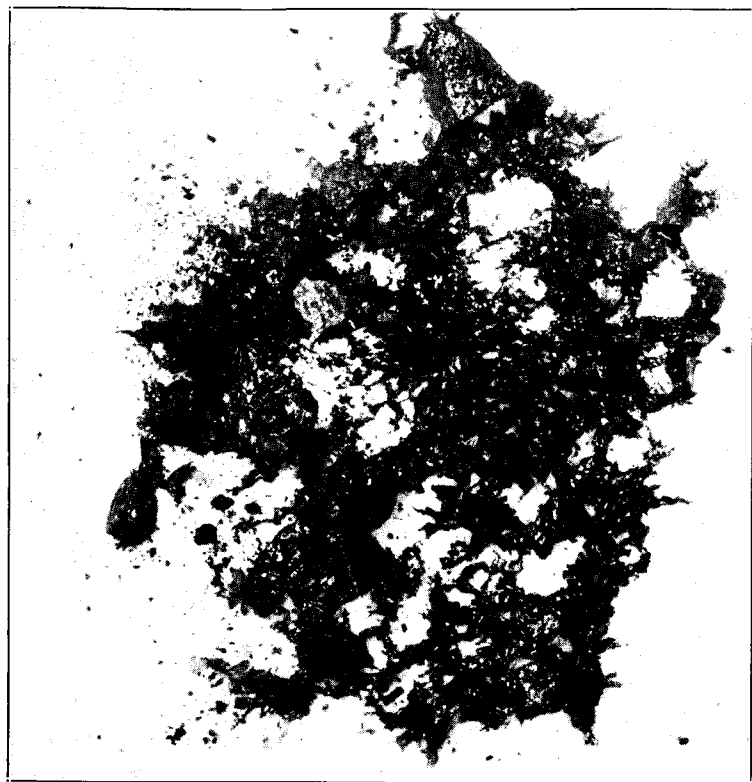


FIGURE 53. PHOTOGRAPH OF MAGNETIZED ORE PARTICLES

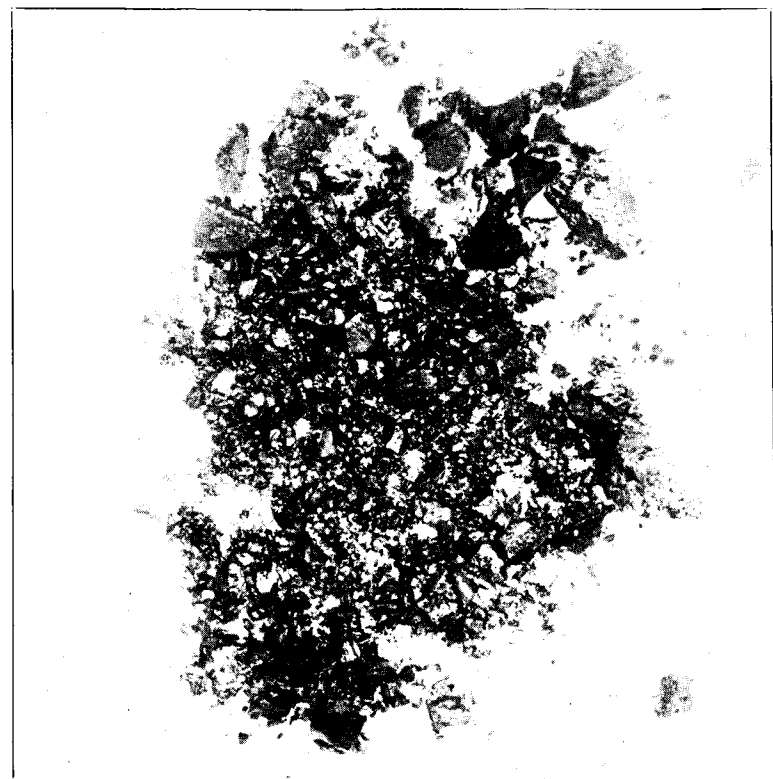


FIGURE 54. PHOTOGRAPH OF MAGNETIZED ORE PARTICLES AFTER  
BEING DEMAGNETIZED

Figure 53 and Figure 54 are enlarged photographs of magnetic ore particles before and after being demagnetized. The tendency of the magnetic particles to cling together is apparent in Figure 53. Passing this material through a small demagnetizer produces the effect shown in Figure 54. In this illustration the particles are seen to be sufficiently free and independent to permit efficient classification.

#### MAGNETIC ROASTING FURNACE

Since magnetic roasting is so closely allied to magnetic concentration, it seems advisable to describe the small magnetic roasting furnace with which the Experiment Station is equipped. From the results secured from small tests, certain conditions regarding temperature, size of particles, time, and atmospheric conditions were determined and made use of in the design of this furnace. Simplicity of construction and adaptability to a variety of ores were also considered. In a testing unit it is a great advantage to have no residual charge of ore left in the machine to contaminate the next sample to be treated. It will be seen that this furnace answers the requirements of a testing unit and at the same time has ample capacity to test samples of considerable size.

Figure 55 is a diagrammatic drawing and Figure 56 is a photograph of this roasting furnace. The inner pipe is 3 inches in diameter and revolves at 50 revolutions per minute. The furnace is 8 feet long and the outer pipe is covered with heat insulation to prevent radiation. It is seen from the drawing that the air for combustion is drawn in around the lower end of the inner pipe. This serves to cool the ore before it is discharged from the furnace and at the same time heats the air for combustion. The products of combustion travel around the inner pipe toward the upper end of the machine and impart heat to the cool ore as it travels toward the high temperature zone near the center of the furnace. It is therefore seen that the counter current principles of heat transfer are used in this machine, and a very small amount of gas supplied to the burner raises the ore to the required temperature for roasting.

The feed rate of ore to the machine is governed by the slope of the pipe. This governs the rate of travel of the ore through the pipe and therefore the rate at which the ore is allowed to enter. The ore is crushed to  $\frac{1}{2}$  inch or finer before being fed to the machine, and about 1 per cent of high volatile coal or fuel oil is added with the ore. This fuel serves to produce the reducing atmosphere necessary for magnetic roasting and at the same time supplies a part of the heat for raising the ore to the proper temperature.

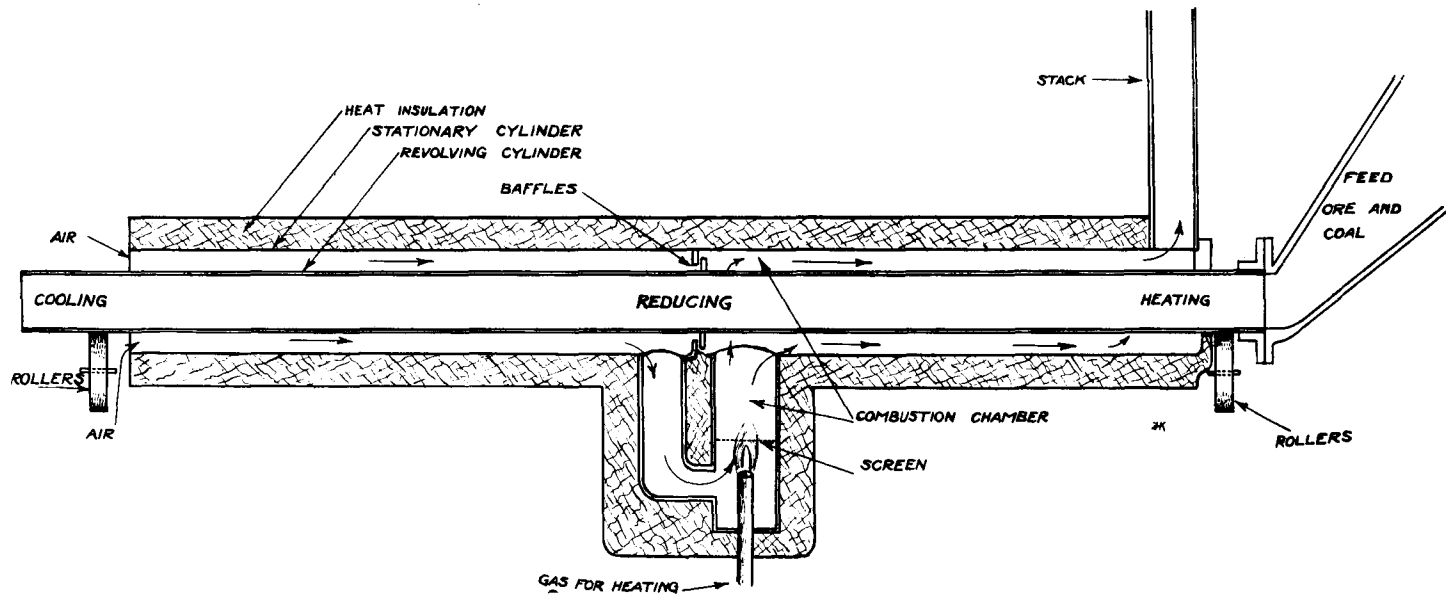


FIGURE 55. DIAGRAMMATIC DRAWING OF MAGNETIC ROASTING FURNACE



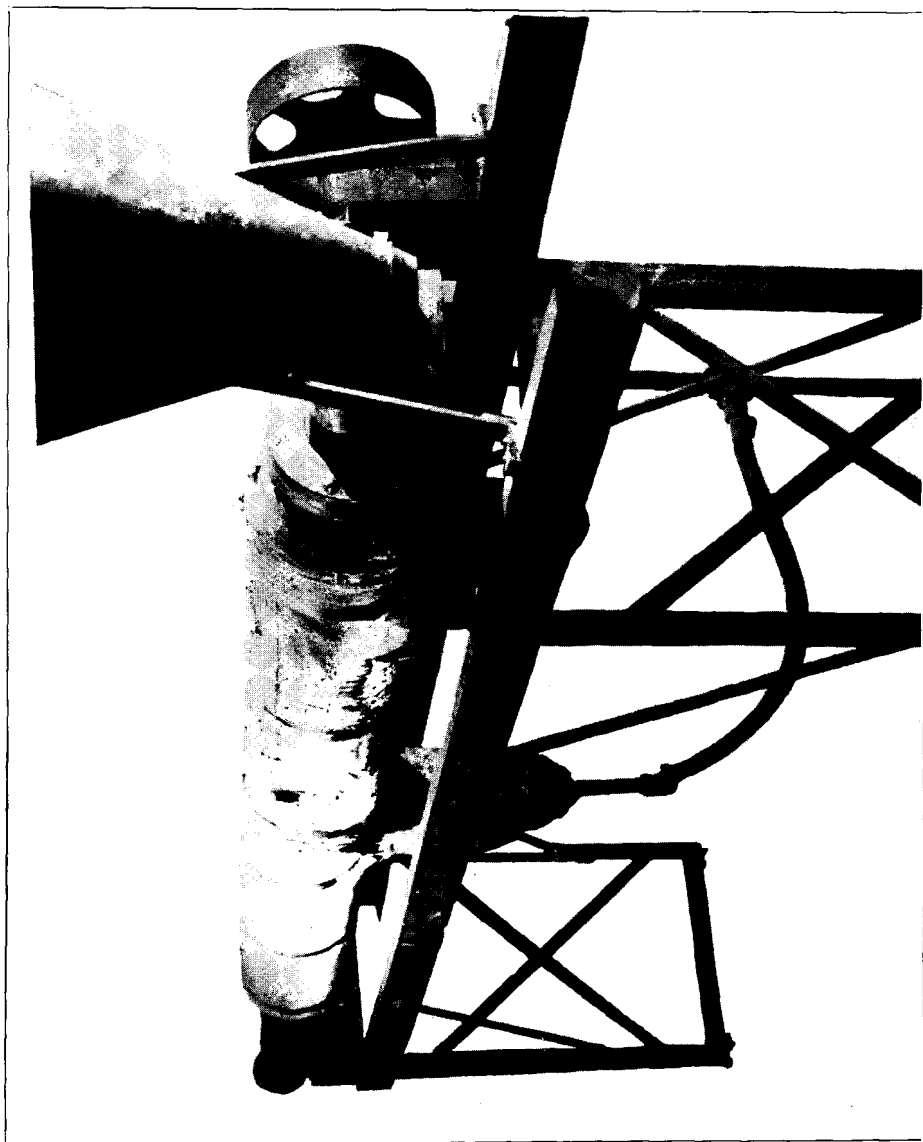


FIGURE 56. PHOTOGRAPH OF MAGNETIC ROASTING FURNACE

It is recognized that this machine is not of a type suitable for commercial roasting of hematite ores on a large scale. The capacity is small since the ore must be heated by contact with the steel pipe. The temperature of this pipe must be kept below 800° C., and this fact necessarily limits the rate of flow of the ore. The machine, however, is very satisfactory for testing purposes and has a capacity of about 100 pounds per hour when fed dry ore crushed to  $\frac{1}{4}$  inch and finer. This type of machine is not satisfactory for use on wet ore, as the steam which is formed in the inner pipe tends to dilute the reducing gases greatly and to form chemical compounds which absorb heat and hinder the satisfactory operation of the furnace.

PART VIII  
MAGNETIC CONCENTRATION TESTS ON NATURAL  
MAGNETITE ORES

MAGNETITE-BEARING ROCK FROM THE EASTERN  
MESABI RANGE<sup>15</sup>

The rock of the eastern end of the Mesabi Range contains a considerable amount of iron in the form of magnetite. It is a hard, dense, unaltered taconite, assaying about 25 per cent magnetic iron. Figure 57 is a photomicrograph of a typical specimen of this rock, the dark material being magnetite and the light material the silicate. The magnetite is seen to be finely disseminated throughout the whole specimen, but certain areas can be selected that contain a large proportion of all the mineral shown, while the remaining areas contain a considerable portion of all the silica shown. By comparison with the scale accompanying the photograph it can be seen that a certain amount of almost clean silica may be eliminated from the specimen when crushed to 8 mesh (.093-inch opening) and it is also evident that a good recovery of mineral free from silica can not be made at a size coarser than 100 mesh (.0058-inch opening). These conclusions were verified by the examination of other specimens and formed the basis for the actual testing work.

When testing work on the Eastern Mesabi magnetite ore was first undertaken by the Mines Experiment Station, only simple means were available for treating the rock. The attempt was made, however, to demonstrate the possibility of making a merchantable concentrate with a good recovery of the iron. The first attempt to concentrate this ore was made at —100 mesh (.0058-inch opening). Table V shows

TABLE V  
MAGNETIC TUBE CONCENTRATION TEST ON EASTERN MESABI ROCK

Products, —100 mesh	Per cent wgt.	Per cent sol. Fe	Per cent SiO <sub>2</sub>	Per cent Fe by wgt.
Crude ore .....	100.00	28.57	49.30	100.00
Conct. ....	45.54	60.14	13.70	95.90
Tailing .....	54.46	2.17	82.00	4.10

the results secured by use of the magnetic tube concentrator previously described. The results of this test seem to bear out in a general way the results expected from a study of the photomicrographs, as a

<sup>15</sup> For geological description of these deposits see F. B. Grout and T. M. Broderick. The magnetite deposits of the Eastern Mesabi Range, Minnesota. Minnesota Geological Survey. *Bulletin* no. 17.

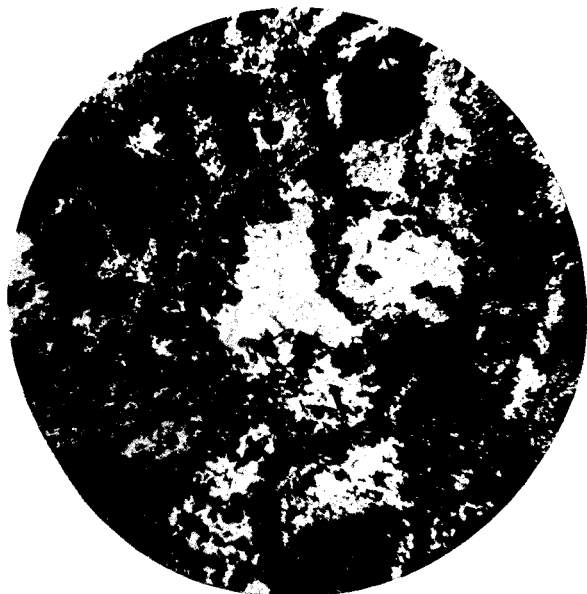
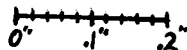


FIGURE 57. TYPICAL PHOTOMICRO-  
GRAPH OF EASTERN MESABI ROCK



merchantable concentrate was produced at 100 mesh (.0058-inch opening). Further attempts were made to produce concentrates from the ore crushed to various sizes within the range of treatment of the magnetic tube. Table VI shows the results secured from a number of these tests. Figure 58 is a curve sheet showing in graphic form the results given in Table VI. It may be noted that the phosphorus in the concentrate is uniformly high until the rock is crushed to —48 mesh, at which point the phosphorus curve starts rapidly downward. At 200 mesh (.0029-inch opening) the phosphorus in the concentrate is reduced to a quantity beyond which the advantage of further reduction is doubtful. It would then appear that all of the concentrate made should be 150 mesh (.0041-inch opening) or finer, in order to assure a low phosphorus, low silica ore.

TABLE VI  
MAGNETIC TUBE CONCENTRATION TESTS AT DIFFERENT SIZES ON EASTERN  
MESABI ROCK

Crude ore.....	26.80% sol. Fe	25.84% mag. Fe	.038% phos.	52.70% silica			
Products	—14	—28	—48	—65	—100	—200	—300
	mesh	mesh	mesh	mesh	mesh	mesh	mesh
Conct. per cent wgt.....	64.50	60.46	55.47	51.28	42.87	41.35	40.96
Conct. per cent sol. Fe.....	40.33	42.93	46.90	50.65	60.27	62.50	63.17
Conct. per cent phos.....	.038	.038	.038	.032	.025	.021	.020
Conct. per cent silica.....	35.30	33.04	28.49	23.86	13.25	11.56	9.88
Tailing per cent wgt.....	35.50	39.54	44.53	48.72	57.13	58.65	59.04
Tailing per cent sol. Fe.....	2.22	2.14	1.76	1.71	1.68	1.60	1.57

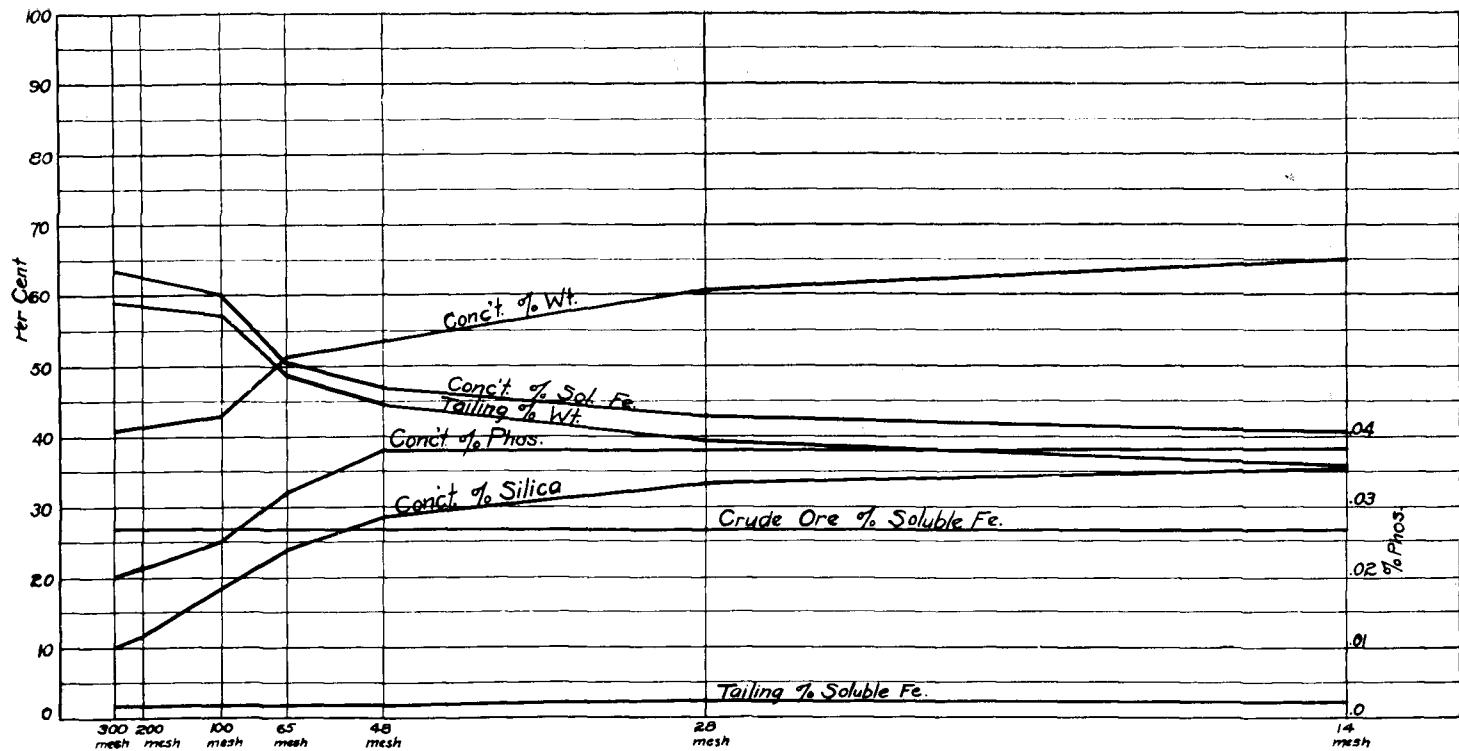


FIGURE 58. CONCENTRATING CHARACTERISTIC CURVES OF EASTERN MESABI ROCK

In order to study the possibility of eliminating a portion of the rock free from magnetite at some coarse size, the Dings high- and low-power magnetic separator previously described was secured and dry tests were made at various sizes. These tests were made on carefully sized feed samples, the idea being to produce the best possible results. Table VII shows the results secured from these tests. It appears that for any particular amount of tailing discarded, the magnetic iron assay of the tailing decreases in a general way as the particles of ore are reduced in size. A considerable portion of the rock can be discarded at a comparatively coarse size, carrying not over 10 per cent magnetic iron. These tests indicate the possibility of discarding low-grade tailing without fine grinding.

Originally, the results of these tests were reported in terms of the soluble iron assay of the various products. An examination of some of these products led to the conclusion that all of the iron was not in the form of magnetite. It was found that material showing no attraction whatever for the magnets, carried in some cases as much as 5 per cent of iron that was soluble in hydrochloric acid, and about 2 per cent of iron in addition that was not soluble in acid. As the concentration of this ore was to be accomplished ultimately at —150 mesh (.0041-inch opening) and by use of magnetic separators, all of the iron existing in forms that were not magnetic would eventually be lost in the tailing. For this reason the previously described method for determining the magnetic iron assay of the samples was developed, and the products made in the test on the Dings machine were assayed for magnetic iron as shown in Table VII.

While these tests indicate the results that may be expected by cobbing the different sized products separately, the results of cobbing an unsized sample could hardly be foretold from this table. It would seem that the above results could be compiled in such a manner as to represent any given screen analysis of original feed. This would be true if it were not for the fact that different sizes of ore particles require different magnetic field strengths in order to be influenced in a similar manner. If the proper field strength is used in making a separation at 1 inch, it is far too strong to make a good separation of the sample of ore crushed to 10 mesh (.065-inch opening). It is therefore necessary when working on an unsized feed so to adjust the field strength as to form the most desirable compromise between the coarser and finer particles. In order to determine the possibility of cobbing unsized feeds of ore at various maximum sizes, it was necessary to secure a new type of magnetic cobber. The laboratory cobber of the Ball-Norton drum type was secured and a number of tests were made

TABLE VII  
 COBBING TESTS AT DIFFERENT SIZES ON EASTERN MESABI ROCK  
 Sized Feed  
 Magnetic iron assay of tailing made at various sizes

Per cent weight of tailing	Test No. 1 - $\frac{1}{2}$ " + 1"	Test No. 2 -1" + $\frac{3}{4}$ "	Test No. 3 - $\frac{3}{4}$ " + $\frac{1}{2}$ "	Test No. 4 - $\frac{1}{2}$ " + 4M.	Test No. 5 -4M. + 6M	Test No. 6 -6M. + 8M.	Test No. 7 -8M. + 10M.	Test No. 8 -10M. + 20M.
100	27.05	27.53	27.79	28.32	28.32	30.38	29.04	30.34
95	25.83	26.51	26.80	27.27	26.95	29.00	27.75	29.00
90	24.74	25.00	25.62	25.93	25.75	27.62	26.33	27.75
85	23.78	23.78	24.10	24.50	24.50	26.12	24.62	26.30
80	22.75	22.75	22.87	23.00	23.00	24.50	22.80	24.60
75	21.75	21.47	21.52	22.37	21.50	22.75	21.12	22.60
70	20.50	20.12	20.00	20.20	20.00	20.75	19.12	20.55
65	19.25	18.62	18.50	18.58	18.60	18.50	16.85	18.50
60	17.90	17.26	17.20	17.20	17.25	16.25	14.62	16.10
55	16.85	16.23	16.22	15.87	15.95	14.50	12.62	13.75
50	15.90	15.25	15.00	14.88	13.90	12.75	11.00	11.00
45	14.83	14.25	13.55	13.83	11.75	11.25	9.52	9.00
40	13.72	13.08	12.65	12.88	10.65	10.00	8.38	8.00
35	12.53	12.00	11.75	12.00	9.50	8.80	7.38	7.00
30	11.51	11.15	10.82	11.00	8.38	7.75	6.62	6.10
25	10.72	10.18	10.00	9.45	7.62	7.05	6.12	5.25
20	9.87	9.50	9.22	8.12	6.37	6.75	5.38	4.40
15	8.85	8.45	7.75	7.05	4.90	5.82	4.45	3.30
10	7.30	6.85	6.37	6.25	3.75	4.25	3.12	2.78
5	5.55	5.40	5.15	4.71	2.32	2.08	1.45	1.52

upon it. Table VIII shows the magnetic iron assay of the tailing that can be discarded from various unsized<sup>16</sup> products of Eastern Mesabi rock. In all cases approximately 30 per cent of the ore was discarded as tailing. As would be expected, with finer crushing a lower grade of tailing was made. The curve sheet in Figure 59 accompanying this table shows the results graphically.

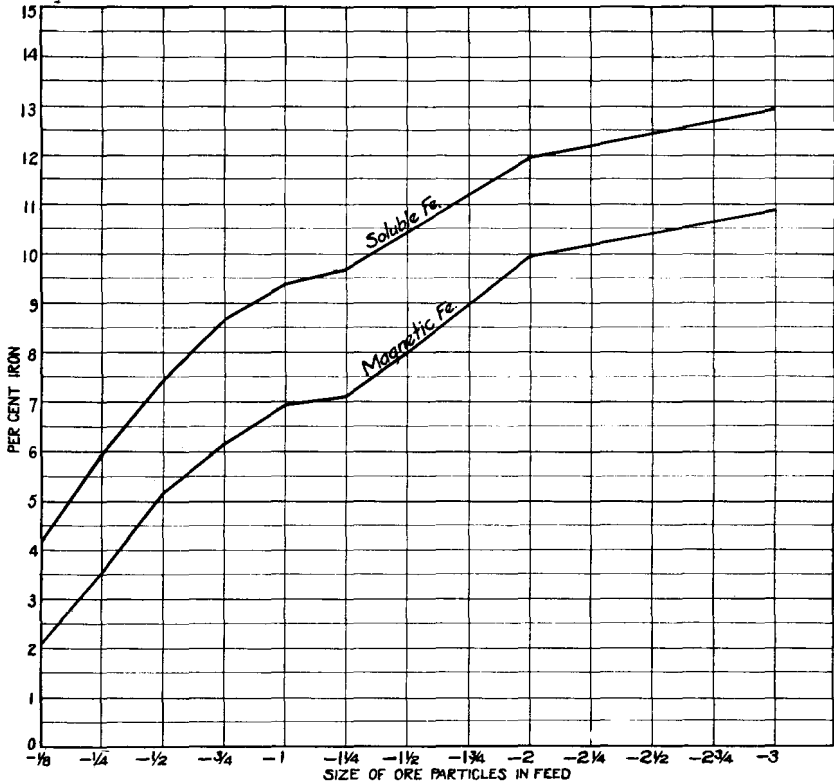


FIGURE 59. COBBING CHARACTERISTIC CURVES OF EASTERN MESABI ROCK WHEN 30 PER CENT OF THE ORE IS DISCARDED AS TAILING

It is interesting to compare the results secured by cobbing an unsized sample with the results secured by cobbing each size separately. Table IX shows such a comparison made upon samples of Eastern Mesabi rock. As would be expected, the results secured by cobbing each size separately are better than those secured from the unsized samples. However, the cost in a large plant of screening and cobbing each size separately might easily be greater than would be warranted by the improvement in the metallurgical results. Any final decision of this question requires a careful economic study of the entire ore-dressing problem.

<sup>16</sup> See footnote on page 9 for definition of "sized" and "unsized" ore.



TABLE VIII  
COBBING TESTS AT DIFFERENT SIZES ON EASTERN MESABI ROCK  
Unsize Feed

Size of feed	Crude ore		Conct.		Tailing		
	Per cent wgt.	Per cent sol. Fe	Per cent wgt.	Per cent sol. Fe	Per cent wgt.	Per cent sol. Fe	Per cent mag. Fe
-3 inch	100.00	28.20	70.70	34.42	29.30	13.18	11.02
-2 inch	100.00	28.28	70.84	35.45	29.16	12.09	10.11
-1½-inch	100.00	28.35	70.31	35.89	29.69	10.49	8.24
-1¼ inch	100.00	28.85	71.41	36.51	28.59	9.74	7.33
-1 inch	100.00	29.23	69.97	37.72	30.03	9.46	7.10
-¾ inch	100.00	28.87	69.98	37.52	30.02	8.72	6.34
-½ inch	100.00	27.84	68.89	37.00	31.11	7.56	5.41
-¼ inch	100.00	29.10	69.73	38.98	30.27	6.09	3.58
-⅛ inch	100.00	27.51	72.29	36.46	27.71	4.14	2.17

TABLE IX  
COMPARISON OF RESULTS OF COBBING SIZED AND UNSIZED ORE

Size	Cobbing each size separately			
	Per cent wgt. Feed	Per cent sol. Fe Feed	Per cent wgt. Tails	Per cent sol. Fe Tails
-1¼" + ½"	24.50	27.45	7.35	6.92
-½" + 4M.	23.12	27.52	6.94	6.00
-4M. + 8M.	20.20	28.17	6.06	5.82
-8M. + 14M.	11.79	28.82	3.54	5.57
-14M. + 28M.	9.61	29.17	2.88	6.66
-28M. + 48M.	3.84	28.47	1.15	6.52
-48M.	6.94	27.51	2.08	3.11
Total -1¼".....	100.00	27.98	30.00	6.02
Size	Cobbing all sizes mixed			
	Per cent wgt. Feed	Per cent sol. Fe Feed	Per cent wgt. Tails	Per cent sol. Fe Tails
Unsize -1¼"	100.00	27.98	30.00	7.27

In order to determine the effect of cobbing upon the grade of final concentrate, fine grinding and concentration tests were made upon duplicate samples before and after cobbing. These tests consisted in crushing the ore to relatively coarse sizes, for example, -4 mesh (.185-inch opening), and then cobbing out the low-grade material. The concentrates from the cobbing tests were then crushed to -150 mesh (.0041-inch opening) and concentrated wet in the magnetic log-washer. The results secured from these tests were compared with the results secured by crushing the entire sample of crude ore to -150 mesh (.0041-inch opening) without preliminary cobbing. The results secured with and without cobbing at -4 mesh (.185-inch opening) are shown in Table X.

From the results shown in Table X it would appear that there is little difference in the assays of the final products whether or not

the ore is cobbled before fine grinding. The final concentrate produced from the cobbled ore assayed slightly higher in iron and lower in phosphorus than the concentrate produced from the uncobbled ore, but this may have been due to slightly finer grinding. The important fact is that by cobbing, 31.75 per cent of the rock was discarded without being crushed to -150 mesh (.0041-inch opening). A careful economic study is necessary in order to determine whether or not the additional ore recovered is sufficient to pay for the cost of grinding to -150 mesh (.0041-inch opening) this 31.75 per cent of tailing,

TABLE X  
COMPARISON OF RESULTS OF CONCENTRATING EASTERN MESABI ROCK WITH AND WITHOUT COBBING

Products	With cobbing			With no cobbing		
	Per cent wgt.	Per cent mag. Fe	Per cent P.	Per cent wgt.	Per cent mag. Fe	Per cent P.
Crude ore -4 mesh.....	100.00	25.09	.046	100.00	25.09	.049
Cobber tailing .....	31.75	9.34	.047			
Cobber conct. ....	68.25	32.41	.046			
Mag. log. feed -150 mesh.....	68.25	32.41	.046	100.00	25.09	.049
Mag. log. tailing .....	33.76	0.93	.071	61.06	1.17	.062
Mag. log. conct. ....	34.49	63.23	.022	38.94	62.60	.027
Combined tailing.....	65.51	5.01	.075	61.06	1.17	.062

assaying only 9.34 per cent magnetic iron. Since any desired quantity of material may be eliminated by the cobbbers as is shown by the curves in Figure 59, the question as to the proper amount to be eliminated requires a detailed study of mining and milling costs. It seems probable, however, that a considerable amount of the low-grade rock should be removed without fine grinding, as the cost of operating a magnetic cobber is very small and that of operating a ball mill is comparatively large.

#### LARGE SCALE CONCENTRATION TESTS ON EASTERN MESABI ROCK

In making the preceding tests, crushing to fine sizes was done on samples of from 1 to 5 pounds, in Abbe jars. As Eastern Mesabi rock is hard and tough, the process of fine grinding was very slow and unsatisfactory. All of the ore remained in the jar for the full grinding period and some of it was pulverized to an extremely fine size. The question arose as to whether or not the results secured from the ore ground in small samples in the Abbe jars could be reproduced on ore ground continuously in ball mills. It was also desirable to make some tests at a larger scale than was possible with

the small equipment upon which the previous tests were made. For this reason a 3-foot Hardinge conical mill, a one-quarter size Dorr duplex classifier and a one-quarter size Janney classifier were secured and installed in the Experiment Station. A magnetic log-washer 12 inches wide and 5 feet long was also constructed. With this equipment, some of which is shown in Figure 60, it was possible to make tests of any desired duration, using a continuous flow of ore through the circuit. Some very interesting tests were made with this equipment and several different flow sheets were used. Figure 61 is a flow sheet showing the arrangement of the machinery in which only the ball mill and the magnetic log-washer were used. The ore was fed to the ball mill, from which it flowed into the log-washer. The results secured from one of the tests made upon this flow sheet are given in Table XI.

It appears from the results of this test that the grinding was not sufficiently fine and consequently the concentrate assayed only 52.53 per cent iron. The concentrate contained 94 per cent of the soluble iron in the feed and only 6 per cent was lost in the tailing. The efficiency of the magnetic separating machine is more accurately shown by the magnetic iron recovery since perfect extraction would be the recovery of 100 per cent of the magnetic iron in the sample. For this reason magnetic iron determinations were made on the unsized products of this test and the recovery was again computed. The results are shown in Table XII. It appears from this table that while 6 per cent of the soluble iron was lost in the tailing, only 1.36 per cent of the magnetic iron was lost; and therefore, the efficiency of the separations was 98.64 per cent.

From this test and other tests on this flow sheet of which this test is typical, certain general observations were made.

1. It is possible, by use of this flow sheet, to recover over 98 per cent of the magnetic iron.

2. The accidental particles of coarse ore discharged from the ball mill make impractical the production of a concentrate assaying as high as 60 per cent iron with this flow sheet. All of the coarse material contains a sufficient amount of magnetic iron to be caught by the magnetic log-washer. This material produces a low-grade concentrate which materially reduces the assay of the total concentrate.

3. This flow sheet would be wholly unsatisfactory for the production of a high-grade concentrate from Eastern Mesabi rock, on a commercial scale.

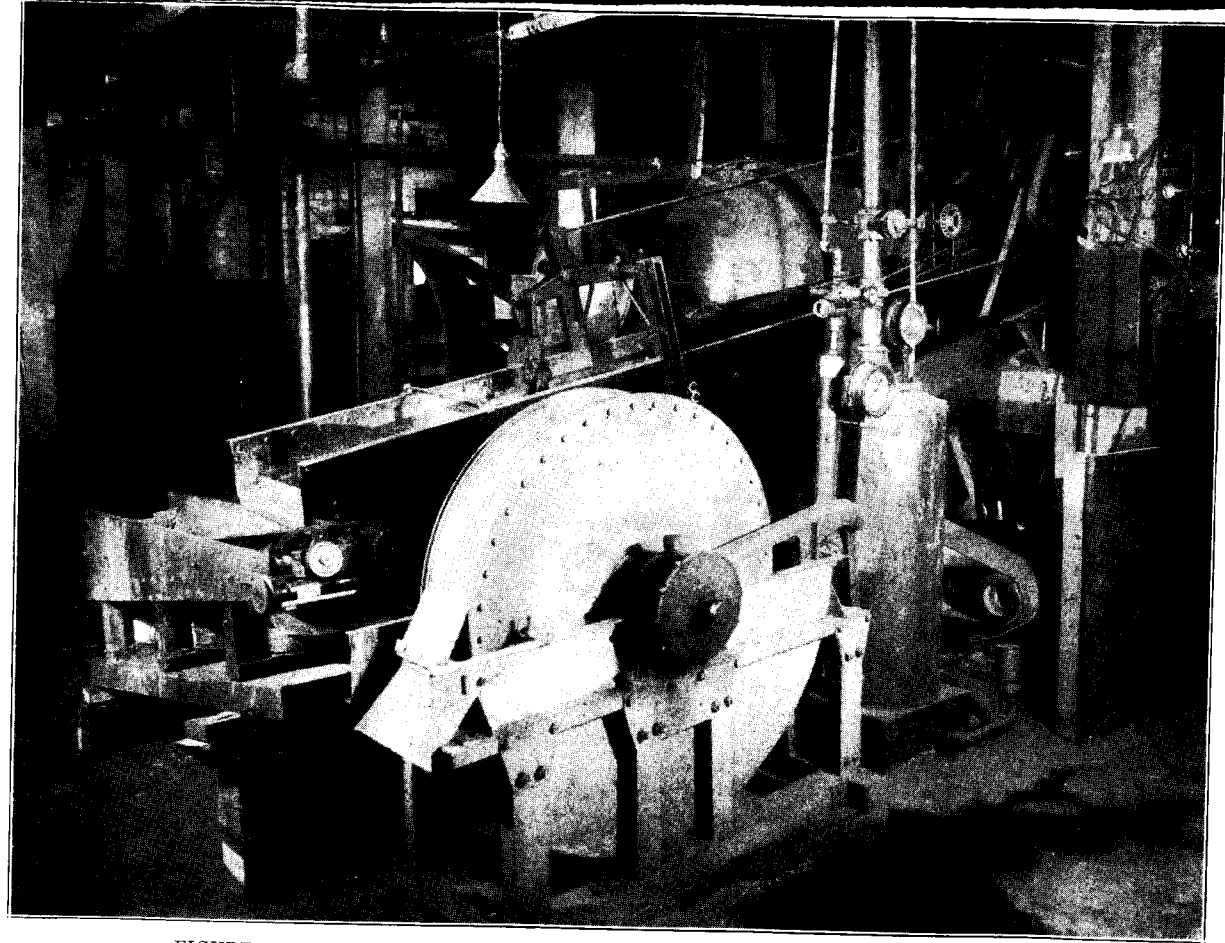
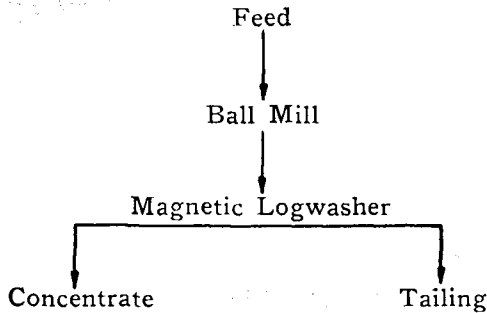


FIGURE 60. PHOTOGRAPH OF EQUIPMENT FOR FINE GRINDING AND MAGNETIC CONCENTRATION IN THE MINES EXPERIMENT STATION LABORATORY

FIGURE 61. FLOW SHEET FOR OPEN CIRCUIT GRINDING AND CONCENTRATION TEST

TABLE XI  
TEST ON EASTERN MESABI ROCK WITH OPEN-CIRCUIT GRINDING

Ball mill		Operating data		Magnetic log-washer	
Speed .....	36 r. p. m.	Speed of logs.....	34 r. p. m.	Slope .....	2 3/16" per ft.
Power .....	.7 h. p.	Power for drive.....	1/8 h. p.	Power for magnets.....	.250 k. w.
Ball load .....	1000 lbs.				
Size of balls.....	1 inch and 2 inch				
Ore feed rate.....	640 lbs. per hr.				

Screen analysis and assay of products

Size mesh	Ball mill feed		Ball mill product		Concentrate		Tailing	
	Per cent wgt.	Per cent sol. Fe	Per cent wgt.	Per cent sol. Fe	Per cent wgt.	Per cent sol. Fe	Per cent wgt.	Per cent sol. Fe
+ 10 .....	23.53	32.34	00.00		00.00			
+ 20 .....	24.66	31.14	0.45	31.85	0.47	32.47	00.00	
+ 48 .....	20.27	29.87	4.68	27.49	3.85	31.88	0.79	5.81
+ 100 .....	10.54	21.56	14.94	25.46	7.94	38.06	4.32	4.33
+ 150 .....	4.79	18.20	14.83	21.26	5.82	42.15	9.12	2.27
+ 200 .....	2.83	17.65	9.07	20.66	3.73	45.24	2.28	2.13
+ 300 .....	3.46	17.83	9.39	21.33	4.61	50.33	7.62	2.07
- 300 .....	9.92	32.50	46.64	35.53	25.17	64.50	23.28	4.53
Total .....	100.00	28.83	100.00	28.83	51.59	52.53	48.41	3.57

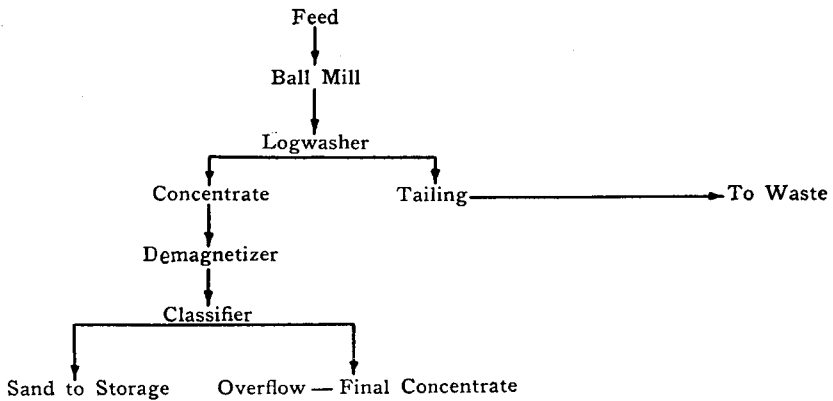
The results secured from the flow sheet in Figure 61 indicate that 59.88 per cent of the concentrate assayed 64.50 per cent iron and was finer than 300 mesh (.0017-inch opening). It therefore appeared that if this —300-mesh material could be removed from the concentrate as a finished product and all material coarser than 300 mesh returned for further treatment, a satisfactory flow sheet might be formed. The plant was therefore arranged to operate on the flow sheet shown in Figure 62. The results secured from a typical test using this flow sheet are shown in Table XIII.

TABLE XII  
MAGNETIC IRON ASSAY OF PRODUCTS OF OPEN-CIRCUIT GRINDING TEST

	Ball mill product	Log. conct.	Log tails
Assay per cent sol. Fe.....	28.83	52.53	3.57
Assay per cent mag. Fe.....	27.62	52.12	.87
Per cent wgt. ore .....	100.00	51.59	48.41
Per cent wgt. sol. Fe .....	100.00	94.00	6.00
Per cent wgt. mag. Fe .....	100.00	98.64	1.36

In this test 23.11 per cent of the original ore was recovered as final concentrate. This low extraction is due to the fact that 30.56 per cent of the original ore appeared as classifier sand and was too high grade to be discarded and too low grade to be included in the final concentrate. In this test the sand was stored for later treatment, but in any operating plant it would be returned to the original or a second ball mill for further treatment. In this way the extraction could be improved considerably.

FIGURE 62. FLOW SHEET FOR OPEN CIRCUIT GRINDING, CONCENTRATION, AND CLASSIFICATION TEST



From this test and other tests on this flow sheet, of which this test is typical, certain general observations were made.

1. It is possible with this flow sheet to produce a very high-grade concentrate assaying well within the Bessemer limits.
2. This flow sheet produces a middling product which would be re-treated in any commercial operation.
3. All of the classifier overflow coarser than 300 mesh (.0017-inch opening) is extremely low grade and any considerable amount of this material will increase the silica content of the concentrate. With this flow sheet, it is necessary to crush all of the valuable mineral and most of the silica through 300 mesh in order to produce a high-grade concentrate.

TABLE XIII  
TEST ON EASTERN MESABI ROCK WITH OPEN-CIRCUIT GRINDING AND CLASSIFICATION  
Operating data

Ball mill	Magnetic log-washer
Speed .....36 r. p. m.	Speed of logs.....40 r. p. m.
Power .....7 h. p.	Slope .....2½" per ft
Ball load.....1000 lbs.	Power to operate.....¼ h. p.
Size of balls.....2½", 2"; 1¼"	Power for magnets .....375 k. w.
Feed rate.....870 lbs. per hr.	

Assays and screen analyses of products

Mesh size	Ball mill feed		Ball mill product		Mag. log. conct.		Mag. log. tails		Classifier sand		Classifier overflow	
	Per cent wgt.	Per cent sol. Fe.	Per cent wgt.	Per cent sol. Fe.	Per cent wgt.	Per cent sol. Fe.	Per cent wgt.	Per cent sol. Fe.	Per cent wgt.	Per cent sol. Fe.	Per cent wgt.	Per cent sol. Fe.
+ 8 .....	00.00				00.00				00.00			
+ 14 .....	29.00		00.00		1.60	29.74			3.74	33.96		
+ 28 .....	23.50		4.30	32.00	6.10	32.07	00.00		15.88	36.59		
+ 48 .....	13.00		9.20	32.45	12.00	34.70	4.40	10.74	27.80	42.56		
+100 .....	10.50		18.60	26.96	18.70	39.43	16.40	7.74	29.29	46.47	00.00	
+200 .....	7.70		18.10	22.98	13.50	43.86	21.00	5.41	12.53	49.11	.70	25.61
+300 .....	3.30		8.40	22.83	6.00	49.50	11.00	6.46	3.73	55.87	1.50	30.19
-300 .....	13.00		41.40	35.00	42.10	64.10	47.20	8.26	7.03	67.01	97.80	64.44
<b>Total .....</b>	<b>100.00</b>	<b>29.74</b>	<b>100.00</b>	<b>29.74</b>	<b>100.00</b>	<b>49.83</b>	<b>100.00</b>	<b>7.49</b>	<b>100.00</b>	<b>45.37</b>	<b>100.00</b>	<b>63.65</b>
Mag. Fe assay.....	28.40		28.40		49.18		5.77		38.42		63.41	
Per cent wgt. of ore.....	100.00		100.00		53.67		46.33		30.56		23.11	
Per cent wgt. mag. Fe.....	100.00		100.00		92.94		7.06		41.34		51.59	

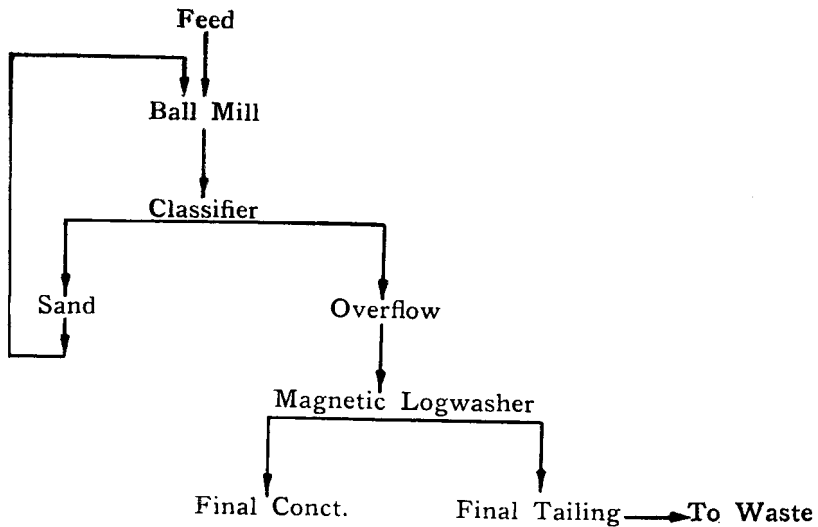
Complete analysis of classifier overflow

Mag. Fe.....63.41 per cent	Sulphur .....Trace	Lime .....53 per cent
Sol. Fe.....63.65 per cent	Phos. ....0.17 per cent	Magnesia .....90 per cent
Ins. Fe.....1.47 per cent	Silica .....8.00 per cent	Manganese .....39 per cent
Tot. Fe.....65.12 per cent	Titanic acid.....Trace	
Ferrous Fe.....20.42 per cent	Alumina .....44 per cent	

Hydraulic classification is not suited to the separation of a low-grade iron concentrate into high-grade fine material and a low-grade coarse material. Since classification depends upon the specific gravity of the minerals as well as the size and shape of the particles, large low-grade and fine high-grade particles tend to appear in the same product from the classifier, a condition which is not desired with this ore. For this reason the flow sheet in Figure 63 was arranged to enable the classifier to work to better advantage. The results secured on a typical test using this flow sheet are shown in Table XIV.

In this test 74 per cent of the feed to the magnetic log-washer was finer than 300 mesh. The concentrate produced in this test

FIGURE 63. FLOW SHEET FOR CLOSED CIRCUIT GRINDING AND CONCENTRATION TEST



assayed 62.16 per cent total iron and .027 per cent phosphorus. The silica, however, assayed 13.25 per cent, which is rather high. It therefore might be desirable to feed the log-washer slightly finer material and produce a concentrate somewhat lower in silica. This could easily be done by adjusting the classifier to overflow slightly finer ore. The classifier delivered to the ball mill to be reground 2,423 pounds of sand per hour, a circulating load of 368 per cent of the original feed. By making the classification finer so as to produce a higher grade of concentrate this circulating load would be somewhat increased. Subsequent tests, however, showed that a concentrate assaying under 10 per cent silica could be made without overloading the ball mill or classifier.



**TABLE XIV**  
**TEST ON EASTERN MESABI ROCK WITH CLOSED-CIRCUIT GRINDING**

**Ball mill**

Speed .....34 r. p. m.  
 Power .....6.7 h. p.  
 Ball load.....1000 lbs.  
 Size of balls.....1½"  
 Feed rate.....628 lbs. per hr.

Operating data

**Magnetic log-washer**

Speed of logs.....31 r. p. m.  
 Slope .....1¾" per ft.  
 Power for drive.....½ h. p.  
 Power for magnets......371 k. w.  
 Rake classifier  
 Slope .....2" per ft.  
 Speed .....12 strokes per min.

Assays and screens analyses of products

Mesh size	Ball mill feed		Ball mill product		Classifier sands		Classifier overflow		Mag. log. conct.		Mag. log. tails	
	Per cent wgt.	Sol. Fe	Per cent wgt.	Sol. Fe	Per cent wgt.	Sol. Fe	Per cent wgt.	Sol. Fe	Per cent wgt.	Sol. Fe	Per cent wgt.	Sol. Fe
+ 8 .....	00.00		00.00		00.00							
+ 14 .....	29.00	31.74	0.30	35.36	0.40	31.59						
+ 28 .....	23.50	29.17	2.20	32.95	2.30	31.66						
+ 48 .....	13.00	31.89	6.10	31.89	7.10	30.98	00.00		00.00		00.00	
+100 .....	10.50	22.22	17.90	25.77	21.20	25.24	0.50	11.70	0.20	20.48	0.30	6.86
+200 .....	7.70	17.98	30.20	21.99	34.00	22.82	10.30	4.68	2.60	20.20	10.50	1.64
+300 .....	3.30	18.97	17.80	29.24	18.00	31.74	15.20	11.70	10.20	40.24	14.60	1.64
-300 .....	13.00	31.89	25.50	38.99	17.00	43.98	74.00	34.47	87.00	64.34	74.60	3.51
<b>Total .....</b>	<b>100.00</b>	<b>28.54</b>	<b>100.00</b>	<b>28.85</b>	<b>100.00</b>	<b>29.32</b>	<b>100.00</b>	<b>27.83</b>	<b>100.00</b>	<b>60.63</b>	<b>100.00</b>	<b>3.05</b>
Mag. Fe assay.....	27.32		27.32		28.07		26.30		60.32		0.59	
Per cent wgt. of ore.....	100.00						100.00		43.04		56.96	
Per cent wgt. mag. Fe.....							100.00		98.71		1.29	

Complete analysis of final concentrate

Sol. Fe.....60.63 per cent  
 Ins. Fe..... 1.53 per cent  
 Tot. Fe.....62.16 per cent  
 Ferrous Fe.....19.86 per cent

Phos. .... 0.27 per cent  
 Silica .....13.25 per cent  
 Alumina ..... .31 per cent  
 Titanic acid.....Trace

Sulphur .....Trace  
 Magnesia ..... .81 per cent  
 Manganese ..... .16 per cent  
 Lime ..... .65 per cent

From this and other tests on this flow sheet, of which this test is typical, certain general observations were made.

1. A drag or rake type classifier can be used to advantage in this flow sheet. This type of machine may be so designed as to elevate and return the sands to the ball mill, thus eliminating the necessity for pumps or elevators.

2. The drag or rake type of classifier handles a large tonnage of sand, a condition which seems to be necessary for the efficient grinding of this ore to 150 mesh (.0041-inch opening).

3. The ball mill in this flow sheet is supplied with a large amount of feed with the proper moisture content for efficient crushing.

4. The magnetic log-washer receives only material that is ground sufficiently fine to produce finished concentrate and tailing.

5. No middling product is made in this flow sheet.

6. By adjusting the amount of water added to the classifier, the ore overflowing may be made as fine as desired and therefore the concentrate can be made to assay as high in iron as is desired.

7. The machinery and the way in which it may be arranged in this flow sheet is simple, flexible, and effective, and the results secured indicate that the desired grade of product can be made with an extremely high recovery of the valuable mineral.

#### CONCLUSION AND SUMMARY OF RESULTS SECURED FROM THE TESTS ON THE EASTERN MESABI MAGNETITE-BEARING ROCK

While it was not possible at the time these tests on the larger machines were made to produce a sufficient amount of cobber concentrate for feed to the ball mill, all of the information secured indicated that cobbing before fine grinding would be of considerable advantage. If the crude ore assayed 24 per cent iron and 40 per cent of the weight could be discarded by the cobber as tailing assaying 8 per cent magnetic iron, a rough concentrate could be produced amounting to only 60 per cent of the weight of the original rock but assaying 35 per cent magnetic iron. If this material were to be fed to the ball mill, ground to 150 mesh and concentrated, a product could be made assaying 64 per cent total iron and .020 per cent phosphorus. The ratio of concentration secured shows that 3 tons of rock would be necessary in order to produce one ton of concentrate with a magnetic iron recovery of 86 per cent. It would therefore be necessary to mine, coarse crush to  $\frac{1}{4}$  inch, and cob three tons of rock and fine grind to 150 mesh and concentrate  $1\frac{3}{4}$  tons of rock in order to produce one ton of finished concentrate.

Without cobbing, but by fine grinding all of the rock to 150 mesh and then concentrating, a magnetic iron recovery of 98 per cent could be secured. The real difference then between these two plans appears to be that with cobbing, three tons of rock will produce one ton of concentrate, and without cobbing three tons of rock will produce 1 1/6 tons of concentrate. However, in order to secure this one sixth of a ton of concentrate it is necessary to crush 1 3/4 tons of rock from 1/4 inch to 150 mesh. It is doubtful if the value of the one sixth of a ton of concentrate is sufficient to cover its cost of production.

The amount of low-grade rock that should be cobbled from the crude rock in order to show the greatest economy can only be determined by a careful economic study of the whole problem of mining, crushing, concentrating, agglomerating, shipping, and selling. If cobbing is to be done, it is necessary to spend more money in the construction of the plant and in operating it, as the cobbing machinery must be built, maintained, and attended, and the waste rock which is formed must be removed and placed on other ground. It is evident that the solution of this problem could not be undertaken by the Mines Experiment Station. For this reason and also on account of the desire to prove out the experiments on a still larger scale, the Mesabi Syndicate was formed for the purpose of investigating the possibility of producing iron ore commercially from the hard rock of the Eastern Mesabi Range. An experimental mill was constructed at Duluth, Minnesota, and was operated during the years 1916, 1917, and 1918. Several thousand tons of very high-grade concentrate were made, part of which was sintered and shipped to furnaces where it was made into a special high-grade steel for military purposes. No natural ore is to be had in this country of a grade equal to the concentrate that can be made from this crude rock, carrying only 24 per cent magnetic iron.

#### VERMILION RANGE MAGNETITES

The rocks of the Vermilion Range in Lake and Cook counties, contain in some instances a considerable amount of magnetite. Ilmenite is sometimes present, however, and being quite strongly magnetic, tends to enter the concentrate made by the magnetic machinery. The samples that have been received from this district are not at all uniform in structure and composition. Some of the rock is very finely crystalline and the magnetic particles are evenly disseminated through the whole mass, while in other samples the magnetite appears in bands of various widths. In the ore containing titanium, microscopic examination shows the ilmenite to be finely intergrown with the magnetite. The association in most cases is so intimate that with the finest grinding

it is often impossible to remove the ilmenite by any mechanical method. While fine grinding and magnetic concentration may separate part of the ilmenite from the magnetite, a large proportion of the original titanium is nearly always found in the concentrate. There is a considerable amount of magnetite in the Vermilion and Gunflint districts, however, that contains no titanium. This may be concentrated by magnetic machinery in the ordinary way.

A sample of magnetite-bearing rock was secured<sup>17</sup> from a deposit about 15 miles east of Ely. The magnetite in this material occurred both in bands and as fine crystals disseminated throughout the whole ground mass of silica. A microscopic examination of the material showed that fine crushing followed by wet magnetic separation would be necessary in order to produce a satisfactory concentrate. For this reason a series of preliminary magnetic concentration tests were made by use of the magnetic tube concentrator in order to determine the comminution necessary. The results of these tests are shown in Table XV.

TABLE XV  
MAGNETIC TUBE CONCENTRATION TESTS AT DIFFERENT SIZES ON VERMILION RANGE MAGNETITE

Crude ore..... 29.77 per cent sol. Fe, 26.31 per cent mag. Fe Trace titanium

Size	Concentrate			Tailing	
	Per cent wgt.	Per cent sol. Fe	Per cent phos.	Per cent wgt.	Per cent sol. Fe
Through 10 mesh .....	58.32	47.11	.106	41.68	5.11
Through 20 mesh .....	55.03	49.15	.106	44.97	5.67
Through 40 mesh .....	52.10	52.03	.105	47.90	5.20
Through 60 mesh .....	50.81	53.18	.103	49.19	5.24
Through 100 mesh .....	47.11	55.85	.096	52.89	6.22
Through 150 mesh .....	45.99	57.61	.086	54.01	5.76
Through 200 mesh .....	43.73	59.26	.081	56.27	6.56
Through 300 mesh .....	43.13	60.28	.077	56.87	6.33

These tests were all made upon small samples, but the results indicate closely the concentrating characteristics of the ore. The fineness of the crystalline structure is shown by the fact that at -300 mesh (.0017-inch opening) a concentrate containing only 60.28 per cent soluble iron was obtained. As this concentrate assayed .077 per cent phosphorus, the commercial possibility of producing a high-grade concentrate from this ore is doubtful. It appears that the crushing does not begin to liberate the phosphorus-bearing mineral until about 60 mesh (.0087-inch opening) is reached. At this point the phosphorus in the concentrate begins to fall rapidly but never reaches a point within the Bessemer limit. In order to check the results of these small tests

<sup>17</sup> Furnished by the Minnesota Geological Survey.

on the magnetic tube concentrator a large sample was pulverized to 100 mesh (.0058-inch opening) and fed to the magnetic log-washer. The results secured from these tests are shown in Table XVI.

TABLE XVI  
MAGNETIC LOG-WASHER TEST ON VERMILION RANGE MAGNETITE

Products	Per cent wgt.	Per cent tot. Fe	Per cent mag. Fe	Per cent phos.
Crude ore .....	100.00	31.07	26.31	.085
Concentrate .....	50.49	55.29	52.57	.091
Tailing .....	49.51	6.36	0.32	.079

Screen analysis of products

Size mesh	Crude ore		Concentrate		Tailing	
	Per cent wgt.	Per cent sol. Fe	Per cent wgt.	Per cent sol. Fe	Per cent wgt.	Per cent sol. Fe
On 100 .....	1.09	42.85	2.19	54.83	1.04	4.77
On 200 .....	12.61	39.05	14.93	50.63	6.05	5.39
On 300 .....	10.74	34.96	17.79	51.93	4.71	4.09
Through 300 .....	75.56	26.73	65.09	55.74	88.20	4.77
Unsize .....	100.00	29.77	100.00	54.27	100.00	4.78

Table XVII is shown for the purpose of comparing the results of this test on the magnetic log-washer with the results secured with the magnetic tube concentrator. It appears that the log-washer made a little lower grade tailing and therefore a little lower grade of concentrate than the tube, but the results of the two tests check very closely.

TABLE XVII  
COMPARISON OF CONCENTRATION TESTS ON LOG-WASHER AND MAGNETIC TUBE CONCENTRATOR

Test	Size of feed	Concentrate		Tailing	
		Per cent sol. Fe	Per cent sol. P.	Per cent sol. Fe	Per cent sol. P.
Magnetic tube .....	-100 mesh	55.85	.096	6.22	.055
Magnetic log-washer .....	-100 mesh	54.27	.089	4.78	.059

The grade of final concentrate produced is hardly good enough to warrant the expensive method of treatment necessary. It might be possible, however, to produce a rough concentrate at 6 mesh (.131-inch opening), thereby eliminating a large proportion of the weight of the rock from further treatment. The remaining ore could then be crushed to the size required in order to produce the desired grade of concentrate. This method of treatment would undoubtedly reduce the operating cost, but would considerably increase the first cost of the plant.

Another sample of magnetite-bearing rock was secured<sup>18</sup> about three miles southwest of Ely, and is of a little different structure from the sample previously reported. The structure of this material was a little coarser than the previous sample and narrow bands of nearly clean silica were apparent. The sample was divided into two parts, one of which was treated at  $\frac{1}{4}$  inch on the Dings magnetic separator, and the other crushed to 150 mesh (.0041-inch opening), and concentrated in the magnetic log-washer. The results of these tests are shown in Table XVIII.

TABLE XVIII  
CONCENTRATION TESTS ON VERMILION RANGE MAGNETITE

Test at $\frac{1}{4}$ inch on the Dings separator					
Product	Per cent wgt.			Per cent sol. Fe	
Crude ore	100.00				21.59
Concentrate	63.49				30.01
Tailing	36.51				6.85
Test at —150 mesh on magnetic log-washer					
Product	Per cent wgt.	Per cent sol. Fe	Per cent sol. Phos.	Per cent TiO <sub>2</sub>	Per cent SiO <sub>2</sub>
Crude ore	100.00	21.59	.065	Trace	56.08
Concentrate	28.63	64.45	.028	Trace	8.50
Tailing	71.37	4.40	.079	Trace	71.30

As was expected from an examination of the sample, no high-grade concentrate could be made at  $\frac{1}{4}$  inch. However, 36.51 per cent of the rock could be discarded at this size, assaying 6.85 per cent iron. When the whole sample was crushed to 150 mesh (.0041-inch opening) a concentrate assaying 64.45 per cent soluble iron was made, containing 8.50 per cent silica and .028 per cent phosphorus. It would require about 4 tons of this rock to produce 1 ton of concentrate. The cost of mining would therefore largely determine whether or not the commercial development of this deposit would be profitable. The results of the test show that from a rock assaying 21.59 per cent soluble iron a concentrate can be made at —150 mesh (.0041-inch opening) that assays well within the Bessemer limit.

#### VERMILION RANGE TITANIFEROUS MAGNETITE

A sample of rock containing fine crystals of magnetite was secured<sup>19</sup> from the eastern extension of the Vermilion Range. A sample was ground to pass 100 mesh (.0058-inch opening) and was concentrated on the magnetic tube concentrator. The results of this test are shown in Table XIX. The concentrate is evidently a mixture of magnetite and ilmenite, containing a little less than 1 per cent silica. The ilmenite

<sup>18</sup> Furnished by the Minnesota Geological Survey.

<sup>19</sup> *Ibid.*

seems to be uniformly disseminated throughout the whole mass, as fine crushing and concentration does not materially change the percentage of this mineral in either the concentrate or tailing. The phosphorus does not seem to be associated with the magnetite as a large part of it appears in the tailing.

TABLE XIX

## CONCENTRATION TEST ON VERMILION RANGE TITANIFEROUS MAGNETITE

Products — 100 mesh	Per cent wgt.	Per cent sol. Fe	Per cent SiO <sub>2</sub>	Per cent TiO <sub>2</sub>	Per cent phos.
Crude ore .....	100.00	39.51	11.40	16.50	.060
Concentrate .....	56.48	54.50	.80	15.70	.004
Tailing .....	43.52	16.16	26.95	18.00	.252

TABLE XX

## CONCENTRATION TEST ON VERMILION RANGE TITANIFEROUS MAGNETITE

Products — 100 mesh	Per cent wgt.	Per cent sol. Fe	Per cent TiO <sub>2</sub>
Crude .....	100.00	29.77	1.72
Concentrate .....	28.64	56.29	4.65
Tailing .....	71.36	15.11	.54

TABLE XXI

## CONCENTRATION TEST ON VERMILION RANGE TITANIFEROUS MAGNETITE

Products — 100 mesh	Per cent wgt.	Per cent sol. Fe	Per cent TiO <sub>2</sub>
Crude ore .....	100.00	21.95	12.28
Concentrate .....	31.74	61.61	9.66
Tailing .....	68.26	15.23	13.89

A smaller sample of rock taken from the same district but south and west of the previously reported deposit was crushed to 100 mesh and concentrated, producing the results shown in Table XX. In this case the ilmenite appears largely in the concentrate and only a small percentage is found in the non-magnetic tailing.

Still another sample<sup>20</sup> taken from about the same district produces the results shown in Table XXI. In this ore the ilmenite is not so closely associated with the magnetite and a considerable portion of it enters the non-magnetic tailing. The concentrate still contains too much titanium to be considered a desirable ore.

In most of the samples of ore taken from the Vermilion district, the titanium, if present in the crude ore, can not be entirely removed from the ore by fine grinding and magnetic concentration. The ratio of iron to titanium can be materially altered in some cases, but as a rule if the crude ore is high in titanium the concentrate will not be a desirable product.

<sup>20</sup> Furnished by the Minnesota Geological Survey.

## CUYUNA RANGE MAGNETITE

The occurrence of magnetite-bearing slate in the Cuyuna district is described by Harder and Johnston of the *Minnesota Geological Survey*.<sup>21</sup> This rock has fairly distinct layers of magnetite, amphibole, and quartz, but is rather fine grained and the bands of purest magnetite contain sufficient silica to make them non-merchantable. For this reason fine grinding is necessary in all of the samples that have been reported to the Experiment Station. This ore formation usually contains more or less hematite associated with the magnetite, some of which is in the specular form. Not enough of this rock has been treated to warrant any general statements as to the possibilities of magnetic concentration, but the results secured from a sample of this material may be of interest.

TABLE XXII  
MAGNETIC LOG-WASHER AND TABLE TEST ON CUYUNA RANGE MAGNETITE

Products —150 mesh	Per cent wgt.	Per cent tot. Fe
Feed .....	100.00	34.41
Mag. log conct. ....	32.56	68.19
Mag. log tails .....	67.44	18.03
Table conct. ....	8.78	67.07
Total tails .....	58.66	11.19
Total conct. ....	41.34	67.36

## Complete analysis of products

Assay	Crude ore	Concentrate	Tailing
Per cent ferrous iron .....	7.69	16.41	1.54
Per cent ferric iron .....	26.72	50.95	9.65
Per cent total iron .....	34.41	67.36	11.19
Per cent silica .....	42.20	5.27	68.21
Per cent phosphorus .....	.114	.021	.180
Per cent manganese .....	.11	.20	.06
Per cent alumina .....	3.89	.50	6.27
Per cent lime .....	.63	Trace	1.07
Per cent magnesia .....	1.67	.14	2.74
Per cent titanic acid .....	.19	.16	.20
Per cent ignition loss .....	.82	.07	1.14

The rock tested was finely crystalline and showed a considerable portion of specular hematite associated with the magnetite. This specular hematite could not be recovered in the magnetic machines, and it was therefore necessary to resort to table concentration in order to secure a good recovery of the iron. The treatment consisted in crushing the sample to 150 mesh (.0041-inch opening) and in subsequently concentrating it in the small magnetic log-washer. The tailing

<sup>21</sup> E. C. Harder and A. W. Johnston, Preliminary report of the geology of east central Minnesota, including the Cuyuna iron ore district. *Minnesota Geological Survey. Bulletin* no. 15.



from the magnetic machine was thickened and passed over concentrating tables. Table XXII shows the results secured by treating this ore. This test shows the possibility of making a very high-grade Bessemer concentrate from the low-grade Cuyuna magnetite-bearing slate. The process, however, would be expensive as fine grinding and agglomerating are necessary. The extent and availability of the deposit would have considerable bearing on the possibility of commercially handling this material.

#### MARQUETTE RANGE MAGNETITE

The Marquette Range in Michigan contains large tonnages of magnetic iron-bearing rock. The samples of this material which have been treated at the Experiment Station were of a finely crystalline structure but slightly banded in appearance. In testing one of these samples, the attempt was made to secure a separation of the iron and low-grade materials at a coarse size by the use of magnetic cobbors. While it was found impossible to produce a high-grade concentrate from this rock at 4 mesh (.185-inch opening), a certain amount of very low-grade material could be discarded. Table XXIII shows the results of the cobbing tests made upon this ore.

TABLE XXIII  
COBBING TEST ON MARQUETTE RANGE MAGNETITE

Products -4 mesh	Per cent wt.	Per cent sol. Fe	Per cent SiO <sub>2</sub>	Per cent phos.
Crude ore .....	100.00	36.31	45.20	.148
Concentrate .....	57.08	53.46	22.22	.191
Tailing .....	42.92	6.52	89.17	.048

Another sample of this rock was pulverized to pass a 100-mesh screen and treated on the small magnetic log-washer. Results of this test are shown in Table XXIV. While it appears that a high grade concentrate can not be made at a size coarser than 100 mesh (.0058-inch opening), it is possible by cobbing to eliminate a large amount of low-grade material and thereby produce a partially concentrated ore.

TABLE XXIV  
MAGNETIC LOG-WASHER TEST ON MARQUETTE RANGE MAGNETITE

Products -100 mesh	Per cent wt.	Per cent sol. Fe	Per cent SiO <sub>2</sub>	Per cent phos.
Crude ore .....	100.00	36.30	45.52	.168
Concentrate .....	48.50	63.97	11.40	.041
Tailing .....	51.50	7.26	81.36	.229

This partially concentrated ore may then be ground to a fine size and concentrated. It would, of course, be necessary to agglomerate this concentrate, but when treated in this manner a high-grade Bessemer ore could be made. It is interesting to note that the phosphorus is concentrated with the iron at —4 mesh (.185-inch opening), but at —100 mesh (.0058-inch opening) it is separated from the iron and appears largely in the tailing.

## GOGEBIC RANGE MAGNETITE

The western extension of the Gogebic Range into the Penokee district of Wisconsin also contains magnetite-bearing material. The samples of this material which have been examined show a slightly banded, but very finely crystalline structure. Table XXV shows the results secured from a cobbing test made upon a sample taken near

TABLE XXV  
COBBING TEST ON GOGEBIC RANGE MAGNETITE

Products —1 inch	Per cent wgt.	Per cent sol. Fe
Crude ore .....	100.00	34.41
Concentrate .....	57.12	41.27
Tailing .....	42.88	25.28

Penokee Gap. Another sample of this material was crushed to pass a 150 mesh (.0041-inch opening) screen and concentrated on the magnetic log-washer. The results are shown in Table XXVI. This method of treatment did not produce a satisfactory grade of concentrate. Rather than grind the material finer, the magnetic field of the

TABLE XXVI  
MAGNETIC LOG-WASHER TEST ON GOGEBIC RANGE MAGNETITE

Products —150 mesh	Per cent wgt.	Per cent sol. Fe
Crude ore .....	100.00	34.14
Concentrate .....	56.42	51.07
Tailing .....	43.58	12.23

log-washer was decreased in strength so that the more weakly magnetic portion of the ore might overflow with the tailing. The results of this test are shown in Table XXVII. These results indicate that it is possible to secure a high-grade concentrate from this material at 150 mesh (.0041-inch opening), but in order to do so, a considerable portion of the material must be discarded as tailing and be reground to a finer size.

TABLE XXVII  
MAGNETIC LOG-WASHER TEST ON GOGEBIC RANGE MAGNETITE

Products —150 mesh	Per cent wgt.	Per cent sol. Fe
Crude ore .....	100.00	33.71
Concentrate .....	24.38	63.43
Tailing .....	75.62	24.13

Several other samples of ore taken from this same district were treated on the magnetic tube concentrator at —100 mesh (.0058-inch opening). The results of these tests are shown in Table XXVIII.

TABLE XXVIII  
MAGNETIC TUBE CONCENTRATION TESTS ON EIGHT SAMPLES OF GOGEBIC RANGE MAGNETITE

Sample no.	Crude ore				Concentrate			Tailing		
	Per cent wgt.	Per cent sol. Fe	Per cent mag. Fe	Per cent P.	Per cent wgt.	Per cent sol. Fe	Per cent P.	Per cent wgt.	Per cent sol. Fe	Per cent P.
1	100.00	35.45	7.72	.042	13.80	55.95	.073	86.20	31.13	.033
2	100.00	43.65	16.92	.038	30.60	55.29	.088	69.40	37.89	.020
3	100.00	39.33	9.87	.039	19.20	51.41	.056	80.80	35.90	.035
4	100.00	42.77	23.88	.049	41.20	57.95	.052	58.80	31.13	.047
5	100.00	41.66	16.14	.034	31.80	50.74	.039	68.20	37.89	.031
6	100.00	46.31	16.45	.065	31.00	53.07	.063	69.00	43.21	.067
7	100.00	49.41	19.92	.046	33.60	59.28	.068	66.40	42.21	.035
8	100.00	32.57	15.54	.049	25.60	60.72	.105	74.40	18.72	.032

## PART IX

### MAGNETIC CONCENTRATION TESTS ON NON-MAGNETIC ORES RENDERED MAGNETIC BY ROASTING

While it is possible to make magnetic separations of the weakly magnetic minerals, the expense is in many cases prohibitive. For this reason in the magnetic concentration of non-magnetic iron ores possibly the simplest method<sup>22</sup> is to first render the iron oxide magnetic by roasting and then proceed with the separation.

As has been stated, non-magnetic iron ores may be rendered magnetic by roasting at a rather low temperature in a reducing atmosphere. After this reaction has taken place low-intensity magnetic concentrating machinery may be used effectively. Either before or after roasting, the ore must be crushed to a size that will liberate the particles of mineral. If all of the crushing precedes the roasting process, it is not necessary to change the particles of hematite completely to magnetite. Only a surface roast is required. If crushing follows the magnetic roasting, it is necessary to reduce all of the ore to magnetite in order to avoid large losses in the tailing from the separators. After the ore has been crushed and roasted to the magnetic state, any of the ordinary types of magnetic separators may be used for concentration. The results of magnetic roasting and concentration tests on a few samples of non-magnetic ore are reported to illustrate the method and the results that can be secured.

#### MESABI HEMATITE

The ore tested was a low-grade, soft hematite, showing little or no banding and quite finely crystalline structure. The sample was, therefore, divided into two parts, one being crushed to —48 mesh (.0116-inch opening) and the other to —100 mesh (.0058-inch opening), after which each sample was roasted in a small continuous roasting furnace. The temperature required was about 600° C. and ordinary illuminating gas was used as the reducing agent. After being given the magnetic roast, the samples were concentrated on the small magnetic

<sup>22</sup> A sufficient amount of work has not as yet been done either with magnetic roasting or with high intensity separations as applied to iron ores to definitely establish the superiority of either of these methods. However, at the present time the plan of roasting the non-magnetic iron ores to the magnetic state, to be followed by low-intensity magnetic separation, seems to offer the greatest promise.

log-washer. Tables XXIX and XXX show the results that were secured. The direct results of the reducing roast may be observed by comparing the magnetic iron assays of the ore before and after roasting. The more effective is the reduction, the more nearly the magnetic iron and the soluble iron assays of the sample after roasting will agree. However, the presence of iron in the form of soluble silicates will cause the efficiency of the reaction to appear lower than it actually is. This is due to the fact that iron silicate can not be rendered magnetic by low temperature roasting. The concentrate produced from the ore treated at —48 mesh (.0116-inch opening) is not so high in iron as that produced from the ore at —100 mesh (.0058-inch opening), but the phosphorus assay is uniformly low. The two concentration tests made at —100 mesh (.0058-inch opening) show the effect of changing the strength of the fields of the magnetic log-washer. In the second test with the stronger field the concentrate is lower in iron, but the recovery of ore is considerably higher than in the first test, in which the weaker field was used.

TABLE XXIX  
MAGNETIC ROASTING AND CONCENTRATION OF MESABI HEMATITE ORE

Products —48 mesh	Per cent wtg.	Per cent sol. Fe	Per cent mag. Fe	Per cent phos.
Crude ore before roasting	100.00	39.57	.78	.042
Crude ore after roasting	95.60	41.39	35.30	.043
Mag. log conct.	67.00	54.79	54.37	.018
Mag. log tails	28.60	10.24	2.24	.066

TABLE XXX  
MAGNETIC ROASTING AND CONCENTRATION OF MESABI HEMATITE ORE

Products —100 mesh	Per cent wtg.	Per cent sol. Fe	Per cent mag. Fe	Per cent phos.
Crude ore before roasting	100.00	39.57	.78	.042
Crude ore after roasting	96.61	40.96	33.00	.044
Mag. log conct. (test 1)	52.37	64.12	63.97	.019
Mag. log tails (test 1)	44.24	13.54	4.68	.082
Mag. log conct. (test 2)	60.70	59.63	58.88	.019
Mag. log tails (test 2)	35.91	9.40	2.11	.078

### CUYUNA MANGANIFEROUS ORES

By roasting and magnetically concentrating the Cuyuna manganese iron ores, it is often possible to produce concentrates higher in iron but lower in manganese and silica than the crude ore. In some of the samples examined, the manganese seems to be more closely associated with the iron than with the gangue. In these ores, by crushing to the proper size, a concentrate can sometimes be made which contains a considerable amount of manganese and iron. In all cases,

however, a large portion of the manganese appears in the tailing. If the ore is low in silica, this tailing which contains most of the manganese may be a valuable product. Sufficient work has not been done<sup>23</sup> on the Cuyuna manganese ores to determine the value of beneficiation by magnetic roasting and concentration. Table XXXI, however, shows the results secured by roasting and magnetically concentrating a sample of low-grade Cuyuna ore. While it was possible to raise the combined iron and manganese content of the ore from 29.62 per cent to 44.43 per cent, the concentrate made with 100 mesh grinding still contained a large amount of silica.

Table XXXII shows the results of a magnetic roasting and concentration test on a sample of high silica ore. This test indicates that part of the manganese can either be retained in the concentrate or discarded with the tailing, depending upon the size to which the ore is crushed. Table XXXIII shows the results of tests made at different sizes on medium silica ore. The silica was materially reduced by this method of treatment, but much of the manganese entered the tailing. With 100 mesh (.0058-inch opening) grinding this combined iron and manganese content of the ore was raised from 57.28 per cent to 63.15 per cent, but 2½ tons of ore would be required to make 1 ton of concentrate. Table XXXIV shows the results of roasting and concentrating a sample of low silica ore. In this test the results secured at —100 mesh (.0058-inch opening) are better than those secured with finer grinding. At this size the crude ore, concentrate, and tailing all contained about the same combined percentage of iron and manganese, but the concentrate contained most of the iron and the tailing most of the manganese. The crude material used in this test was a very high-grade ore and the value of concentrating material of this variety is doubtful.

TABLE XXXI  
MAGNETIC ROASTING AND CONCENTRATION OF CUYUNA MANGANIFEROUS IRON ORE

Products — 100 mesh	Per cent wt.	Per cent Fe	Per cent Mn	Per cent SiO <sub>2</sub>
Roasted feed .....	100.00	23.39	6.23	47.72
Roasted product .....	94.28	24.81	6.62	50.65
Magnetic tube conct. ....	55.71	39.33	5.10	34.40
Magnetic tube tailing .....	38.57	4.71	8.54	73.15

<sup>23</sup> Experimental work on the Cuyuna manganese iron ores is now being carried on at the Mines Experiment Station.

TABLE XXXII  
MAGNETIC ROASTING AND CONCENTRATION OF CUYUNA MANGANIFEROUS IRON ORE

Test no.	Size mesh	HIGH SILICA ORE									
		Crude ore			Concentrate					Tailing	
		Per cent wgt.	Per cent Fe	Per cent Mn	Per cent wgt.	Per cent Fe	Per cent Mn	Per cent P.	Per cent wgt.	Per cent Fe	Per cent Mn
1	-300	100.00	26.66	18.95	27.92	68.05	3.87	.065	72.08	10.64	24.80
2	-200	100.00	26.66	18.95	33.75	60.69	9.33	.078	66.25	9.33	23.85
3	-100	100.00	26.66	18.95	35.65	55.00	11.12	.090	64.35	10.91	23.24

TABLE XXXIII  
MAGNETIC ROASTING AND CONCENTRATION OF CUYUNA MANGANIFEROUS IRON ORE

Test no.	Size mesh	MEDIUM SILICA ORE											
		Crude Ore				Concentrate					Tailing		
		Per cent wgt.	Per cent Fe	Per cent Mn	Per cent SiO <sub>2</sub>	Per cent wgt.	Per cent Fe	Per cent Mn	Per cent SiO <sub>2</sub>	Per cent wgt.	Per cent Fe	Per cent Mn	Per cent SiO <sub>2</sub>
1	-300	100.00	25.76	31.52	20.39	32.03	52.28	14.06	7.66	67.97	13.26	37.14	27.44
2	-200	100.00	25.76	31.52	20.39	38.44	50.76	14.22	9.53	61.56	10.15	41.44	27.17
3	-100	100.00	25.76	31.52	20.39	41.01	47.88	15.27	11.23	58.99	10.38	41.98	26.50

TABLE XXXIV  
MAGNETIC ROASTING AND CONCENTRATION OF CUYUNA MANGANIFEROUS IRON ORE

Test no.	Size mesh	LOW SILICA ORE											
		Crude Ore				Concentrate					Tailing		
		Per cent wgt.	Per cent Fe	Per cent Mn	Per cent SiO <sub>2</sub>	Per cent wgt.	Per cent Fe	Per cent Mn	Per cent SiO <sub>2</sub>	Per cent wgt.	Per cent Fe	Per cent Mn	Per cent SiO <sub>2</sub>
1	-300	100.00	39.32	29.56	2.80	66.59	51.29	17.20	2.55	33.41	15.46	53.48	4.25
2	-200	100.00	39.32	29.56	2.80	66.73	52.28	15.60	2.48	33.27	13.33	56.18	3.55
3	-100	100.00	39.32	29.56	2.80	70.36	51.29	17.26	2.34	29.64	10.91	58.52	3.88



## MARQUETTE RANGE HEMATITE

The sample of this material was hard, finely crystalline, iron-bearing rock that could not be concentrated hydraulically. The rock was crushed to -10 mesh (.065-inch opening) and roasted in the small continuous magnetic roasting furnace. The product from the furnace was divided into five parts, each of which was crushed to a different size and concentrated in the small magnetic log-washer. A summary of the results secured from these tests is given in Table XXXV.

These tests show the variation in the grade of concentrate that can be produced by crushing to various sizes. At -200 mesh (.0029-inch opening) a high-grade concentrate was produced, assaying .009 per cent phosphorus. The phosphorus in the ore seems to be associated with the gangue rather than with the iron oxide and it is, therefore, eliminated by concentrating at the finer sizes. This is often found to be the case with the hematite ores and is one of the advantages of this method of treatment.

TABLE XXXV  
MAGNETIC ROASTING AND CONCENTRATION OF MARQUETTE RANGE  
HEMATITE

Test no.	Size of ore	Concentrate				Tailing	
		Per cent wgt.	Per cent Fe	Per cent SiO <sub>2</sub>	Per cent phos.	Per cent wgt.	Per cent Fe
1	- 10 mesh	49.21	43.58	27.97	.016	50.79	21.29
2	- 48 mesh	50.01	49.94	19.19	.018	49.99	14.57
3	-100 mesh	42.95	57.44	15.13	.016	57.05	13.30
4	-200 mesh	38.69	61.40	10.30	.009	61.31	13.87
5	-300 mesh	38.11	61.90	9.78	.008	61.89	14.01

In Table XXXVI is shown a summary of the results secured by roasting and magnetically concentrating several small samples of hematite ore. It is interesting to notice that in nearly every case the phosphorus in the concentrate is below the Bessemer limit. In some of the tests, the tailing contains a considerable amount of iron. This is due largely to the fact that the ore was not properly roasted.

TABLE XXXVI  
MAGNETIC ROASTING AND TUBE CONCENTRATION TESTS ON MISCELLANEOUS  
SAMPLES OF HEMATITE ORE

District	Size at which treated	Sol. Fe in crude ore before roasting	Sol. Fe in conct.	Phos. in conct.	Sol. Fe in tails	Ratio of conct.
Mesabi	—100 mesh	46.44	66.49	.033	35.53	2.84
Mesabi	—100 mesh	51.18	65.33	.053	27.69	1.60
Mesabi	— 48 mesh	49.47	58.79		7.30	1.22
Mesabi	—100 mesh	28.15	61.95	.041	6.73	2.58
Gogebic	—100 mesh	32.06	51.63		5.56	1.75
Gogebic	—100 mesh	39.36	60.26		8.56	1.68
Gogebic	— 48 mesh	39.36	58.65		20.20	2.01
Mesabi	—100 mesh	51.09	62.13	.018	11.27	1.28
Mesabi	—100 mesh	50.10	61.53	.037	22.40	1.41
Mesabi	—100 mesh	41.39	67.49	.020	11.93	1.89
Mesabi	—100 mesh	56.87	66.59	.020	18.82	1.23
Mesabi	—200 mesh	56.87	68.83	.016	24.33	1.34
Mesabi	—100 mesh	58.08	69.94	.009	2.91	1.22
Mesabi	—100 mesh	57.29	69.04	.010	5.96	1.23

## PART X

### STANDARD TESTING METHODS FOR MAGNETIC IRON ORES

As a result of testing a great variety of magnetic ores, a definite method of procedure has been established at the Mines Experiment Station which is followed when a magnetite or a roasted hematite ore is being treated for the first time. The object of this series of tests is to provide sufficient information so that certain general facts may be established which may be used to limit the testing work necessary on a larger sample of the ore. As a result of these tests, it is usually possible to establish approximately the proper method of treatment for the concentration of the ore and thus greatly limit the work necessary on the larger samples. It has been found that the results secured in these small scale tests can be reproduced by large machines operating in commercial plants.

The flow sheet in Figure 64 shows the standard procedure in testing all unknown ores. The sample should weigh from 10 to 50 pounds, altho complete tests can be made on samples weighing 5 pounds or less. All products made in the test are assayed for soluble and magnetic iron, and in addition, the concentrates are assayed for total iron, phosphorus, and silica.

From the results of the cobbing test, it is possible to plot curves showing the assay of the concentrate and tailing that may be made when any particular quantity of cobber tailing is discarded. These curves are called the "cobbing characteristic" curves of the ore, and by their use it is possible to determine whether or not further investigation along this line is warranted.

The concentration tests at the different sizes furnish information by which curves are plotted showing the grade and weight of concentrate that may be recovered at each size. These curves are called the "concentrating characteristic" curves of the ore. By use of these curves the fineness of grinding necessary in order to produce any desired grade of concentrate may be readily determined.

By use of these characteristic curves it is possible to determine with a good degree of accuracy the nature of the treatment best adapted to the concentration of the ore. In all cases, further investigation is necessary and, in order to secure accurate results, should be conducted on samples weighing several tons. Much useless and expensive work is saved, however, by use of the preliminary tests made on the small samples. In order to illustrate this method of

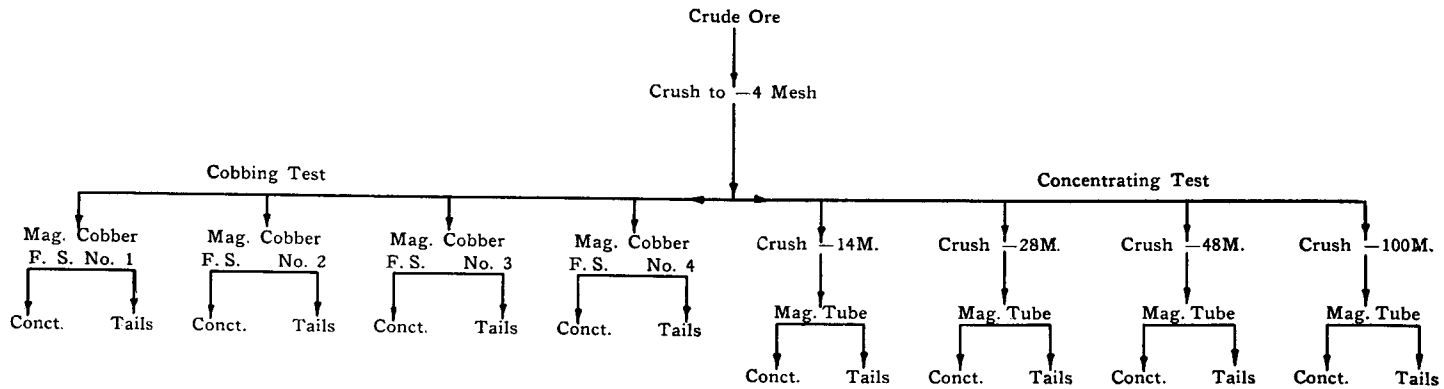


FIGURE 64. FLOW SHEET USED IN TESTING MAGNETIC ORES

testing, a portion of a report made on a small sample of magnetite-bearing rock is given. Later a sample of the ore weighing several tons was treated, and the results of this large test are given for comparison with the results of the preliminary tests.

RESULTS OF PRELIMINARY TESTS ON ORE NO. 459E

Table XXXVII and corresponding curves, Figure 65, show the results secured by cobbing a sample of the ore when crushed through

TABLE XXXVII  
 DRY COBBING TEST AT -4 MESH  
 Crude ore 25.47% tot. Fe, 22.50% mag. Fe

Field strength no.	Concentrate				Tailing		
	Per cent wgt.	Per cent tot. Fe	Per cent mag. Fe	Per cent phos.	Per cent wgt.	Per cent tot. Fe	Per cent mag. Fe
1 .....	46.97	45.52	43.46	.013	53.03	9.11	3.60
2 .....	28.84	49.21	47.40	.007	71.16	10.29	4.89
3 .....	24.58	54.85	53.61	.005	75.42	10.65	5.07
4 .....	19.52	58.60	58.03	.004	80.48	12.52	8.12

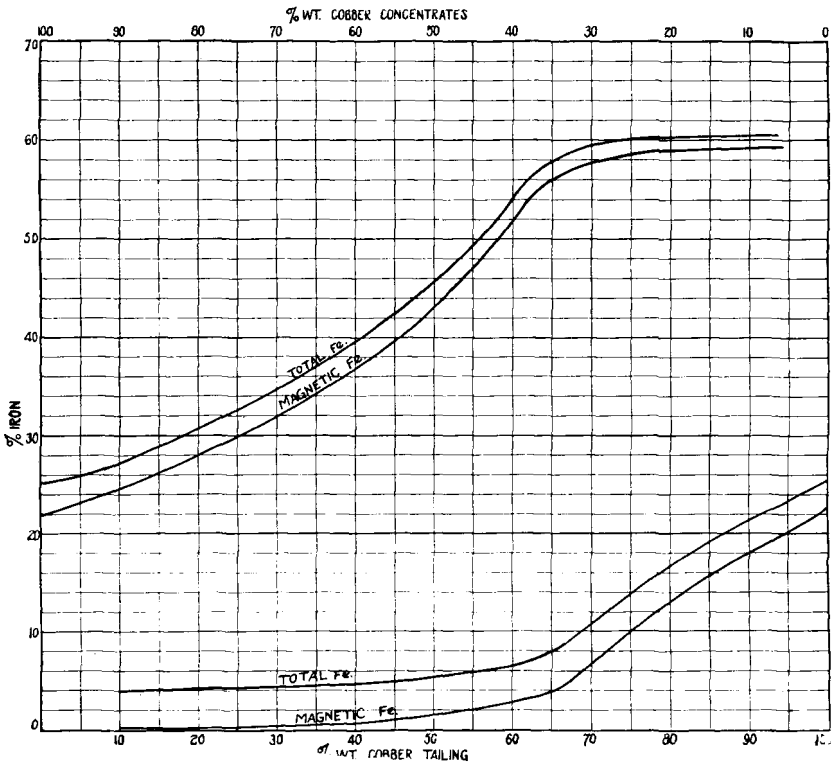


FIGURE 65. COBBING CHARACTERISTIC CURVES FOR ORE NO. 459 E

TABLE XXXVIII  
WET CONCENTRATION TESTS AT VARIOUS SIZES

Crude ore 25.47% tot. Fe, 22.50% mag. Fe

Size mesh	Concentrate			Tailing	
	Per cent wgt.	Per cent tot. Fe	Per cent phos.	Per cent wgt.	Per cent tot. Fe
- 14 .....	39.38	57.87	.011	60.62	4.27
- 28 .....	34.07	64.91	.006	65.93	4.95
- 48 .....	33.95	67.91	.004	66.05	3.52
- 100 .....	31.89	70.46	.002	68.11	4.27

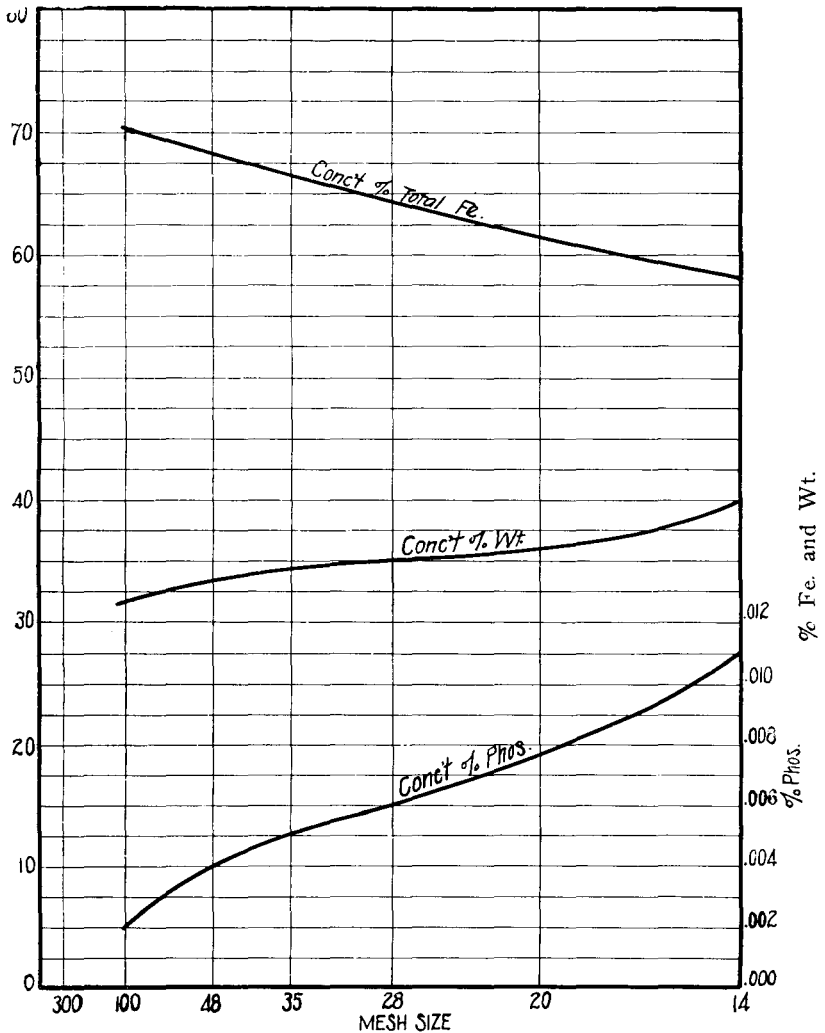


FIGURE 66. CONCENTRATING CHARACTERISTIC CURVES FOR ORE NO. 459 E

4 mesh (.185-inch opening). These results indicate that cobbing will eliminate low-grade tailing as well as produce a good grade of concentrate. As the ore is mined underground, it is desirable to keep the recovery of concentrate as high as possible. A 58.60 per cent iron concentrate can be made on the cobbers, but 5 tons of ore would be required in order to produce 1 ton of final concentrate and 40 per cent of the total iron would be lost in the tailing. It would probably be more economical, therefore, to remove only a low-grade tailing with the cobbers, and then to crush fine the cobber concentrate for further treatment.

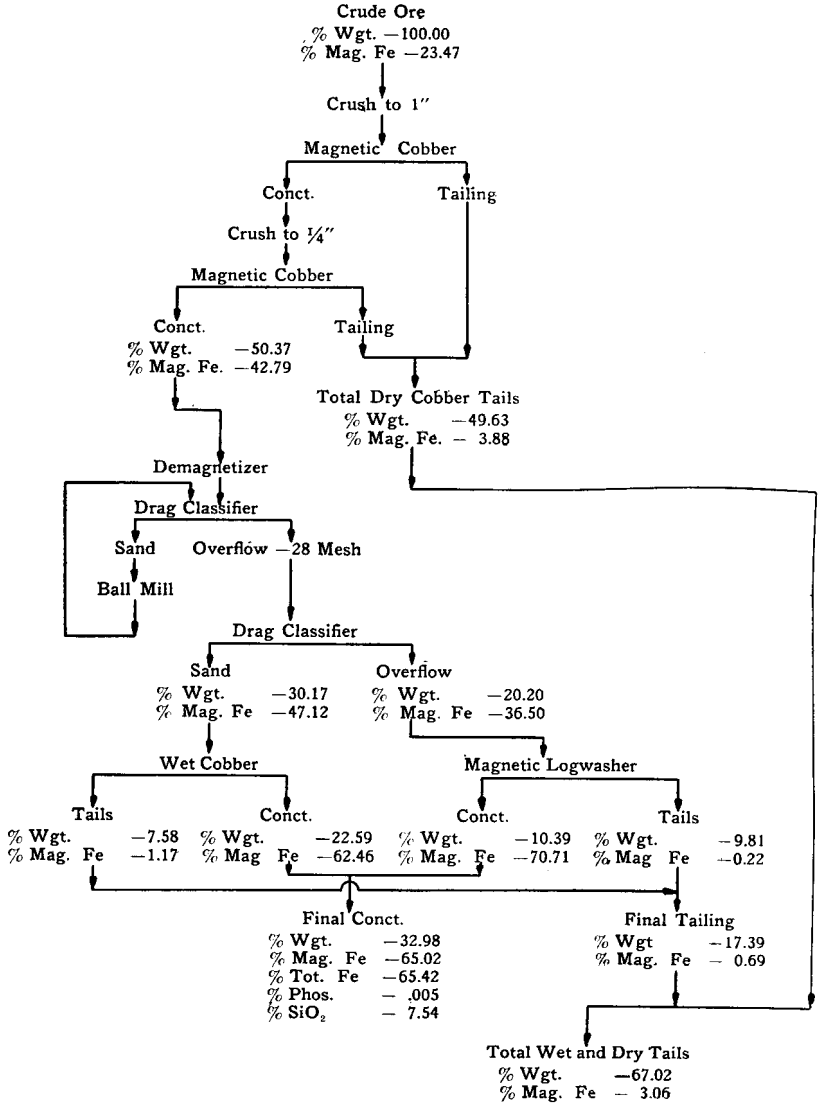
Table XXXVIII and the corresponding curves shown in Figure 66 indicate the results secured by fine grinding and wet concentration. These results show that a very high-grade concentrate can be made at 28 mesh (.0232-inch opening) with a ratio of concentration of 3 tons into 1. This is much better than was done with the cobbers. Finer grinding produces concentrates of still higher grades, but the value of producing concentrates assaying above 65 per cent iron is doubtful.

From the results secured by the cobbing and fine grinding tests, it appears that possibly the best method of operation would be to cob out 50 per cent of the weight of ore as a low-grade tailing, and grind the cobber concentrate produced, to —28 mesh (.0232-inch opening) for wet concentration. It would then be necessary to mine, crush, and cob 3 tons of ore, grind to —28 mesh and concentrate 1½ tons of ore, and dewater and agglomerate 1 ton of ore in order to produce 1 ton of finished concentrate.

#### LARGE SCALE TESTS ON ORE NO. 459E

A ten-ton sample of this material was received at the Experiment Station for a larger scale test along the lines indicated by the preliminary tests. The results of this larger test are shown in the flow sheet in Figure 67. In this test the ore was cobbled at 1 inch and again at ¼ inch. This was done for the purpose of removing the low-grade tailing at as coarse a size as possible. Approximately 50 per cent of the ore was discarded by the cobbers as tailing and the remaining 50 per cent of the ore was fed to the ball mill which operated in closed circuit with a Simplex Dorr classifier. The overflow from this classifier was —28 mesh (.0232-inch opening) material and was reclassified in a Duplex classifier. The sand product from the classifier was concentrated on the wet cobber and the overflow from the classifier was concentrated on the magnetic log-washer. Both of these machines

FIGURE 67. METALLURGICAL FLOW SHEET FOR ORE NO. 459 E





made a final concentrate and tailing. The two concentrates combined assayed 65.42 per cent total iron, which is approximately the grade of material desired.

In this flow sheet both the wet cobber and magnetic log-washer worked under ideal conditions. The wet cobber was fed no slime and the log-washer no sand. By changing the strength of the field on the wet cobber, the grade of concentrate can be changed. If an economic study shows that the actual results indicated in this test are not the most desirable, modifications are easily made and the flexibility of this flow sheet is one of its most valuable features.

## PART XI

### PLANT FLOW SHEETS FOR LOW-GRADE IRON-ORE CONCENTRATION

In considering the method by which magnetic machinery may be adapted to the concentration of low-grade iron ores, it is necessary to take into consideration all of the problems associated with this method of treatment. A study of the plan as a whole often reveals the fact that the magnetic separation itself is the simplest step in the whole process. After the ore material has been delivered to the mill, it must be crushed, sized, and possibly roasted before it is in proper condition to be delivered to the magnetic machinery. If fine grinding is necessary, the magnetic concentrate must be dewatered and agglomerated before shipment. All of this must be done by automatic machinery at a very low operating cost if the process is to be commercially possible. It will not be possible to design a standard form of flow sheet or mill construction for magnetic concentration plants, such as has been so successfully done with the washing plants on the Mesabi and Cuyuna ranges. After the property has been sampled, the ore must be tested and the economic situation carefully studied before the proper flow sheet and type of mill construction can be determined.

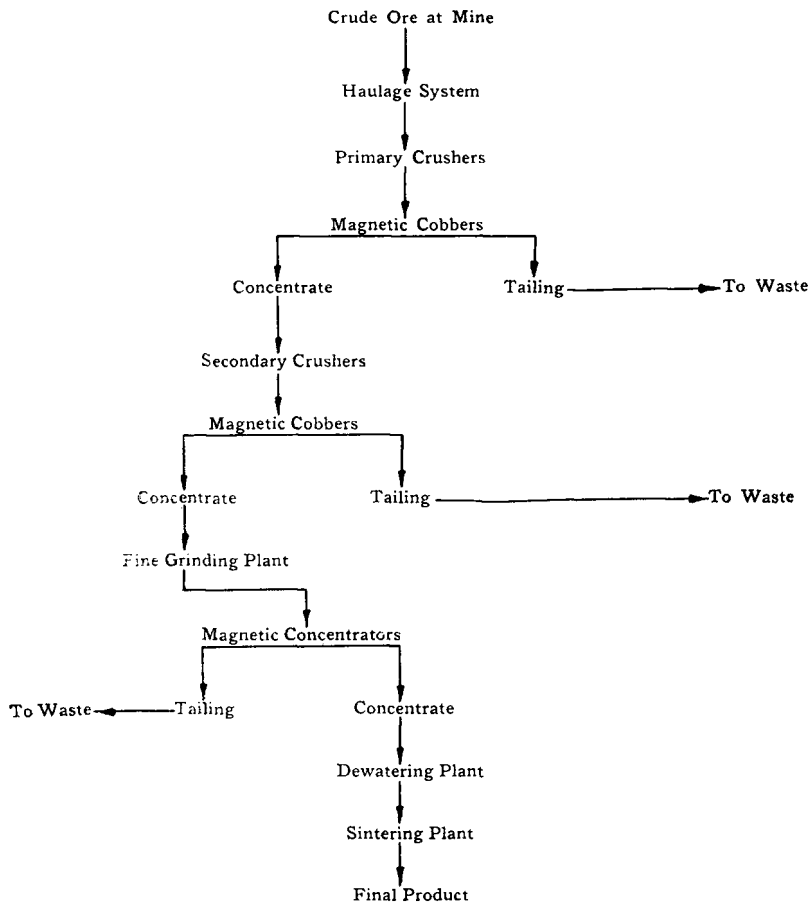
For certain types of ore, it is possible to give a general idea of flow sheets that will produce a high-grade concentrate properly prepared for furnace use. Varying conditions will undoubtedly cause radical variations in the details of these flow sheets, but the general form constitutes possibly the best known practice.

#### FINELY CRYSTALLINE MAGNETITE ORES

The flow sheet shown in Figure 68 is suitable for the treatment of finely crystalline magnetite-bearing rock such as is found on the eastern end of the Mesabi Range and to some extent on the Vermilion Range. In this flow sheet it has been assumed that no concentrate can be made from this ore without fine grinding, and, also, that the ore is of such structure that cobbing can advantageously be carried on.

The machinery making up the primary crushing plant in this flow sheet should be of a sufficient size to crush the rock as mined by steam shovels. After this plant had reduced the size of the ore to about 3 inches, it might be possible, by use of magnetic graders, to discard some of the rock as tailing. The concentrate from these graders would be reduced to possibly  $\frac{1}{2}$  inch in the secondary crushing plant,

FIGURE 68. FLOW SHEET OF PLANT FOR CONCENTRATING FINELY CRYSTALLINE MAGNETITE



at which size still more waste material might be discarded. In some cases, crushing to  $\frac{1}{4}$  inch and even finer before fine grinding might be desirable in order to take advantage of the possibility of eliminating more coarse tailing. On the other hand, if no waste material could be discarded at a coarse size, it might prove advisable to deliver two- or three-inch rock to the ball mills in the fine grinding plant. The expense of fine grinding is so great that advantage should be taken of every possibility of eliminating waste material before the ore is sent to the ball mills.

The fine grinding plant would consist of ball mills or rod mills, and classifiers or screens, which together would reduce the particles of ore to the desired size for final concentration. This finely crushed

material would then be delivered to the magnetic concentrating plant where the final concentrate and tailing would be made. The dewatering plant would consist of thickeners, settling tanks, filters, and possibly driers, depending to some extent upon the nature of the agglomerating process. The agglomeration of the fine ores may be accomplished by briquetting, sintering, nodulizing, or any other method of treatment that produces a lump ore that will not disintegrate during shipment or at the temperature reached in the upper portion of the blast furnace.

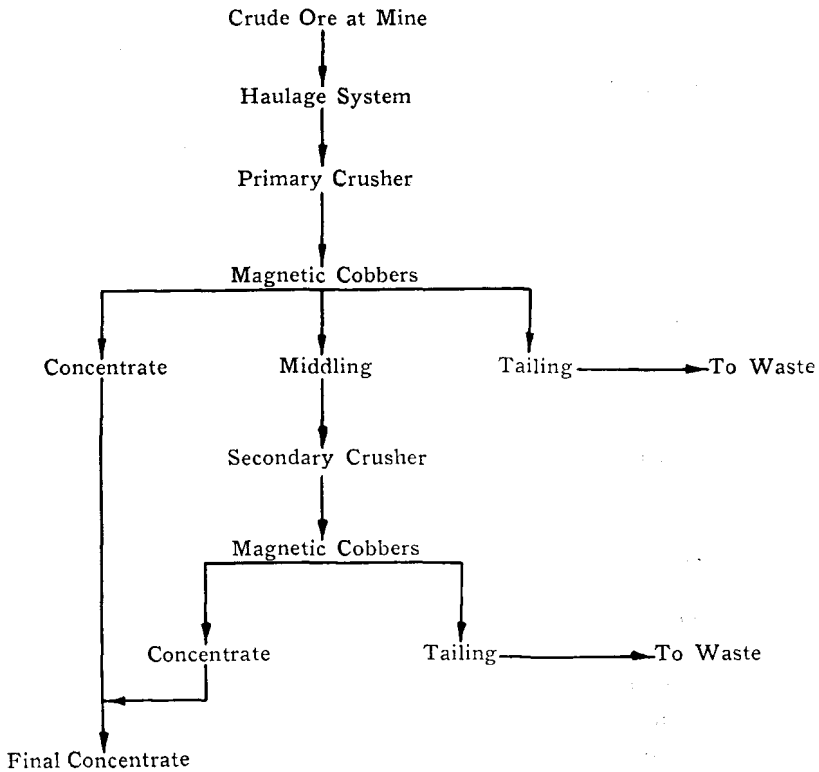
#### COARSELY CRYSTALLINE MAGNETITE ORES

If the crystals of magnetite in the ore are coarse, the flow sheet may be greatly simplified. The exact crystalline structure of the ore governs largely the nature of the most desirable flow sheet, but if fine grinding, such as is ordinarily accomplished in ball mills, can be eliminated, the cost of the plant as well as the cost of operation can be kept very low. The flow sheet in Figure 69 represents the general plan of treatment if fine grinding is not necessary.

It may be noticed that the chief difference between this flow sheet and the dry crushing and cobbing portion of the flow sheet shown in Figure 68 is the arrangement of the cobbers. In this flow sheet, the magnetic cobbers are arranged to make three products, a final concentrate, a final tailing, and a middling to be re-treated. It is possible so to operate a single cobbing machine that these three products will be delivered. Better results can be obtained, however, if two cobbers are used, the first one having a strong magnetic field which discards only the low-grade tailing, and the second one having a weak field which produces a final concentrate and a middling.

Possibly no agglomerating plant would be necessary in this flow sheet unless a large amount of very fine material were produced. The amount of fines in the concentrate would depend largely on the structure of the ore and the allowable loss of iron in the tailing. If the loss of fine iron in the tailing is to be kept small, fine grinding of at least a small part of the ore is usually necessary. A mixture of coarsely and finely crystalline magnetite in the ore would make necessary a combination of the flow sheets shown in Figures 61 and 62. This method of treatment with and without fine grinding has been in use at some of the magnetite mines in New York State for many years, producing high-grade iron ores from rock that could not be smelted direct.

FIGURE 69. FLOW SHEET OF PLANT FOR CONCENTRATING COARSELY CRYSTALLINE MAGNETITE



## TITANIFEROUS MAGNETITE ORES

The titaniferous magnetite-bearing rocks vary so greatly in structure and assay that it is almost impossible to lay out a definite plan of treatment without first making a detailed examination of the ore. As titaniferous iron ore is not considered desirable blast furnace material, it is necessary at the present time to produce an iron concentrate containing less than 3 per cent or 4 per cent titanium. As has been previously shown, it is possible with some ores to separate magnetically part of the titanium from the iron. With other ores the structure is such that the iron and the titanium can not be separated even if the ore is crushed to the finest possible size. The flow sheet shown in Figure 70 could be used on finely grained, titaniferous magnetite-bearing rock in which the structure is such that fine crushing will separate the iron and titanium minerals sufficiently to make possible the production of a valuable iron concentrate.

In this flow sheet advantage is taken of the fact that ilmenite is not as strongly magnetic as magnetite. If the magnetic concentrating machines are operated with a comparatively weak field, the titanium will enter the tailing with the silica. This method of operation, however, would produce a tailing containing considerable iron, and whether or not this flow sheet could be used to advantage would depend largely upon economic conditions. The possibility also exists, in connection with the concentration of the low silica titaniferous ores, of producing a tailing that is nearly pure ilmenite. If a market could be found for this material, a flow sheet could easily be arranged so as to produce ilmenite in the desired physical form.

### HEMATITE ORES

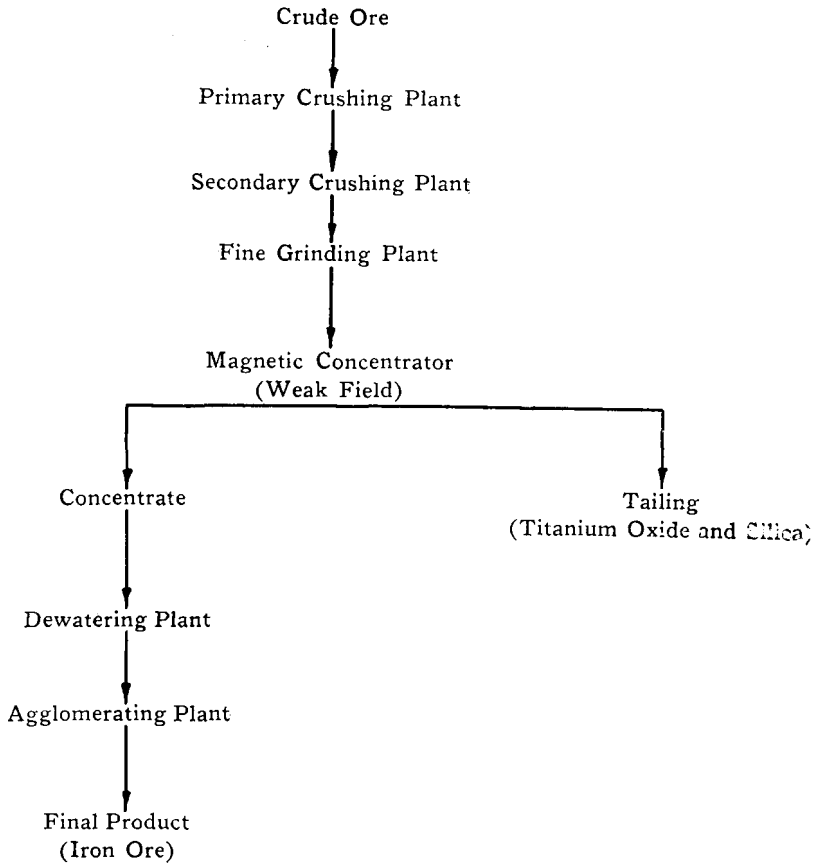
When roasting is necessary before magnetic concentration, the relative location of the roasting furnace will depend to some extent upon the physical structure of the ore. If the structure is such that ball-mill crushing is necessary before a separation of the minerals can be effected, the roasting furnace should be placed just following the secondary crushing plant. In this case the flow sheet would be as shown in Figure 71. If the structure of the ore is such that fine grinding is not necessary, the magnetic roasting should be carried on after the final crushing stage and just ahead of the magnetic concentrating machines. In this case the flow sheet will be as shown in Figure 72.

The reason for this difference in the relative location of the roasting furnace may be explained by the fact that if the roasted ore is to be crushed, it is necessary to have every particle of iron oxide completely changed to magnetite. If the ore is not to be crushed after roasting, it is only necessary that a large portion of each particle of iron oxide be in the form of magnetite. Tests that have been made with magnetic roasting indicate that the finer the ore is crushed the cheaper the process becomes. However, the possibility of eliminating coarse tailing may alter the entire flow sheet. After the ore has been rendered magnetic, the method of treatment is the same as that used in connection with the natural magnetites.

### MANGANIFEROUS IRON ORES

Methods of treatment similar to those discussed in connection with the hematite ores can be used to treat the manganiferous iron ores. If the manganese oxide and silica are closely associated in fine crystals with the iron oxide, fine grinding is necessary and a low recovery of the manganese is to be expected. If, however, the silica is more coarsely

FIGURE 70. FLOW SHEET OF PLANT FOR CONCENTRATING TITANIFEROUS MAGNETITE



crystalline and the iron and manganese oxides are intimately associated, it may be possible by crushing to the proper size to eliminate part of the silica and produce a concentrate containing the iron oxide and a considerable proportion of all of the manganese present in the crude ore. If the ore is low in silica, magnetic roasting followed by fine grinding, and magnetic concentration can be used to produce an iron concentrate which is low in manganese and a manganese concentrate low in iron and silica. The flow sheet shown in Figure 73 would be satisfactory for material of this kind in which the silica is very low. In this flow sheet, the magnetic separators divide the finely crushed material into a magnetic product and a non-magnetic product. The manganese and silica appear in the non-magnetic product and the iron forms the magnetic product.

FIGURE 71. FLOW SHEET OF PLANT FOR CONCENTRATING LOW-GRADE HEMATITE USING FINE GRINDING

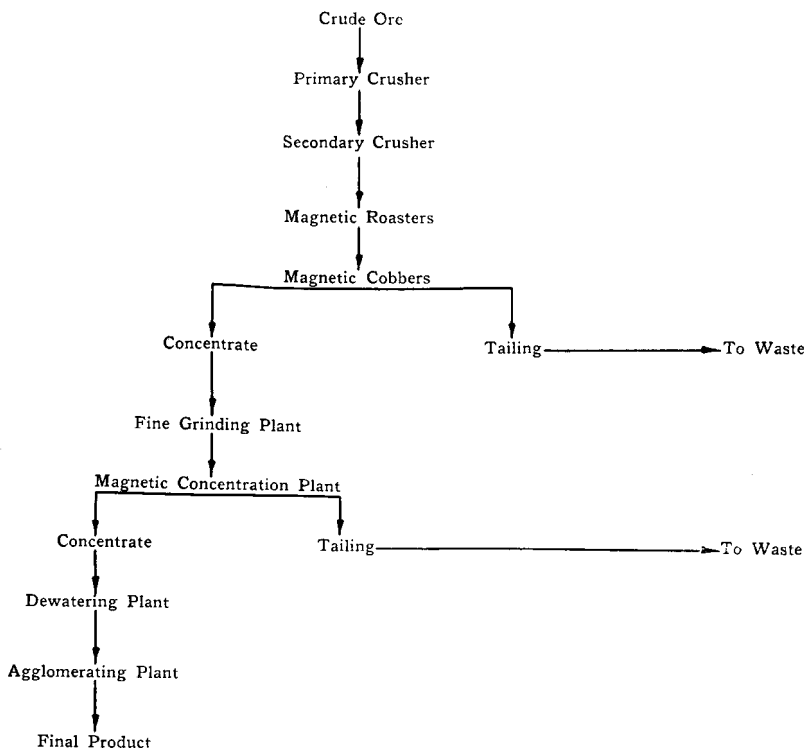
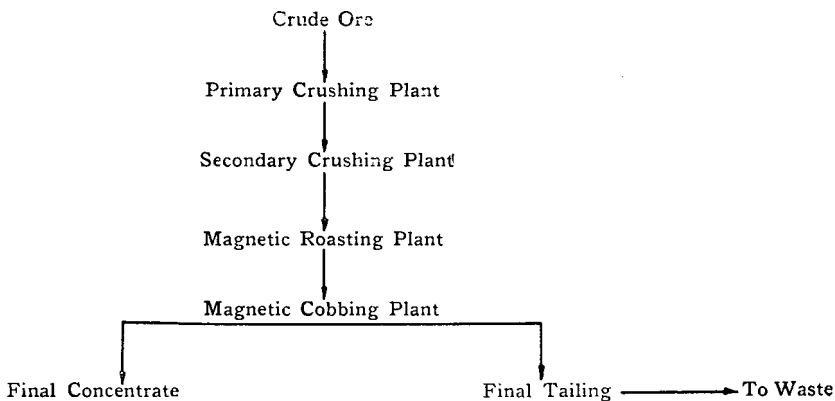


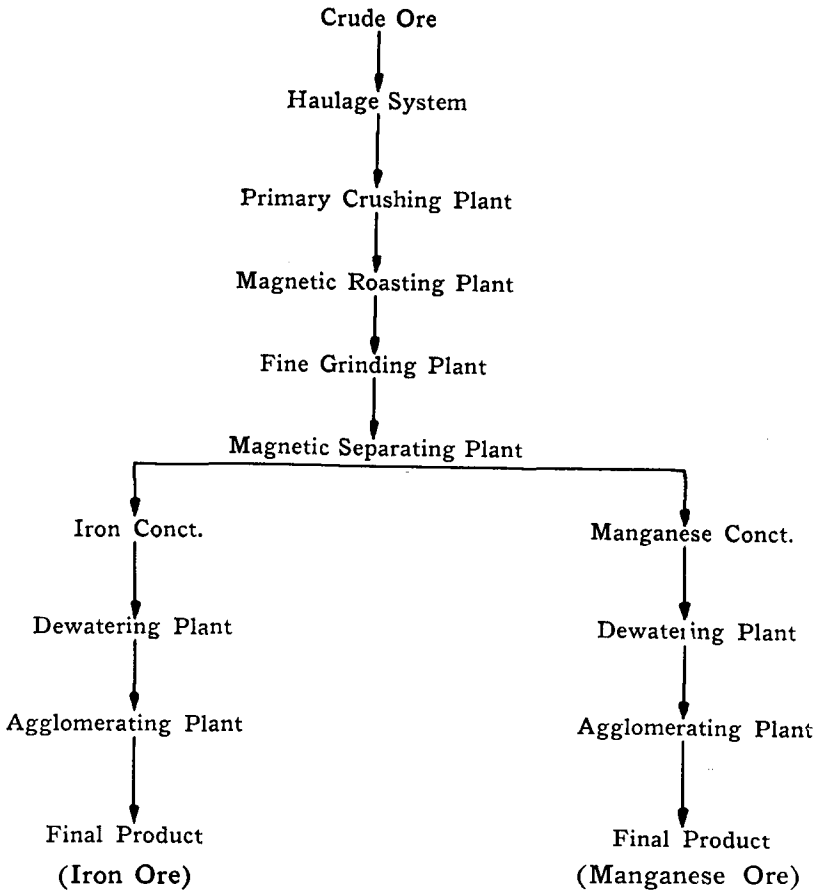
FIGURE 72. FLOW SHEET OF PLANT FOR CONCENTRATING LOW-GRADE HEMATITE WITHOUT FINE GRINDING





This flow sheet would be modified considerably in order to meet the requirements of different types of manganese ores, and as has been previously pointed out, it is only suitable for use in connection with ores of certain physical structures. If a highly siliceous ore is concentrated using this flow sheet, the iron concentrate will be the only valuable product, as the manganese and silica will appear together in the tailing.

FIGURE 73. FLOW SHEET OF PLANT FOR CONCENTRATING MANGANIFEROUS IRON ORE



## PART XII

### CONCLUSIONS AND GENERAL SURVEY

The economic problems in connection with the magnetic concentration of the low-grade iron ores have not been considered, as the primary object of this discussion was to describe the principles and practice of magnetic concentration. In considering economic questions, the operations of existing plants furnish valuable information. There are in the United States thirteen plants<sup>24</sup> and in Canada two plants<sup>25</sup> for concentrating iron ore by magnetic means. At a number of places, magnetic concentration has been applied unsuccessfully, but in most cases the failure has been due to economic rather than metallurgical causes. There has never been any considerable difficulty in producing a clean, high-grade, magnetic concentrate from almost any kind of magnetite-bearing rock. The cost of the magnetic separation proper has always been very low, but the cost of mining, crushing, screening, and transporting to market in many cases has been too heavy to leave any surplus to pay for the cost of construction of an expensive mill. The plants that are now in operation have been able to keep their costs sufficiently low to allow them to compete with the natural ores. A short description of three of these plants operating on three typical ores is included in this report in order to give some idea of the wide range of possibilities and the great variety of ores that are at the present time being concentrated commercially. These three plants have been selected as being typical of present practice in connection with magnetite-bearing rocks requiring (1) coarse crushing, (2) intermediate crushing, and (3) fine crushing.

At Mineville, New York, Witherbee, Sherman & Company have for a number of years operated mines and magnetic concentration plants. The ore mined assays from 35 per cent to 50 per cent iron

<sup>24</sup> Magnetic separating plants in the United States for concentrating iron ore—1921:

Witherbee, Sherman & Company, Mineville, New York.....	3 plants
Chateaugay Ore & Iron Co., Lyon Mountain, New York.....	1 plant
Benson Mines Co., Benson Mines, New York.....	1 plant
Bethlehem Steel Co., Lebanon, Pennsylvania.....	1 plant
The Cranberry Furnace Co., Cranberry, North Carolina.....	1 plant
The Replogle Steel Co., Wharton, New Jersey.....	1 plant
Ramapo Ore Co., Sterlington, New York.....	1 plant
Ringwood Company, Ringwood, New Jersey.....	1 plant
Mesabi Iron Co., Babbitt, Minnesota (under construction).....	1 plant
Hanover Bessemer Iron & Copper Co., Fierro, New Mexico.....	1 plant
North Jersey Steel Co., Beach Glen, N. J.....	1 plant

<sup>25</sup> Magnetic separating plants in Canada for concentrating iron ore—1921:

Canada Iron Mining Co., Trenton, Ontario, Canada.....	1 plant
Moose Mountain, Ltd., Sellwood, Ontario, Canada.....	1 plant

and in structure is coarsely crystalline. After crushing to 2 inches a 60 per cent iron concentrate is removed and the non-magnetic tailing is rejected by means of Ball-Norton drum cobbles. A middling product is also made which is crushed in steps to finer sizes, and after each crushing step, concentrates and tailings are removed. The final separation is made at  $\frac{1}{4}$  inch. The total concentrate produced assays 60 per cent iron and represents about 90 per cent of the total iron in the original ore. The whole process is dry and the concentrate is sufficiently coarse for blast furnace use without agglomeration.

At Lebanon, Pennsylvania, the Bethlehem Steel Company is operating a magnetic concentrating plant which produces a high-grade concentrate from crude ore shipped from Cornwall, Pennsylvania, about 6 miles distant. The ore as mined is very irregular, and varies in grade from 20 per cent to 50 per cent magnetic iron. It has been found that 20 mesh (.0328-inch opening) grinding is sufficiently fine for the separation of a 60 per cent concentrate from this ore. The crude ore is crushed to about 2 inches before it enters the ball mills, which crush in open circuit to —20 mesh (.0328-inch opening). The pulp flows to Gröndal separators, which produce a final concentrate and tailing. The concentrate is partially dewatered in Dorr classifiers and from these enters settling tanks. The water is drained off from these tanks and a product is made containing about 8 per cent moisture. This concentrate is removed from the tanks by clam-shell buckets and taken to the sintering plant. In this plant the concentrate is mixed with a sufficient amount of flue dust to reduce the moisture to about 4 per cent, and also provide a sufficient amount of fuel for sintering. This mixture is then fed to the Greenawalt sintering pans and sintered. After passing over grizzlies for the removal of the dust, the sintered product is shipped to the furnace.

At Sellwood, Ontario, Canada, Moose Mountain Limited has operated a magnetic concentration plant for about 10 years. The ore is finely crystalline and —100 mesh (.0058-inch opening) grinding is necessary in order to produce a 64 per cent iron concentrate. The ore is mined by underground and open-pit methods and is crushed in jaw and gyratory crushers to about 3-inch size. This material is then fed to ball mills which reduce it to —100 mesh (.0058-inch opening) in two or three stages. The concentration is all carried on wet by use of Gröndal separators, and the final concentrate is dewatered in thickeners, filters, and driers, to produce a product containing about 8 per cent moisture. This is fed to brick presses and formed into briquettes 2 inches by 4 inches by 8 inches. These bricks are piled on cars which carry them through the Gröndal briquetting kilns. In these kilns the

bricks are heated to a temperature of 1300° C., which causes the particles of ore to fuse together into a hard porous mass. After being crushed and screened the bricks are ready for shipment to the furnaces.

The presentation of valuable cost data in connection with the magnetic concentration of low-grade ore is extremely difficult at this time. Conditions are so unsettled and so variable that only by detailed study of each particular problem can reliable figures be secured. In general it may be said, however, that the profit per ton that may be made by the treatment of low-grade iron ores will be small, and only by handling large tonnages can large profits be made. The most attractive feature in connection with this problem is the extremely large amount of material available for treatment. Large deposits of magnetite-bearing rock that can be mined by open-pit methods occur in Minnesota, New York, Pennsylvania, North Carolina, and other states. The mining cost of this material would be low, and in many cases the market is close at hand. If magnetic roasting of the low-grade hematites be considered practical at this time, many locations can be found, especially in Minnesota, where all of the preliminary mining work has been done, and the property is open and ready for operation. Some of the large open-pit mines from which the high-grade ore has been removed are still equipped with tracks, pumps, etc., which may be used for the removal of the low-grade ore.

It is necessary for the mining cost of the low-grade ores to be low if the concentrate made from them is to compete with the natural ores. A study of the operating costs of plants for magnetic concentration often brings out the fact that underground mining is too expensive. A study of the first cost of the plant also brings out the fact that a very large supply of ore material is necessary in order to make the proposition attractive. It therefore appears that there are at least three prerequisites to a successful magnetic concentration undertaking. These may be stated as (1) a large supply of ore material, (2) a low mining cost, and (3) a ready market. If these three conditions are favorable, figures can be assembled which will show the profit that can be made by handling any given ore. It is impossible to state exact cost figures without a detailed study of the quality and structure of the ore in question. However, the costs given in Table XXXIX are included in this report in order to give an idea of the relative importance of the various steps in treating low-grade iron ore magnetically. These data represent the best information available at the present time.

As has been pointed out, it may be necessary to mine, crush, and roast perhaps three tons of ore, cob, fine grind, and concentrate two tons of

ore, dewater and agglomerate one ton of ore, stockpile one-half ton of ore, and dispose of two tons of tailings for every ton of final product that is shipped. For this reason it is necessary to know all of the metallurgical as well as the physical properties of the deposit before any estimate of the production cost can be made. The royalties and taxes have been left out of Table XXXIX as these costs vary radically with local conditions.

TABLE XXXIX  
OPERATING COSTS FOR MAGNETIC CONCENTRATION PLANTS

Items	Cost in dollars		
	High	Medium	Low
Mining and transferring to mill, per ton.....	\$0.50	\$0.30	\$0.10
Coarse crushing, mine run to 3", per ton.....	.20	.10	.05
Secondary crushing, 3" to ¼", per ton.....	.20	.10	.05
Magnetic cobbing, per ton.....	.05	.02	.01
Magnetic roasting, per ton.....	1.00	.75	.50
Fine crushing to 48 mesh, per ton.....	.20	.10	.05
Fine crushing to 150 mesh, per ton.....	.35	.25	.15
Magnetic concentrating, per ton.....	.10	.05	.02
Dewatering, per ton.....	.20	.10	.05
Agglomerating, per ton.....	1.25	1.00	.75
Stockpiling and reclaiming, per ton.....	.15	.10	.05
Tailings disposals, per ton.....	.05	.03	.01

Insurance, depreciation, interest, etc., depend upon the amount of the original investment, and this will vary considerably with individual properties. It is impossible to go into the detailed cost of the plants for treating these low-grade ores, but the average costs given in Table XL may give some idea of the approximate investment necessary for magnetic concentration plants. These figures are exclusive of the costs of transportation facilities, power plants, and water supply.

TABLE XL  
CONSTRUCTION COST OF PLANTS FOR MAGNETIC CONCENTRATION

Kind of plant	Cost per ton of yearly capacity		
	High	Medium	Low
When fine grinding is not necessary.....	\$1.00	\$0.75	\$0.50
When fine grinding is necessary.....	3.00	2.25	1.50

These figures are based on the costs of recently constructed mills in the United States that treat low-grade ores of various kinds. The comparison is, of course, rough, but these costs may be used for estimating purposes. It may be of interest to state that the present ore-washing plants on the Minnesota iron ranges cost about 15 cents per ton of yearly capacity, computed on the same basis of running time as above, that is, 24 hours per day and 300 days per year. As they are operated only 10 hours per day and 180 days per year, they cost about 50 cents per ton of actual yearly capacity.

In using the above figures in making comparisons, it should be kept in mind that the iron ore produced by magnetic concentration and agglomeration may be a very high-grade product. If properly treated it is a hard, uniform ore of very open structure containing no material finer than 100 mesh (.0058-inch opening). It may be made to assay 65 per cent iron, 8 per cent silica, and .025 per cent phosphorus. The value of such a product is somewhat in doubt, but on the 1921 scale of prices and classed as Old Range Bessemer ore it would be worth approximately \$8.50 per ton delivered at the lower lake ports, or approximately \$6.50 per ton at the plant.

As an example of a possible case, the following calculations may be made. Assume a soft hematite ore assaying 40 per cent iron, located in some open-pit mine from which the high-grade ore has been removed. The treatment necessary is; crushing to 4 mesh (.185-inch opening), roasting, cobbing and fine grinding to 48 mesh (.0116-inch opening), and magnetic concentration, dewatering, and agglomeration. Assume a final product assaying 63 per cent iron, 9 per cent silica, and .025 per cent phosphorus and a ratio of concentration of 1¾ tons into 1. The cost of treatment per ton of final product may be tabulated as follows:

Item	Cost per ton treated	Cost per ton of sinter
Mining and transferring to mill.....	1.75 tons at \$ .30	\$ .53
Crushing to ¼ inch.....	1.75 tons at .20	.35
Magnetic roasting.....	1.75 tons at .75	1.31
Magnetic cobbing.....	1.75 tons at .02	.03
Fine grinding at 48 mesh.....	1.40 tons at .15	.21
Magnetic concentration .....	1.40 tons at .05	.07
Dewatering .....	1.00 tons at .10	.10
Agglomerating .....	1.00 tons at 1.00	1.00
Stockpiling, reclaiming, and interest.....	.50 tons at .10	.05
Disposal of tailings.....	.75 tons at .03	.02
Royalty .....	1.00 tons at .25	.25
Interest on capital.....at 6% on	1.75 tons at 2.25	.24
Depreciation .....	at 10% on 1.75 tons at 2.25	.39
Overhead .....	1.00 tons at .50	.50
Shrinkage and loss in transit.....	1.00 tons at .05	.05
Freight and selling.....	1.00 tons at 2.10	2.10
Total cost per ton of concentrate delivered at lower lake ports		\$7.22

Computing the value of this ore on the Old Range Bessemer base and 1921 prices the value would be about \$8.09 per ton. This plant would then show a profit of \$.87 per ton of finished material or \$.50 per ton of ore mined. A plant handling 1,000 tons of ore per day would produce 572 tons of concentrate. This concentrating plant alone would cost approximately \$675,000. All of the above figures are simply estimates of what might be done at the present time and

are included in this report in order to give some idea of the cost of magnetically concentrating the low-grade iron ores. Any change in the freight rate, labor prices, cost of power, the iron-ore prices, or the tax rate will materially affect the economics of this problem.

In considering an industry of this kind it is advisable to look into the future as far as possible. This is especially true in connection with the effort to develop the low-grade ore industry, since the amount of material available is sufficient to last several hundred years. During this time there will undoubtedly be great advancement in metallurgy, ore-dressing, and engineering in general. More efficient and economical methods of treatment will be devised and the whole iron- and steel-making process will be considerably simplified. Blast furnace practice will undoubtedly be improved and perhaps some of the so-called direct reduction processes will come into use. However, it is certain that the cost of fuel, or heat units, is going to increase gradually as the supply of coal is exhausted. The direct results of an increase in fuel cost will be a demand for iron ore requiring less fuel in the production of steel. Undoubtedly the physical structure and chemical composition of the manufactured ores can be made such that the fuel consumed in smelting them will be less than the fuel consumed in smelting natural ores. The furnace operators will also be assured of a perfectly uniform ore supply, never varying in structure or chemical composition. It would therefore seem that, in the future, manufactured ore would be in greater and greater demand and would be recognized as a superior product more valuable than the direct smelting ores.

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J. A. O. PREUS, Governor of Minnesota

J. R. HOWARD, President, American Farm Bureau Federation

FRANK O. LOWDEN, Ex-Governor of Illinois

DUNCAN MARSHALL, Minister of Agriculture, Alberta,  
Canada

DR. CAROLINE HEDGER, Nutrition Specialist

MRS. ELLSWORTH RICHARDSON

SIDNEY ANDERSON, Congressman First District

L. E. POTTER, President, Minnesota Farm Bureau  
Federation

and Others

## FARMERS' AND HOME-MAKERS' WEEK

The **Answer** to the **Question** on the preceding page is difficult to find. Perhaps if those who are studying the question on the farms and those who are studying it at the colleges, schools, and experiment stations unite their forces something can be done toward finding the answer.

This joining of efforts is what is done during the Farmers' and Home-Makers' Week short course which is held this year at University Farm, St. Paul, from Monday noon, January 2, to Saturday noon, January 7, 1922.

For several years the men and women of Minnesota most interested in better homes and better farming have gathered by hundreds at this Farmers' and Home-Makers' short course and engaged in a week of study, discussion, demonstrations, entertainments, banquets, and personal visits with those from elsewhere in the state.

There are seven different programs for the men and six for the women going on at the same time throughout the week. Each person takes his or her choice for each hour of each day attending one continuous program or going from one program to another according to his or her interest in the particular topics. There are more exercises on the program for this one week than any one person could attend in two months of continuous work and all of them of interest to men and women of Minnesota, especially those engaged in active farming.

Even those who have been attending Farmers' and Home-Makers' Week short course each year for the last seven years, and there are many, can find something new this year.

**No expense except for traveling and board!**

**No fees charged to members for any of the class work, entertainments, lectures, or demonstrations!**

**Help to answer this one big question by coming to Farmers' and Home-Makers' Week Short Course!**

**After you find the answer for yourself, take it to others!**

### FARMERS

In attempting to answer the one big question asked on page 2, special attention will be given to the following subjects:

**Farm Management, Farm Crops, and Soils**—Farm business methods; studying production costs; the farm layout; devices and plans of operating; soil and its care; the use of crop rotation plans; the farmstead arrangement; labor-saving devices and plans of operating; soil and its care; the use of fertilizers and farm manures; seed selection; seed disinfection; grain and corn judging; forage crops, new and old; keeping out plant diseases; stopping the insect pests; how to eradicate the weeds; farm implement demonstrations.

**Livestock Production**—Some of the more important problems in livestock feeding will be discussed, such as how to get the greatest gains from pasture; increasing the price of grain by selling it to livestock; fattening cattle, hogs, and sheep; feeding calves for baby beef. Lectures will be given on some of the problems of the breeder, such as the value of pedigree in purebred livestock production, and how to judge a pedigree. Meat cutting demonstrations and the judging of cattle, sheep, horses, and hogs will be featured.

**Dairy Cattle**—How to judge animals of the leading dairy breeds, how to pick the profitable cow and how to feed her for the largest milk yield at the least expense. Raising calves and young stock, picking the future head of the herd, management of the cow on official test.

**Veterinary Medicine**—How to prevent losses from disease among livestock; special attention to diseases of hogs, cattle, sheep, and swine; prevention and control of animal tubercu-

## RAILROADS GRANT REDUCED RATES

The Western Passenger Association has offered railroad rates of one and one half fare from points in Minnesota only on the "Certificate Plan" to those who signify their intention of attending the meetings of the Minnesota Farm Bureau Federation (and to dependent members of their families), to be held in St. Paul during Farmers' and Home-Makers' Week, January 2 to 7, 1922, on the following conditions:

### READ THESE INSTRUCTIONS WITH GREAT CARE!!!

1. Tickets at the normal one-way tariff fare for the going journey may be bought on any of the following dates: December 31, 1921, January 1, 2, 3, 4, 5, and 6, 1922, but not on any other date.
2. Be sure when purchasing your going ticket to ask the ticket agent for a certificate. Do not make the mistake of asking for a receipt. If, however, it is impossible to get a certificate from the local ticket agent, a receipt will be satisfactory and should be secured when ticket is purchased. See that the ticket reads either to St. Paul or to Minneapolis, and not to any other place. See that your certificate is stamped with the same date as your ticket. Sign your name to the certificate or receipt in ink. Show this to the ticket agent.
3. Call at the railroad station for ticket and certificate at least 30 minutes before departure of train.
4. Certificates are not kept at all stations. Ask your home station whether you can procure certificates and through tickets to the place of meeting. If not, buy a local ticket to the nearest point where a certificate and through ticket to place of meeting can be bought.
5. Immediately on your arrival at the meeting, present your certificate to the endorsing officer, Secretary F. L. French, as the reduced fare for the return journey will not apply unless you are properly identified as provided for by the certificate.
6. No refund of fare will be made on account of failure either to obtain a proper certificate, or to have the certificate validated.
7. The reduction for the return journey is not guaranteed, but is contingent on an attendance of not less than 350 members of the organization and dependent members of their families at the meeting holding regularly issued certificates from ticket agents at starting points, showing payment of normal one-way tariff fare of not less than 67 cents on the going trip.
8. If the necessary minimum of 350 regularly issued certificates are presented to the Joint Agent, and your certificate is validated, you will be entitled to a return ticket via the same route as the going journey at one half of the normal one-way tariff fare from place of meeting to point at which your certificate was issued, up to and including January 10, 1922.
9. Return tickets issued at the reduced fare will not be good on any limited train on which such reduced fare transportation is not honored.
10. No certificate issued in connection with a child's half fare ticket, or a clergy, charity or employe's ticket, or any other form of transportation sold at less than the normal one-way adult fare will be honored for reduced fare returning, not included in computing the number in attendance.
11. No refund of fare will be made because of failure to obtain proper certificates. If holders of certificates purchase full fare tickets and return before the requisite number of certificates are in the hands of the Joint Agent, refund will not be made.

12. "CERTIFICATES WILL NOT BE VALIDATED FOR YOU CONVENTION UNLESS PASSENGER REFUND COUPONS OR TICKETS USED ON GOING TRIP ARE SURRENDERED TO OUR JOINT AGENT WHEN THE CERTIFICATES ARE PRESENTED TO HIM FOR EXECUTION. IT WILL THEREFORE BE NECESSARY FOR YOU TO REQUIRE YOUR MEMBERS TO TURN IN THEIR 'PASSENGER REFUND COUPONS' AND ATTACH SAME TO THE CERTIFICATE IN EACH CASE. IF THE REQUIRED NUMBER OF CERTIFICATES IS PRESENTED, THE JOINT AGENT WILL DETACH THE 'PASSENGER REFUND COUPONS' AND FORWARD SAME TO THIS OFFICE."

13. The above paragraph (12) is a quotation from the rules of the Western Passenger Association. The "Passenger Refund Coupon," which is attached to your going ticket when you obtain it from your local ticket agent, you are to keep and attach to your certificate when you present it to Secretary French. If enough valid going tickets are presented to obtain the reduced return rates and if your ticket is validated for such reduced return rates, the "Passenger Refund Coupon" will be retained by the Joint Agent and sent to the Western Passenger Association. If your ticket is not validated for reduced return rate, the "Passenger Refund Coupon" will remain with Mr. French to be returned to such as call for the same.

**KEEP YOUR "PASSENGER REFUND COUPON" AND PRESENT WITH YOUR CERTIFICATE TO MR. FRENCH!**

14. Remember that if your going ticket reads to St. Paul, you must purchase your return ticket in St. Paul; if your going ticket reads to Minneapolis, you must purchase your return ticket in Minneapolis.

losis; how to prevent losses from worms affecting horses, sheep, and swine; what to do in case of contagious abortion, or sterility of cattle; castration of pigs; dehorning of calves; stable disinfectants and how to use them; laws and regulations in regard to animal diseases.

**Horticulture**—The way to grow fruits and vegetables for profit; how to spray; how to prune; why fruit does not set; grape culture; garden tools and their use; fruit and vegetable varieties; berries and flowers for the home garden; how to graft and bud; propagation and care of house plants; demonstration of how to arrange flowers; shrubs, plants, and vines for home grounds; selection of seeds and plants for the garden; control of vegetable insects and diseases; how to treat vegetable seed in order to control diseases; possibilities for cooperative demonstration work in vegetable gardening.

**Agricultural Engineering**—The fact must be recognized that an immense development has taken place within the last few years in the mechanical appliances offered to the farmer and his wife, and conditions have changed very rapidly. Careful study, therefore, is necessary in selecting appliances, building materials, etc., in order to choose those best suited for individual conditions. Some of the subjects discussed are: Farm buildings; building materials; farm shop; use of tools; blacksmithing; cement; lighting farm buildings; water systems; septic tanks; heating farm buildings; farm power, tractor types, care, and operation; gas engine troubles; drainage, tile and open ditch drainage; methods of installation; land clearing, methods of clearing, use of pullers and explosives. Ample opportunity is given for conferences and discussions of any problems.

**Bees**—Lectures and demonstrations have been prepared for three classes of beekeepers: For **beginners**, clear-cut explanations of the nature of bees, their ways of working, and the proper way to handle them. For **advanced beekeepers**, the most approved methods of management for comb and extracted honey production and the results of the newest investigations. For **professional beekeepers**, some new machines and appliances, and a few advanced ideas that we would like to see tried and adopted on every large bee farm.

**Poultry**—The outlook for the poultry industry in 1922; the care of eggs in the home; practical poultry houses for the Northwest; killing and picking demonstration and lecture; feeding for winter egg production; poultry diseases; how to make a post-mortem examination; elimination of the unprofitable hen; successful poultry show management; annual meeting of the Minnesota State Poultry Breeders' Association.

## HOME-MAKERS

**Home-Makers' Week** furnishes an opportunity for women from farm, town, and city to unite for the discussion and solution of some of their problems. Every woman interested in better things for her own home and family and for her country will find here suggestions of great value.

Some of the problems considered in the program are:

**Child Health**—A special feature of this year's program will be the talks to mothers and fathers by Dr. Caroline A. Hedger of Chicago. Parents are learning that one of their real problems is that of keeping their children well. The large number of under-nourished children in the cities and rural districts has led to extensive nutrition-health work, and Dr. Hedger has had wide experience in helping to solve the problems of mal-nutrition.

**Home Management**—The cost of food in relation to the budget; home labor; essentials of nutrition as involved in the planning of meals.

**Food**—Their use in the body; their selection in order to make them consistent with health and thrift; planning and preparing meals.

**Textiles and Clothing Construction**—Discussion and demonstration of thrift problems in clothing and household fabrics.

**Dress Design and House Furnishing**—Color and design as applied to dress, house-planning, and house-furnishing.

**Home Care of the Sick**—The home-maker's responsibilities for the care of the sick.

## IMPORTANT MEETINGS

Farmers' and Home-Makers' Week has become the general meeting place for many of the farmers' organizations of the state. This plan makes it possible to attend the meetings of several of these organizations on one trip. Every farmer ought to be a member of one or more of these associations. Come to **Farmers' and Home-Makers' Week Short Course** and take part in these meetings:

Minnesota Farm Bureau Federation

Minnesota Federation of Farmers' Clubs

Minnesota Livestock Breeders' Association

The various associations of breeders of Holsteins, Guernseys, Jerseys, Ayrshires, Brown Swiss, Aberdeen Angus, Herefords, Shorthorns, and Red Polled cattle; Horses; Sheep; and Swine

The Creamery Managers of the State

Minnesota Poultry Raisers

Minnesota Fruit Growers

Minnesota Vegetable Growers

Minnesota Flower Growers

Testers, Minnesota Cow-testing Associations

Minnesota Institution Farmers' Club

## REACHING THE CAMPUS

University Farm can be reached from Minneapolis or St. Paul by Como-Harriet or Como-Hopkins cars, which cross Carter avenue and Doswell avenue four blocks from the Campus.

## ROOM AND BOARD

Lodging may be had at University Farm dormitories at 50 cents a night for each person, or rooms within walking distance at a somewhat higher rate. Meals may be obtained at University Farm dining-hall or the cafeteria. Trunks checked to either city will be delivered at the Farm or in the vicinity for 50 cents each.

## NOON MEETINGS

To unite our interests a mass meeting will be held each noon in the Assembly Hall where we may touch elbows in the consideration of some of the larger problems that concern rural Minnesota. Persons of national reputation will address these meetings.

## EVENING ENTERTAINMENTS

That all may be rested for the arduous duties of the succeeding day, there will be an entertainment each evening, consisting of moving pictures, music, plays, and short addresses, singing, and other features, of which the climax will be the big Farmers' and Home-Makers banquet on Friday evening.

## INFORMATION

A bulletin giving other information may be obtained from the Registrar, University Farm, St. Paul, Minn.

**A. V. Storm,**

Director of Short Courses

**W. C. Coffey,**

Dean

University Department of Agriculture

**The University of Minnesota**

DEPARTMENT OF AGRICULTURE



THE EIGHTH ANNUAL

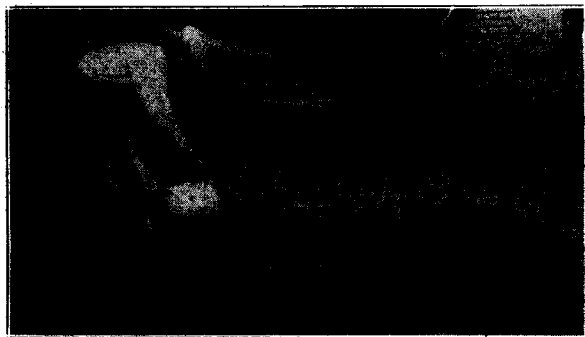
***Farmers' and Home-Makers'  
Short Course***

***For Men and Women***



UNIVERSITY FARM, ST. PAUL, MINNESOTA

JANUARY 2-7, 1922



SHORT COURSE SERIES

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Act of October 3, 1917, authorized July 12, 1918.

**BRING THIS PROGRAM WITH YOU AND KEEP  
IT THROUGHOUT THE WEEK**

# FARMERS' AND HOME-MAKERS' WEEK

## SHORT COURSE FOR MEN AND WOMEN



WHAT SHALL BE DONE TO MAKE LIFE ON  
MINNESOTA FARMS MORE PROFIT-  
ABLE AND PLEASURABLE?



Come to University Farm January 2 to 7, 1922, and  
Assist in Settling This Question



Hundreds of men and women will be there to coöperate with you, including men and women from the faculty of the University Department of Agriculture, men from the State Department of Agriculture, men and women prominent in Minnesota and other states, such as:

- L. D. Coffman, President, University of Minnesota
- M. E. Haggerty, Dean of the College of Education
- F. B. Snyder, President, Board of Regents, University of Minnesota
- N. J. Holmberg, State Commissioner of Agriculture
- J. R. Howard, President, American Farm Bureau Federation
- Frank O. Lowden, Ex-Governor of Illinois
- Duncan Marshall, Minister of Agriculture, Alberta, Canada
- Dr. Caroline Hedger, Nutrition Specialist
- Mrs. Ellsworth Richardson, of the American Farm Bureau Federation
- Sydney Anderson, Congressman, First District
- L. E. Potter, President, Minnesota Farm Bureau Federation

and others whose names you will find on pages 3 and 4 of this bulletin. Read the following pages to learn the topics, times, and places of the various subjects to be considered.

## OFFICERS

LOTUS D. COFFMAN, President of the University  
W. C. COFFEY, Dean of the Department of Agriculture  
A. V. STORM, Director of Short Courses  
W. P. KIRKWOOD, Editor  
R. M. WEST, Registrar

## FACULTY AND SPEAKERS

### FROM THE UNIVERSITY

W. H. ALDERMAN, Professor of Horticulture  
F. J. ALWAY, Professor of Soils Chemistry  
P. A. ANDERSON, Assistant Professor of Animal Husbandry  
A. C. ARNY, Associate Professor of Agronomy  
ELIZABETH BACON, Instructor in Drawing and Design  
L. B. BASSETT, Associate Professor of Farm Management  
J. H. BEAUMONT, Instructor in Fruit Breeding  
W. A. BILLINGS, Assistant Professor of Pathology  
ALMA L. BINZEL, Assistant Professor of Child Training  
J. D. BLACK, Professor of Agricultural Economics  
ANDREW BOSS, Professor of Agronomy and Farm Management and Vice-Director of Experiment Station  
WILLIAM BOSS, Professor of Farm Engineering  
W. L. BOYD, Professor of Veterinary Medicine  
W. G. BRIERLEY, Associate Professor of Horticulture  
CARLOTTA BROWN, Instructor in Millinery  
CLARA BROWN, Assistant Professor of Home Economics  
J. W. BUSHNELL, Instructor in Horticulture  
LEROY CADY, Associate Professor of Horticulture  
N. K. CARNES, Assistant Professor of Animal Husbandry  
W. L. CAVERT, Farm Management Specialist  
R. N. CHAPMAN, Assistant Professor of Animal Biology  
N. E. CHAPMAN, Poultry Husbandry Specialist  
ALICE CHILD, Assistant Professor of Foods and Cookery  
CORR E. COOKE, Extension Poultry Specialist  
LUCY CORDINER, Extension Specialist in Nutrition  
F. P. DANIELS, Instructor in Horticulture  
J. G. DENT, Instructor in Farm Engineering  
J. M. DREW, Assistant  
AMANDA EBERSOLE, Instructor in Textiles and Clothing  
C. H. ECKLES, Professor of Dairy Husbandry  
G. R. B. ELLIOTT, Assistant Professor of Farm Drainage  
A. M. FIELD, Assistant Professor of Agricultural Education  
E. F. FERRIN, Professor of Animal Husbandry  
HALLY J. FISHER, Instructor in Home Nursing  
C. P. FITCH, Professor of Animal Pathology and Bacteriology  
E. M. FREEMAN, Dean, College of Agriculture, Forestry, and Home Economics  
L. F. GAREY, Assistant Professor of Agronomy and Farm Management  
HARRIET GOLDSTEIN, Associate Professor of Drawing and Design  
S. A. GRAHAM, Instructor of Entomology  
T. W. GULLICKSON, Instructor in Dairy Husbandry



E. A. HANSEN, Dairy Specialist  
 A. L. HARVEY, Instructor in Animal Husbandry  
 R. B. HARVEY, Associate Professor of Plant Pathology and Botany  
 H. K. HAYES, Professor of Plant Breeding  
 MARSHALL HERTIG, Instructor in Animal Biology  
 A. A. HOBERG, Assistant in Poultry  
 R. E. HODGSON, Superintendent S. E. Demonstration Farm and Experiment Station, Waseca  
 C. F. HUFFMAN, Assistant in Dairy Husbandry  
 FRANCIS JAGER, Professor of Bee Culture  
 A. D. JOHNSTON, Instructor in Blacksmithing  
 AURA KEEVER, Instructor in Textiles and Clothing  
 H. C. H. KERNKAMP, Assistant Professor of Veterinary Medicine  
 KATHERINE KESTER, Instructor in Rhetoric  
 AGNES M. KOLSHORN, Instructor in Foods and Cookery  
 F. A. KRANTZ, Instructor in Horticulture  
 A. H. LARSON, Assistant Professor of Plant Pathology and Botany  
 J. L. LARSON, Instructor in Farm Motors  
 J. G. LEACH, Instructor in Plant Pathology  
 LOU LOMBARD, Instructor in Foods and Cookery  
 MABEL C. MCDOWELL, Instructor in Clothing  
 F. W. MCGINNIS, Assistant Professor of Agronomy  
 A. J. MCGUIRE, Reclamation and Livestock Specialist  
 R. S. MACKINTOSH, Horticultural Specialist  
 G. C. MATTHEWS, Assistant Professor of Bee Culture  
 D. D. MAYNE, Principal, School of Agriculture  
 MAUDE J. MILLER, Assistant Professor of Home Economics  
 MARGARET MUMFORD, Assistant Professor of Home Economics  
 E. MAUD PATCHIN, Assistant Professor of Textiles and Clothing  
 F. W. PECK, Director of Agricultural Extension  
 ABE PEPINSKY, Director of Orchestra  
 W. H. PETERS, Professor of Animal Husbandry  
 W. E. PETERSEN, Assistant Professor of Dairy Husbandry  
 G. A. POND, Assistant Professor of Agronomy  
 H. B. PRICE, Assistant Professor of Agricultural Economics  
 A. B. RAYBURN, Assistant Professor of Dairy Husbandry  
 M. H. REYNOLDS, Professor of Veterinary Medicine and Surgery  
 T. S. ROBERTS, Professor of Ornithology, Director of Zoological Museum  
 H. B. ROE, Associate Professor of Agricultural Engineering  
 R. C. ROSE, Plant Pathology Specialist  
 A. G. RUGGLES, Professor of Entomology  
 A. J. SCHWANTES, Assistant Professor of Land Clearing  
 A. C. SMITH, Professor of Poultry Husbandry  
 E. A. STEWART, Assistant Professor of Agricultural Physics  
 RACHAEL H. TALBOT, Instructor in Drawing and Design  
 W. T. TAPLEY, Assistant Professor of Horticulture  
 M. J. THOMPSON, Superintendent N. E. Demonstration Farm and Experiment Station, Duluth

J. B. TORRANCE, Assistant Professor of Farm Engineering  
 A. J. TYLER, Assistant Professor of Farm Engineering  
 F. L. WASHBURN, Professor of Entomology and Economic  
 Zoology  
 MILDRED WEIGLEY, Professor of Home Economics  
 MARION WELLER, Associate Professor of Textiles and Clothing  
 H. B. WHITE, Assistant Professor of Farm Buildings  
 L. V. WILSON, Dairy Specialist  
 HELEN R. WORKING, Instructor in Foods and Cookery  
 HOLBROOK WORKING, Assistant Professor of Agricultural  
 Economics  
 C. G. WORSHAM, Instructor in Farm Management  
 GRACE BENNETT WYNNE, Instructor in Vocal Music  
 H. G. ZAVORAL, Livestock Specialist

#### FROM OUTSIDE

WALLACE ASHBY, Duluth  
 C. P. BULL, St. Paul  
 CLARENCE CAREY, St. Paul  
 ROBERT FREEMAN, St. Paul  
 MRS. E. W. GOULD, Minneapolis  
 CAROLINE A. HEDGER, M. D., McCormick Memorial Fund,  
 Chicago  
 H. J. HUGHES, State Department of Agriculture, St. Paul  
 M. KRAMER, Fairmont  
 C. A. MATHES, St. Paul  
 R. C. MILLER, U. S. Department of Agriculture  
 H. A. NOURSE, St. Paul  
 O. J. OLSON, St. Paul  
 E. G. E. REEL, Excelsior  
 MRS. L. S. REMINGTON, St. Paul  
 C. H. SMITH, Faribault  
 C. H. SOMMERS, Rush City  
 A. G. TOLAAS, Chief Inspector, Minnesota Seed Potato Cer-  
 tification Board, University Farm  
 RALPH WEDGE, Albert Lea  
 A. D. WILSON, Guthrie



## WHAT TO DO

To reach University Farm from Minneapolis or St. Paul take a Como-Harriet or Como-Hopkins car toward the other city. One fare takes you to Carter Avenue or Doswell Avenue. A short walk to the northeast brings you to the Administration Building. The Registrar's office is on the second floor.

On arriving, register at the Registrar's office. Procure a program and a badge. Keep both with you during the week. They will save you much trouble.

For rooms at University Farm see Mr. Anderson near the post-office in the Administration Building. Lodgings can be had in the dormitories at University Farm for 50 cents for each person per night, and at private homes near the Farm at a slightly higher rate. For meals see announcement, page 9.

You can have your mail sent to you while at Farmers' and Home-Makers' Short Course. Have it addressed to you at University Farm, St. Paul, Minnesota. Call for it at the Post-office, first floor of the Administration Building, between the hours of 8 and 12 a.m. and 1 and 5 p.m.

Be sure to read carefully the announcements in these pages of the different association meetings and conferences, note particularly the day, hour, and place, or you may miss some which you desire to attend.

Attend every general meeting in the Assembly Room, Administration Building, from 1 to 2 o'clock Wednesday, Thursday, and Friday. There will be music, including singing by the audience led by Miss Grace Wynne, an experienced leader, and addresses by persons prominent in agriculture and home life. Important announcements will be made which you should hear. No classes or other meetings will be held during this hour.

Be sure to attend the evening programs in the Assembly Room Monday, Tuesday, Wednesday, and Thursday evenings, beginning at 6:45. There will be moving pictures, music, both instrumental and vocal, and singing by the audience led by Miss Wynne. There will be addresses by prominent men and women whom you should not fail to hear. The evening programs will close early. Your membership badge will admit you.

Study carefully the details of the daily programs of instruction. There are many exercises in progress at the same time. You can not attend all. Choose those in which you are most interested.

Buy your tickets for the Friday night Banquet (\$1 each) at the Registrar's office, before Thursday if possible. The exact number must be known in time to make proper preparation so all can be accommodated. Your delay may seriously inconvenience someone else.

Tickets for sale at the Registrar's office, Administration Building.

Tuesday, January Third, will be Minnesota Farm Bureau Federation Day. The Annual State Convention of the Fed-

eration will open its session at 10:30 a.m., Tuesday in the Auditorium of the Administration Building at University Farm.

James R. Howard, President of the American Farm Bureau Federation, L. E. Potter, President of the State Federation, Hon. Sydney Anderson, Chairman of the Joint Congressional Committee investigating agricultural conditions, Governor J. A. O. Preus and Mrs. Ellsworth Richardson of Iowa are among the speakers who will address the convention during the day.

On Tuesday evening the Directors of the State Federation will meet in Room 217, Engineering Building, to discuss the agricultural credit stipulation and hear the report of a committee of the Minnesota Farm Bureau Federation which has been investigating the possibility of launching a Farmers' Finance Corporation for Minnesota.

The Farm Bureau Convention will be in session on Wednesday and Thursday also. Its sessions on those days will be in the Chamber of the House of Representatives in the State Capitol, St. Paul.

There will be another evening session of the Convention Wednesday, when the Directors, sitting as a committee of the whole, will draw up the agricultural program for 1922.

**REDUCED RETURN RAILROAD RATES** can only be granted provided the requirements are fulfilled as shown in the supplement to this bulletin. Be sure to observe the following instructions:

1. Immediately on arrival at University Farm, take your ticket and "Passenger Refund Coupon" to the Registrar's office, second floor Administration Building, University Farm. (If more convenient, these may be taken to the office of the Minnesota Farm Bureau Federation, 3rd floor Old Capitol Building, St. Paul.)

2. Hand to the clerk in charge your railroad certificate (or if receipt was obtained instead of certificate, your receipt) and your "Passenger Refund Coupon."

3. Tell the clerk whether, when you are ready to go home, you wish to obtain your certificate from the Registrar's office, University Farm, or from the Farm Bureau office in the Old Capitol Building. Your certificate will be so marked, and when you call for it you should call at the Registrar's office at University Farm or at the Farm Bureau office, 3rd floor Old Capitol Building, according to the instructions you gave the clerk at the time of depositing your certificate.

4. If enough valid certificates are received to authorize the return rates, you can purchase your return ticket at the reduced fare, any time after you receive your certificate from Mr. French up to and including January 10, by presenting your properly signed certificate to the ticket agent in St. Paul, if you bought your coming ticket to St. Paul, or to the ticket agent in Minneapolis, if you bought your coming ticket to Minneapolis. **BE SURE TO DEPOSIT YOUR CERTIFICATE, TO CALL FOR IT LATER, TO SEE THAT IT HAS BEEN DULY SIGNED BY MR. FRENCH AND BY THE JOINT AGENT OF THE WESTERN PASSENGER ASSOCIATION, AND TO PRESENT IT TO THE PROPER TICKET OFFICE IN THE PROPER CITY AT THE TIME YOU PURCHASE YOUR RETURN TICKET.**

5. Public announcement will be made at the meetings when a sufficient number of tickets has been received to assure the return rates.

6. Call for your certificate during regular day office hours as the offices are closed at other times.

## WORK FOR HOME-MAKERS

The general plan for the Home-Makers' Short Course consists in offering several series of courses of daily lectures and demonstrations, each series dealing with a separate topic. The lectures and demonstrations dealing with each topic are arranged with the expectation that the larger number in attendance will be present throughout the week. Single lectures and demonstrations will, however, be of interest to those who can attend only single sessions.

It is expected that each person will wish to include certain lectures of general interest to all home-makers. Care has been taken, therefore, to schedule no other work at this time. When there are two series of lectures and demonstrations, however, which are offered during the same hours, a choice must be made between them.

### DAILY PROGRAM FOR HOME-MAKERS

**Forenoon:** Registration in the main corridor of the Administration Building. Each person will fill out a registration card, hand it in, and receive a badge. The badge should be kept throughout the week to indicate membership.

Arrangements for rooms in the Woman's Hall may be made with Mr. Anderson, near the post-office in the Administration Building.

Each person should read over carefully the description of the work offered and should make a selection of that which is best suited to her needs and interests. This selection made, it will be well to note the location of the Home Economics (Home Ec.) Building and the rooms in which the work chosen will be given.

Beginning Wednesday there will be noon meetings in the Assembly Room, Administration Building, which are for women and men. For announcements of these meetings see pages 15, 17, and 20.

#### MONDAY AFTERNOON

- 2:30- 4:20 Food for the Family: Food essentials for health and growth. MISS MILLER, MISS LOMBARD 106 Home Ec.
- 2:30- 3:20 Problems for the Home Dressmaker: Short cuts in making washable garments. MISS KEEVER 114 Home Ec.
- 3:30- 5:00 Millinery Demonstration: Selection of frames and materials with a discussion of the principles which determine the becomingness of shapes and colors. MISS CARLOTTA BROWN, MISS CLARA BROWN, MISS BACON 112 Home Ec.
- For evening program see page 11.

#### TUESDAY FORENOON

- 8:15- 9:05 Health Care of the Family: Preventive nursing. MISS FISHER Woman's Hall, North Wing
- 9:15-10:05 Poultry for Women. MISS COOKE 203 Home Ec.
- 10:15-11:05 Problems in Child Training: Establishing fundamental habits such as Food, Sleep, Play, etc. MISS BINZEL 203 Home Ec.

11:15-12:05 Minnesota Farm Bureau Federation Annual  
State Convention, ASSEMBLY ROOM Admst. Bldg.  
For evening program see page 13.

### WEDNESDAY FORENOON

8:15- 9:05 Health Care of the Family: Comforts for  
the sick. MISS FISHER Woman's Hall, North Wing  
9:15-10:05 Fabrics: What to buy and how to choose;  
points to be considered in judging wearing  
quality of men's and boy's clothing. MISS  
WELLER 307 Home Ec.  
10:15-11:05 Dress Design: How to choose becoming col-  
ors. MISS GOLDSTEIN 402 Home Ec.  
11:15-12:05 Problems in Child Training: The contagion  
of example. MISS BINZEL 203 Home Ec.

### WEDNESDAY NOON

For program of noon meeting see page 15.

### WEDNESDAY AFTERNOON

2:30- 3:20 Pre-natal Feeding. MISS CORDINER 106 Home Ec.  
2:30- 3:20 Problems for the Home Dressmaker: The  
alteration of commercial patterns. MISS EBER-  
SOLE 114 Home Ec.  
3:30- 4:20 Food for the Family: Diet for children of  
pre-school age. MISS MUMFORD, MRS. WORKING  
106 Home Ec.  
3:30- 5:20 Millinery Demonstration: Covering of hat  
brim. MISS CARLOTTA BROWN, MISS CLARA  
BROWN 112 Home Ec.

From 5:15 to 5:45 the faculty of the Division of Home Economics  
will be in the living-room (204) to meet the home-makers. Supper will  
be served at 5:45 in the Home Economics Building. It is hoped that  
as many as possible will be present for the purpose of becoming better  
acquainted. The cost of the supper will be 65 cents per plate.

For the evening program see page 16.

### THURSDAY FORENOON

8:15- 9:05 Vegetable Cookery. MISS CHILD 207 Home Ec.  
9:15-10:05 House Design: Simple means of beautifying  
the living room. MISS GOLDSTEIN 401 Home Ec.  
10:15-11:05 Problems in Child Training: Lengthening the  
"apron strings" gradually. MISS BINZEL 203 Home Ec.  
11:15-12:05 How to Tell a Well Baby. DR. CAROLINE A.  
HEDGER 203 Home Ec.

### THURSDAY NOON

For program of noon meeting see page 17.

### THURSDAY AFTERNOON

2:30- 3:20 Food for the Family: Post-natal feeding.  
MISS CORDINER 106 Home Ec.  
2:30- 3:20 Problems for the Home Dressmaker: The  
kimona waist pattern and its adaptation to  
various uses. MISS PATCHIN 304 Home Ec.  
3:30- 4:20 The Neglected Age (2 to 6). DR. CAROLINE  
A. HEDGER 203 Home Ec.  
4:30- 5:20 Millinery Demonstrations: Covering crown of  
hat. MISS CARLOTTA BROWN, MISS CLARA  
BROWN 112 Home Ec.

From 4:30 to 5:30 tea will be served in the living  
room. Entertainment will be under direction of Miss Talbot.

For evening program see page 18.

### FRIDAY FORENOON

8:15- 9:05 Simple Frozen Desserts. MISS KOLSHORN. 207 Home Ec.  
9:15-10:05 Tests which Can Be Used at Home, with a  
Demonstration of Fabric Testing. MISS  
WELLER 307 Home Ec.

- 10:15-11:05 The School Child (several phases) with slides.  
DR. CAROLINE A. HEDGER 401 Home Ec.
- 11:15-12:05 Round Table Discussion of Home-Makers'  
Problems. MISS WEIGLEY 203 Home Ec.

### FRIDAY NOON

For program of noon meeting see page 20.

### FRIDAY AFTERNOON

- 2:30- 3:20 Food for the Family: Diet for children of  
school age. MISS MUMFORD, MRS. WORKING 106 Home Ec.
- 2:30- 3:20 An Exhibit of Children's Clothing: Shown and  
discussed. MISS PATCHIN, MISS McDOWELL 304 Home Ec.
- 3:30- 4:20 The Adolescent. DR. CAROLINE A. HEDGER 203 Home Ec.
- 4:30- 5:20 Millinery Demonstration: Trimming of hat.  
MISS CARLOTTA BROWN, MISS CLARA BROWN,  
MISS BACON 112 Home Ec.

For evening program see page 21.



Prospective Home-Makers learn to make Hats and Dresses at University Farm. Helpful hints on making Hats, Dresses, and Children's Clothing will be given during Farmers' and Home-Makers' Week, January 2-7, 1922.

### OTHER INFORMATION

Meals will be served from Monday noon to Saturday noon, inclusive, as follows:

Breakfast—7-8:15, Cafeteria, East Wing Dining-Hall

Dinner—11:15-1:15, Cafeteria, MAIN Dining-Hall

Supper—5-6:15, Cafeteria, East Wing Dining-Hall.

The Library, south end of the main corridor in the Administration Building, is open to all from 8 a.m. to 9:30 p.m. daily except Monday, when the hours will be from 8:30 a.m. to 6 p.m. An interesting collection of books of interest to farmers and home-makers will be on display.

For information regarding buildings and grounds, ask any person wearing a red badge. For information regarding the work given and the program, call at Room 209, Administration Building.

Articles found should be left at Room 207, Administration Building, where lost articles may be called for.

The names of the buildings are abbreviated in the program. These abbreviations are as follows:

Admst., Administration Building	Home Ec., Home Economics Building
Dairy H., Dairy Hall	Meat S., Meat Shop
Chem., Chemistry Building	Plant P., Plant Pathology Building
Dairy B., Dairy Barn	Stock P., Stock Pavilion
Engr., Engineering Building	Vet., Veterinary Building
Hort., Horticulture Building	Farm H., Farm House

Signs will designate the buildings.

### WORK FOR FARMERS

Following a particular course, such as "Agronomy, Farm Management, and Soils," or "Farm Engineering," throughout every day of the week is a very good plan. Another year you could then confine your attention to a different course, such as "Poultry and Bees." In this way you become more thoro in each subject and have a new field of study each year.

Be sure to choose one subject for each hour of the day. Mark these subjects for easy reference and to save time between classes.

### DAILY PROGRAM FOR FARMERS

No classes or meetings will be held Monday forenoon. The regular program begins at 1:30 p.m. Monday forenoon will be used for registration, in the main corridor of the Administration Building. Be sure to fill out a registration card, hand it in, and procure a badge as soon as you arrive, whether on Monday or later. Keep this badge throughout the week.

Examine the program carefully and select the work you desire to take. Locate the buildings and rooms. If you wish to room on the campus, see Mr. Anderson, near the post-office, in the Administration Building.

### MONDAY AFTERNOON

#### LIVESTOCK AND DAIRY HUSBANDRY

1:30- 3:20	Demonstration—Judging Dairy Cattle. MR. RAYBURN, MR. HUFFMAN	Dairy B.
1:30- 2:20	Can Livestock Pay a Profit Under Existing Conditions? MR. PETERS	Center Stock P.
2:30- 3:20	How to Increase the Price of Grain by Selling It Through Livestock. MR. ZAVORAL	Center Stock P.
3:30- 4:20	How to Get the Greatest Return from Pasture. MR. FERRIN	Center Stock P.
3:30- 4:20	How to Manage the Dairy Herd. Questions and Discussion. MR. ECKLES	Dairy B.

#### VETERINARY MEDICINE

1:30- 2:20	State Work With Infectious Diseases of Animals. The Farmers' Rights and Opportunities Under the Law and Regulations. MR. REYNOLDS	9 Vet.
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#### FARM MANAGEMENT, FARM CROPS, AND SOILS

1:00- 2:20	Farm Machinery Demonstration. MR. BASSETT	Basement, Admst.
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2:30- 3:20	What Does it Cost to Make a Pound of PORK? MR. POND	24 Admst.
3:30- 4:20	How Much Does it Cost to Produce a Pound of Butterfat? How Many Cows Shall I Keep? MR. CAVERT	24 Admst.
4:20- 5:30	Demonstration in Corn Selection. MR. ARNY Demonstration in Grain Grading. MR. MCGINNIS Demonstration of Farm Machinery. MR. BASSETT	2 Admst. 2 Admst. Basement, Admst.

### HORTICULTURE

1:30- 4:20	Pruning, Budding, and Grafting—Demonstration and Individual Practice—Under Direction of the staff of the Division of Horticulture	8 Hort.
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### FARM ENGINEERING

1:30- 2:20	Care of Tools for the Farm Shop. MR. WHITE	107 Engr.
1:30- 2:20	Land Clearing. MR. THOMPSON	217 Engr.
2:30- 3:20	How Gas Engines Operate. MR. TORRANCE	107 Engr.
2:30- 3:20	Wells and Water Supply for the Farm. MR. STEWART	217 Engr.
3:30- 4:20	Belts, Pulleys, Lacings, etc. MR. DENT	107 Engr.

### POULTRY AND BEES

1:30- 2:20	Poultry. Feeding for Winter Eggs. MR. SMITH	2 Vet.
2:30- 3:20	Bees. Life History of the Individual Bee. MR. JAGER	4 Plant P.
3:30- 4:20	Bees. Life History of the Colony. MR. JAGER	4 Plant P.
4:30- 5:20	Bees. Discussions, Questions, and Answers.	4 Plant P.

## MONDAY EVENING

### Assembly Room

Admst. Bldg.

ANDREW BOSS, Vice-Director of Experiment Station, Presiding

6:45	Music. Agricultural College Male Quartet*
7:00	Motion Pictures†
7:30	A Group of Songs. MISS GRACE BENNETT WYNNE
7:45	Music, Violin Solo. MR. ABE PEPINSKY Announcements
8:00	Motion Pictures.† A Five Reel Feature

## TUESDAY FORENOON

### LIVESTOCK AND DAIRY HUSBANDRY

8:15-10:05	Demonstration—Judging Guernseys. MR. WILSON	Dairy E. Meat S.
8:15-10:05	Beef Cutting. MR. ANDERSON, MR. HARVEY	
10:15-11:05	Feeding the Dairy Cow. MR. ECKLES, MR. WILSON	39 Dairy H.
10:15-11:05	Under What Conditions Does it Pay to Fatten Cattle. MR. CARNES	Center Stock P.
11:15-12:05 and	Minnesota Farm Bureau Federation Annual State Convention.	Assembly Room, Admst.
1:15- 4:20	See page 13.	

### VETERINARY MEDICINE

9:15-10:05	Diseases of the New Born Animal, White Scours, Calf Pneumonia, Naval Ill, etc. DR. BOYD	9 Vet.
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\* The Agricultural College Male Quartet consists of Messrs. Harry Bartelt, St. Paul; Theodore Thorsen, Fertile; H. C. Lende, Baydette; and W. A. Peters, Wadena; graduates of the University of Minnesota College of Agriculture, who have returned to University Farm for this one week to contribute their assistance in making the Short Course pleasant for the Farmers and Home-Makers of Minnesota.

† Motion pictures for the week in charge of Mr. Mayne and Mr. Field.

- 10:15-11:05 Hog Cholera and Its Control. DR. KERN-  
KAMP 9 Vet.
- 11:15-12:05 Minnesota Farm Bureau Federation Annual  
and State Convention. Assembly Room, Admst.
- 1:15- 4:20 See page 13.

### FARM MANAGEMENT, FARM CROPS, AND SOILS

- 8:15- 9:05 Demonstration in Keeping Farm Records.  
MR. WORSHAM 24 Admst.
- Demonstration in Farm Planning. MR. GAREY 24 Admst.
- Demonstration of Farm Machinery. MR. BAS-  
SETT Basement, Admst.
- 9:15-10:05 The Farm Business Problem. How to Make  
Receipts Cover Expenses under Present Condi-  
tions. What Promises Best for 1922. MR.  
Boss 24 Admst.
- 10:15-11:05 Stretching the Farmer's Dollar. MR. PECK 24 Admst.
- 11:15-12:05 Minnesota Farm Bureau Federation Annual  
and State Convention. Assembly Room, Admst.
- 1:15- 4:20 See page 13.

### HORTICULTURE

- Conference on Home Gardening
- 8:15- 9:05 Demonstration of the Best Garden Tools. MR.  
MACKINTOSH 8 Hort.
- 9:15-10:05 (a) Flowers for 12 Months of the Year. MR.  
CADY 102 Hort.
- (b) Spraying: Why, How, When. MR. GRA-  
HAM 102 Hort.
- 10:15-11:05 (a) Berry Growing. MR. DANIELS 102 Hort.
- (b) Vegetable Varieties the Home Gardener  
Should Grow. MR. TAPLEY 102 Hort.
- 11:15-12:05 Minnesota Farm Bureau Federation Annual  
and State Convention. Assembly Room, Admst.
- 1:15- 4:20 See page 13.

### FARM ENGINEERING

- 8:15- 9:05 Length of Life of Farm Tractor. MR. TOR-  
RANCE 107 Engr.
- 8:15- 9:05 Land Clearing, Brushing, Forced Clearing,  
Delayed Clearing. MR. THOMPSON 217 Engr.
- 9:15-10:05 The Economy of Farm Drainage. MR. ROE 217 Engr.
- 9:15-10:05 The Proper Placing of Buildings on the  
Farmstead. MR. WHITE 107 Engr.
- 10:15-11:05 The Proper Use and Construction of the  
Open Drainage Ditch. MR. ELLIOTT 217 Engr.
- 10:15-11:05 A Comparison of Warm Air and Hot Water  
Heating. MR. STEWART 107 Engr.
- 11:15-12:05 Minnesota Farm Bureau Federation Annual  
and State Convention. Assembly Room, Admst.
- 1:15- 4:20 See page 13.

### POULTRY AND BEES

- 8:15- 9:05 Bees. Care During Fall and Winter. MR.  
JAGER 4 Plant P.
- 9:15-10:05 Bees. Organs of the Bee. MR. JAGER 4 Plant P.
- 9:15-10:05 Poultry. Extermination of Rats and Mice in  
Poultry Buildings. MR. WASHBURN 2 Vet.
- 10:15-11:05 Poultry. Marketing Through Egg Circles.  
MISS COOKE 2 Vet.
- 11:15-12:05 Minnesota Farm Bureau Federation Annual  
and State Convention. Assembly Room, Admst.
- 1:15- 4:20 See page 13.

# MINNESOTA FARM BUREAU ANNUAL STATE CONVENTION

Assembly Room

Admst. Bldg.

All members of the Farmers' and Home-Makers' Week Short Course, both men and women, are invited to attend this Farm Bureau Annual State Convention. No Farmers' and Home-Makers' Week programs will be in session on this day after 11:05 when the speaking program of the convention begins.

## TUESDAY FORENOON

10:30 Opening Session

Singing by the audience, led by MISS GRACE BENNETT WYNNE and music by the Agricultural College Male Quartet will be interspersed throughout the program.

Invocation. REV. RUSSELL HENRY STAFFORD, Pastor First Congregational Church, Minneapolis

Address of Welcome. W. C. COFFEY, Dean and Director of the University Department of Agriculture

President's Annual Address. L. E. POTTER, President, Minnesota Farm Bureau Federation

## TUESDAY AFTERNOON

1:15 Address. JAMES R. HOWARD, President, American Farm Bureau Federation

Address. MRS. ELLSWORTH RICHARDSON, Pella, Iowa

Address. HON. SYDNEY ANDERSON, Chairman, Joint Congressional Committee Investigating Agricultural Conditions

7:30 Business Session of the Minnesota Farm Bureau Federation to discuss Agricultural Credit and Proposed Farmers' Finance Corporation for Minnesota. Room 217, Engineering Building

## TUESDAY EVENING

Assembly Room

A. V. STORM, Director of Short Courses, Presiding

6:45 Music. Agricultural College Male Quartet

7:00 Motion Pictures

7:30 General Discussion

8:00 Music. Agricultural College Male Quartet

8:15 Address — The Rural School Problem. MELVIN E. HAGGERTY, Dean of College of Education, University of Minnesota

8:45 The Follies of Fashion. A Cycle of the American Dance in Costume. Directed by MRS. A. J. MCGUIRE. Entre Acte Music and Orchestral Accompaniment led by MR. ABE PEPINSKY.

Folly. MISS BERNICE LANGTRY

Indian Period. MISS NELL MERRILL, MR. PHIL. WILSON  
Pilgrim Period. MRS. W. H. ALDERMAN, MR. W. H. ALDERMAN

Colonial Period (1775). MISS CARLOTTA BROWN, MR. F. L. WASHBURN

Empire Period (1815). MRS. J. J. WILLAMAN, MR. L. B. BASSETT

Civil War Period (1865). MRS. W. E. MORRIS, MR. C. O. ROST

1885 Period. MRS. C. O. ROST, MR. FRED GRIFFEE

1890 Period. (Square Dance.) MRS. R. S. MACKINTOSH, MR. ANDREW BOSS, MRS. A. M. FIELD, MR. A. M. FIELD, MRS. T. W. GULLICKSON, MR. W. P. DYER, MRS. A. J. MCGUIRE, MR. C. P. FITCH, MR. A. J. MCGUIRE at the Fiddle

- 1895 Period (Waltz). MRS. F. J. ALWAY, MR. A. J. MCGUIRE  
 1917, World War Period. MISSES ALYS DYER, EMILY CURTIS, RUTH BALCOME, FREDERICKA ALWAY; MESSRS. LEONARD MELANDER, ELMER HANSON, PAUL EDDY, IRA LAMBERT  
 1921, Present. MRS. N. K. CARNES, MR. N. K. CARNES

### WEDNESDAY FORENOON LIVESTOCK AND DAIRY HUSBANDRY

- 8:15-10:05 Demonstration. Judging Holstein Cattle. MR. RAYBURN Dairy B.  
 8:15-10:05 Kind of Hogs to Raise and How to Feed Them. MR. FERRIN Center Stock Pv.  
 10:15-11:05 The Farmer and His Creamery. MR. MCGUIRE 40 Dairy H.  
 11:15-12:05 Handling a Dairy Herd on Official Test. MR. PETERSEN 39 Dairy H.  
 10:15-12:05 Minnesota Swine Breeders' Association East Stock Pv.  
 Minnesota Sheep Breeders' Association West Stock Pv.  
 Minnesota Horse Breeders' Association 3 Stock Pv.  
 Minnesota Berkshire Breeders' Association 1 Stock Pv.  
 Duroc Jersey Breeders' Association of Minnesota Center Stock Pv.

### VETERINARY MEDICINE

- 9:15-10:05 Common Diseases of Livestock. Their Easy Prevention. DR. REYNOLDS 9 Vet.  
 10:15-11:05 Diseases of Swine—Parasites, Paralysis, and so-called "Hog Flu." DR. KERNKAMP Center Stock Pv.

### FARM MANAGEMENT, FARM CROPS, AND SOILS

- 8:15- 9:05 Demonstration in Corn Selection. MR. ARNY 2 Admst.  
 Demonstration in Potato Selection. MR. KRANTZ, MR. MCGINNIS 2 Admst.  
 Demonstration of Farm Machinery. MR. BASSETT Basement, Admst.  
 9:15-10:05 Making New Varieties of Farm Crops. MR. HAYES 24 Admst.  
 10:15-11:05 Growing Pure Seed Under Farm Conditions MR. HODGSON 24 Admst.  
 11:15-12:05 GROUP SESSION Assembly Room, Admst.  
 MR. FREEMAN, PRESIDING  
 (a) Field Crop Varieties that Minnesota Farmers Ought to Grow. MR. BOSS  
 (b) Fruit Crop Varieties that Minnesota Farmers Ought to Grow. MR. ALDERMAN

### HORTICULTURE

- Conference on Fruit Growing  
 8:15-10:15 Individual Practice in Bridge Grafting, Top-working, and Fruit Tree Propagation. Under Direction of the Staff of the Division of Horticulture 8 Hort.  
 10:15-11:05 (a) Causes of Setting and Dropping of Fruits. MR. BEAUMONT 102 Hort.  
 (b) The Trouble with Our Method of Pruning. MR. BRIERLEY 102 Hort.  
 11:15-12:05 GROUP SESSION Assembly Room, Admst.  
 MR. FREEMAN, PRESIDING  
 (a) Field Crop Varieties that Minnesota Farmers Ought to Grow. MR. BOSS  
 (b) Fruit Crop Varieties that Minnesota Farmers Ought to Grow. MR. ALDERMAN

### FARM ENGINEERING

- 8:15- 9:05 Starting a New Farm in the Cut-over Region. MR. WILSON 217 Engr.  
 9:15-10:05 Tractor Power on the Farm. MR. TORRANCE 107 Engr.

9:15-10:05	Title Drainage. Its Proper Design, Construction, and Function. MR. ROE	217 Engr.
10:15-11:05	Drainage of Peat and Muck Lands. MR. ELLIOTT	217 Engr.
10:15-11:05	Well Planned Farm Houses. MR. WHITE	107 Engr.
11:15-12:05	Good Barns for Minnesota. MR. WHITE	107 Engr.
11:15-12:05	Rope Work, Splicing and Knots. MR. DENT	217 Engr. 4

### POULTRY AND BEES

8:15- 9:05	Bees. Care During Spring and Summer. MR. JAGER	4 Plant P.
9:15-10:05	Poultry. Humane Methods of Killing and Picking. MISS COOKE. Demonstration: MR. HOBERG	Meat S.
10:15-11:05	Bees. Honey Bearing Plants. MR. LARSON	4 Plant P.
11:15-12:05	Poultry. Opportunities in Poultry Culture. MR. NOURSE	2 Vet.

### WEDNESDAY NOON

#### Assembly Room

Admst. Bldg.

HON. F. B. SNYDER, President, Board of Regents, Presiding

1:00 General Singing. Led by MISS WYNNE

Music. Agricultural College Male Quartet

Address. W. C. COFFEY, Dean and Director, University Department of Agriculture

1:50 Dismissal.

For those whose afternoon programs do not begin until 2:30 there will be motion pictures in this room from 2:00 to 2:25.

### WEDNESDAY AFTERNOON

#### LIVESTOCK AND DAIRY HUSBANDRY

2:30- 3:20	How to Find the Profitable Cow. MR. HANSEN	39 Dairy H.
3:30- 4:20	Feeding the Dairy Cow (continued). MR. ECKLES, MR. WILSON	39 Dairy H.
2:00- 4:00	Minnesota Swine Breeders' Association.	East Stock Pv.
	Minnesota Sheep Breeders' Association.	West Stock Pv.
	Minnesota Horse Breeders' Association	3 Stock Pv.
4:00- 5:20	Minnesota Poland China Breeders' Association	1 Stock Pv.

#### VETERINARY MEDICINE

2:30- 3:20	How to Prevent Losses from Contagious Abortion. DR. FITCH	9 Vet.
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#### FARM MANAGEMENT, FARM CROPS, AND SOILS

2:30- 3:20	Keeping Diseases Out of the Field Crops. MR. LEACH	24 Admst.
3:30- 4:20	Seeding and Management of Pastures and Meadows. MR. ARNY	24 Admst.
4:30- 5:20	GROUP SESSION MR. COFFEY, Presiding	Assembly Room, Admst.
	Marketing Costs. How They Can be Reduced. MR. PRICE	
	How Cooperation Can Reduce Marketing Costs. MR. BLACK	

#### HORTICULTURE

2:30- 3:20	(a) Grapes and How to Grow Them. MR. REEL	102 Hort.
	(b) Will Fertilizing Orchards Pay? MR. ALDERMAN	102 Hort.
3:30- 4:20	(a) Dusting vs. Spraying. MR. ROSE	102 Hort.
	(b) Protecting the Orchard from Rodents. MR. WASHBURN	102 Hort.
4:30- 5:20	GROUP SESSION MR. COFFEY, Presiding	Assembly Room, Admst.

Marketing Costs. How They Can be Reduced.  
**MR. PRICE**  
 How Coöperation Can Reduce Marketing  
 Costs. **MR. BLACK**

### FARM ENGINEERING

2:30- 3:20	Types of Roofs for Farm Buildings.	<b>MR. WHITE</b>	107 Engr.
2:30- 3:20	Running Water in Farm Homes.	<b>MR. STEWART</b>	217 Engr.
2:30- 3:20	Blacksmithing on the Farm.	<b>MR. JOHNSTON</b>	20 Engr.
3:30- 4:20	Magneto Setting.	<b>MR. TORRANCE</b>	107 Engr.
3:30- 4:20	Electric Lighting Plants for Rural Homes (Demonstration).	<b>MR. TYLER</b>	6 Engr.
3:30- 4:20	Blacksmithing, Welding, and Forging.	<b>MR. JOHNSTON</b>	20 Engr.
3:30- 4:20	Conference Hour on Individual Drainage Problems.	<b>MR. ROE</b>	208 Engr.

### POULTRY AND BEES

2:00- 4:20	Minnesota State Poultry Breeders' Association		
2:00	Business Meeting		2 Vet.
3:30	Address—How to Build up a Successful Poultry Show Association.	<b>MR. SOMMERS</b>	9 Vet.
	Address—Care of Eggs in the Home.	<b>MISS COOKE</b>	

## WEDNESDAY EVENING

### Assembly Room

**W. C. COFFEY**, Dean and Director of University Department of Agriculture, Presiding

6:45	General Singing. Led by	<b>MISS WYNNE</b>	
7:00	Motion Pictures		
7:30	Music. S. A. U. M. Saxophone Quartet		
7:45	Address—What the State is Doing to Promote Agriculture	<b>N. J. HOLMBERG</b> , Commissioner of Agriculture	
	Music. Agricultural College Male Quartet		
	Play—"Neighbors"—One act, by	<b>Zona Gale</b> . Under the direction of <b>MISS KATHERINE KESTER</b>	
	Characters:		
	Grandma.....	<b>Mrs. E. A. HEWITT</b>	
	Mrs. Abel.....	<b>MISS KATHERINE KESTER</b>	
	Ezra Williams.....	<b>MR. E. G. CHEYNEY</b>	
	Peter.....	<b>MR. H. J. BURTIS</b>	
	Inez.....	<b>MISS MONICA LANGTRY</b>	
	Mrs. Moran.....	<b>Mrs. N. E. CHAPMAN</b>	
	Mrs. Trot.....	<b>MISS BETH HARVEY</b>	
	Mrs. Ellsworth.....	<b>Mrs. W. P. KIRKWOOD</b>	

## THURSDAY FORENOON

### LIVESTOCK AND DAIRY HUSBANDRY

8:15- 9:05	What Determines the Value of a Horse.	<b>MR. PETERS</b>	Center Stock Pv.
8:15-10:05	Demonstration—Judging Jerseys and Ayrshires.	<b>MR. PETERSEN, MR. GULLICKSON</b>	Dairy B.
8:15-10:05	Mutton Killing Demonstration.	<b>MR. ANDERSON, MR. HARVEY</b>	Meat S.
10:15-12:05	Curing Meats.	<b>MR. ANDERSON, MR. HARVEY</b>	Meat S.
10:15-12:05	Minnesota Creamery Managers' Conference		39 Dairy H.
10:15-12:05	Minnesota Holstein Breeders' Association		Assembly Room, Admst.
	Minnesota Ayrshire Breeders' Association		32-A Dairy H.
	Minnesota Jersey Breeders' Association		32-B Dairy H.
	Minnesota Brown Swiss Breeders' Association		37 Dairy H.
	Minnesota Guernsey Breeders' Association		40 Dairy H.

Minnesota Hereford Breeders' Association East Stock Pk.  
 Minnesota Aberdeen-Angus Breeders' Association West Stock Pk.  
 Minnesota Red Polled Breeders' Association 3 Stock Pk.

### VETERINARY MEDICINE

9:15-10:05 How to Prevent Sterility or Failure to Breed  
 in Cattle. DR. BOYD 2 Vet.

### FARM MANAGEMENT, FARM CROPS, AND SOILS

8:15- 9:05 Demonstration in Corn Selection. MR. ARNY 2 Admst.  
 Demonstration in Potato Selection. MR.  
 KRANTZ, MR. MCGINNIS 2 Admst.  
 Demonstration of Farm Machinery. MR. BAS-  
 SETT Basement, Admst.  
 9:15-10:05 Silage and Silage Crops. MR. ARNY 24 Admst.  
 10:15-11:05 Some Pointers on Controlling the Granary  
 Weevils. MR. CHAPMAN 24 Admst.  
 11:15-12:05 GROUP SESSION 102 Horticultural Bldg.  
 MR. BOSS, Presiding  
 What Minnesota Soils Need. MR. ALWAY

### HORTICULTURE

Conference on Garden Flower Growing

8:15-10:05 Demonstration—Individual Practice in the  
 Propagation of House and Garden Plants by  
 Cuttings, Layerings, etc.—Under the Direction  
 of the staff of the Division of Horticulture 8 Hort.  
 10:15-11:05 Birds. (Illustrated with Moving Pictures).  
 DR. ROBERTS 102 Hort.  
 11:15-12:05 GROUP SESSION 102 Horticultural Bldg.  
 MR. BOSS, Presiding  
 What Minnesota Soils Need. MR. ALWAY

### FARM ENGINEERING

8:15- 9:05 Tractor Lubrication. MR. TORRANCE 107 Engr.  
 8:15- 9:05 Land Clearing—Explosives, Pullers, Pilers.  
 MR. SCHWANTES 217 Engr.  
 9:15-10:05 Cost of Drainage and Its Relation to Crop  
 Improvement and the Purchase of New Land.  
 MR. ROE 217 Engr.  
 9:15-10:05 Farm Power. MR. BOSS 107 Engr.  
 10:15-11:05 Community Drainage; The Development of a  
 Drainage District. MR. ELLIOTT 107 Engr.  
 11:15-12:05 Hitching the Tractor to Its Load. MR. LARSON 107 Engr.  
 10:15-11:05 Ignition Troubles and Remedies. MR. TORRANCE 107 Engr.  
 11:15-12:05 Lighting Farm Buildings. MR. STEWART 217 Engr.

### POULTRY AND BEES

8:15- 9:05 Bees. Making the Right Start in Beekeeping.  
 MR. JAGER 4 Plant P  
 9:15-10:05 Poultry. How to Conduct a Post-Mortem  
 Examination of Fowls. DR. BILLINGS 9 Vet.  
 10:15-11:05 Poultry. Diseases of Poultry. DR. BILLINGS 9 Vet.  
 11:15-12:05 Bees. Causes, Prevention and Remedial  
 Measures to Prevent Swarming. MR. MATTHEWS 4 Plant P.

### THURSDAY NOON

Assembly Room Admst. Bldg.

W. C. COFFEY, Dean and Director, Presiding  
 1:00 General Singing, led by MISS WYNNE  
 Music, Agricultural College Male Quartet  
 Address. DR. L. D. COFFMAN, President, Uni-  
 versity of Minnesota  
 1:50 Dismissal

For those whose afternoon programs do not begin until 2:30 there  
 will be motion pictures in this room from 2:00 to 2:25.

## THURSDAY AFTERNOON

### LIVESTOCK AND DAIRY HUSBANDRY

2:00- 4:20	Minnesota Creamery Managers' Conference Minnesota Holstein Breeders' Association	39 Dairy H. Assembly Room, Admst.
	Minnesota Ayrshire Breeders' Association	32-A Dairy H.
	Minnesota Jersey Breeders' Association	32-B Dairy H.
	Minnesota Brown Swiss Breeders' Association	37 Dairy H.
	Minnesota Guernsey Breeders' Association	40 Dairy H.
	Minnesota Hereford Breeders' Association	East Stock Pv.
	Minnesota Aberdeen-Angus Breeders' Association	West Stock Pv.
	Minnesota Red Polled Breeders' Association	3 Stock Pv.

### FARM MANAGEMENT, FARM CROPS, AND SOILS

2:30- 3:20	Raising Certified Potatoes. MR. TOLAAS	24 Admst.
3:30- 4:20	New Forage Crops of Promise—Soybeans, Sweet Clover, Sudan Grass. MR. ARNY	24 Admst.
4:30- 5:20	Demonstration in Corn Selection. MR. ARNY	2 Admst.
	Demonstration in Potato Selection. MR. KRANTZ, MR. MCGINNIS	2 Admst.
	Demonstration of Farm Machinery. MR. BASSETT	Basement, Admst.

### HORTICULTURE

2:30- 3:20	(a) Shrubs for Home Grounds. MR. CAREY	102 Hort.
	(b) Hardy Flowers and Their Use in Land- scape. MR. MATHES	102 Hort.
	(c) Vines for Home Grounds. MRS. GOULD	102 Hort.
3:30- 4:20	(a) What Seeds Will I Plant in 1922. MRS. REMINGTON	102 Hort.
	(b) Arranging Flowers in the Home. Talk and Demonstration. MR. OLSON	102 Hort.

### FARM ENGINEERING

2:30- 3:20	Cement Work on the Farm. MR. WHITE	107 Engr.
3:30- 4:20	Essentials of Good Cement Work. MR. WHITE	107 Engr.
3:30- 4:20	Gas Lights and Heat in Farm Homes (Demon- stration). MR. TYLER	6 Engr.
2:30- 3:20	Blacksmithing, Forging and Tempering Steel. MR. JOHNSTON	20 Engr.
3:30- 4:20	Blacksmithing, Sharpening and Pointing Plow Lays. MR. JOHNSTON	20 Engr.
2:30- 4:20	Conference Hour on Individual Drainage Problems. MR. ROE	208 Engr.

### POULTRY AND BEES

2:30- 3:20	Poultry. How I Hatch and Sell 25,000 Chickens per Week. MR. KRAMER	9 Vet.
3:30- 4:20	Bees. How to Manage for Production of Extracted Honey. MR. MATTHEWS	4 Plant P.
3:30- 5:20	Bees. How to Manage for Production of Comb Honey. MR. MATTHEWS	4 Plant P.

## THURSDAY EVENING

### Assembly Room

Admst. Bldg.

MISS MILDRED WEIGLEY, Professor and Chief of the  
Division of Home Economics, Presiding

6:45	General Singing, led by MISS WYNNE	
7:00	Motion Pictures	
7:30	Address. New Era of the Child. DR. CAROLINE HEDGER	
8:15	The University Symphony Orchestra, MR. ABE PEPINSKY, Conductor	
	Symphony—Number 39 in E flat	<i>Mozart</i>
	Adagio. Allegro	Menuetto. Allegro
	Andante con moto	Finale. Allegro



Waltz from Dances for Small Orchestra *Donald Ferguson*  
 Overture Oberon *Weber*  
 Adagio sostenuto Allegro con fuoco

## FRIDAY MORNING

### LIVESTOCK AND DAIRY HUSBANDRY

- 8:15- 9:05 Selection of the Herd Sire—Illustrated by  
 Herd Bulls of the University Herd. MR. RAYBURN Dairy B.
- 8:15- 9:05 How to Judge Pedigrees. MR. FERRIN Center Stock Pv.
- 9:15-10:05 Raising Calves and Young Stock—Illustrated  
 by University Stock. MR. GULLICKSON Dairy B.
- 9:15-10:05 Value of a Purebred Sire in a Grade and a  
 Scrub Herd. MR. ZAVORAL Center Stock Pv.
- 10:15-12:05 Minnesota Livestock Breeders' Association\*  
 Center Stock Pv.

### VETERINARY MEDICINE

- 9:15-10:05 How to Prevent Losses from Worms and Lice.  
 DR. FITCH 9 Vet.

### FARM MANAGEMENT, FARM CROPS, AND SOILS

- 8:15- 9:05 Demonstration in Corn Selection. MR. ARNY 2 Admst.  
 Demonstration in Potato Selection. MR. KRANTZ,  
 MR. MCGINNIS 2 Admst.  
 Demonstration of Farm Machinery. MR. BASSETT Basement, Admst.
- 9:15-10:05 Price Trend. MR. WORKING, MR. BLACK 24 Admst.
- 10:15-11:05 A Demonstration of Commercial Grain Grad-  
 ing. MR. MILLER 24 Admst.
- 11:15-12:05 GROUP SESSION Assembly Room, Admst.  
 The State Program for Marketing  
 MR. PECK, Presiding  
 The Farmer, MR. WILSON  
 The State Department of Agriculture, MR. HUGHES  
 The University Department of Agricultural  
 Extension, MR. PECK

### HORTICULTURE

- Conference on Vegetable Growing
- 8:15- 9:05 Seed Treatment. Demonstration of Methods  
 and Materials. MR. ROSE and Staff Section  
 of Vegetable Gardening 8 Hort.
- 9:15-10:05 (a) Recent Development in Insect Control. MR. RUGGLES 102 Hort.  
 (b) Possibilities of Organization. MR. FREEMAN 102 Hort.  
 (c) Difficulties in Growing Squash. MR. BUSHNELL 102 Hort.
- 10:15-11:05 (a) Should the Market Gardener Save Some of  
 His Own Seed. MR. SMITH 102 Hort.  
 (b) Celery Yellows and Spinach Mosaic in  
 Minnesota. MR. ROSE 102 Hort.  
 (c) Vegetables in the Meadowlands District  
 of Northern Minnesota. (With Stereopti-  
 con Slides.) MR. ASHBY 102 Hort.  
 Appointment of Committees.
- 11:15-12:05 GROUP SESSION Assembly Room, Admst.  
 The State Program for Marketing  
 MR. PECK, Presiding  
 The Farmer, MR. WILSON  
 The State Department of Agriculture, MR. HUGHES  
 The University Department of Agricultural  
 Extension, MR. PECK

\* The Livestock Association banquet will be held on Thursday, 6:30 p.m., in the St. Francis Hotel, St. Paul. Duncan Marshall will be the speaker.

## FARM ENGINEERING

8:15- 9:05	Land Clearing Associations, Contests, Community Clearing. MR. THOMPSON	217 Engr.
9:15-10:05	The Truck on the Farm. MR. TORRANCE	107 Engr.
9:15-10:05	Drainage Law as it Concerns the Farmer. MR. ELLIOTT	217 Engr.
10:15-11:05	Building a Good Earth Road. MR. ROE	217 Engr.
10:15-11:05	Soldering. MR. DENT	107 Engr.
11:15-12:05	Ventilation of Barns and Other Farm Buildings. MR. STEWART	217 Engr.
11:15-12:05	Hog House and Granary Construction. MR. WHITE	107 Engr.

## POULTRY AND BEES

8:15- 9:05	Bees. Enemies of Bees. MR. JAGER	4 Plant P.
9:15-10:05	Poultry. Poultry Houses for the Northwest. MR. SMITH	2 Vet.
10:15-11:05	Bees. Diseases of Bees. MR. HERTIG	4 Plant P.
11:15-12:05	Bees. Organization and Coöperation in Marketing Honey. MR. MATTHEWS	4 Plant P.

## FRIDAY NOON

### Assembly Room

Admst. Bldg.

HON. C. W. GLOTFELTER, Member Board of Regents,  
Presiding

- 1:00 General Singing, led by MISS WYNNE  
Music, Agricultural College Male Quartet  
Address—HON. FRANK O. LOWDEN, President, Holstein-Friesian Breeders' Association of American, Ex-Governor of Illinois

1:50 Dismissal

For those whose afternoon programs do not begin until 2:30 there will be motion pictures in this room from 2:00 to 2:25.

## FRIDAY AFTERNOON

### LIVESTOCK AND DAIRY HUSBANDRY

- 2:00- 4:20 Minnesota Livestock Breeders' Association  
Center Stock Pv.

### FARM MANAGEMENT, FARM CROPS, AND SOILS

- |            |  |           |
|------------|--|-----------|
| 2:30- 3:20 | The Best Tillage Methods. Reports from Plot Tests and Practice. MR. ARNY | 24 Admst. |
| 3:30- 4:20 | State Weed Control Work. MR. BULL  | 24 Admst. |
| 4:30- 5:20 | Weed Eradication Forum. MR. BOSS   | 24 Admst. |

### HORTICULTURE

- |            |  |           |
|------------|--|-----------|
| 2:00- 3:20 | (a) The Vegetable Grower and the Experiment Station. MR. COFFEY  | 102 Hort. |
|            | (b) Report of the Delegate to the National Vegetable Growers' Convention at Albany, New York. MR. TAPLEY | 102 Hort. |
|            | (c) Frost Resistance in Vegetables. MR. HARVEY   | 102 Hort. |
|            | (d) The Seedsman's Source of Seed. MR. WEDGE   | 102 Hort. |
| 3:30- 5:20 | Minnesota State Vegetable Growers' Association   | 102 Hort. |

### FARM ENGINEERING

- |            |   |           |
|------------|---|-----------|
| 2:30- 3:20 | Blacksmithing—The Horse's Foot and His Shoe. MR. JOHNSTON               | 20 Engr.  |
| 2:30- 4:20 | Keeping Gas Engines and Tractors on "The Job." MR. TORRANCE, MR. LARSON | 107 Engr. |
| 3:30- 4:20 | Blacksmithing—Fitting Horse Shoes. MR. JOHNSTON                         | 20 Engr.  |
| 3:30- 4:20 | Automatic Water Systems in Rural Homes. MR. STEWART                     | 6 Engr.   |
| 3:30- 4:20 | Conference Hour on Road Problems. MR. ROE                               | 208 Engr. |

3:30- 4:20	Conference Hour on Farm Buildings. Mr. WHITE	207 Engr.
<b>POULTRY AND BEES</b>		
2:30- 3:20	Poultry. Selecting Layers Among American Breeds. Miss COOKE	
	Poultry. Selecting Layers Among Light Breeds. Mr. CHAPMAN	9 Vet.
3:30- 4:20	Poultry. Demonstrations of Selection. Miss COOKE, Mr. HOBERG, Mr. CHAPMAN	9 Vet.
4:30- 5:20	Bees. Discussion—Questions and Answers	4 Plant P.

## FRIDAY EVENING

### University Farm Dining Hall

5:45 Farmers' and Home-Makers' Banquet. The program will be given at the banquet tables, DR. LOTUS DELTA COFFMAN, Presiding.

Speakers—

MR. D. A. WALLACE, Editor "The Farmer"  
 HON. FRANK O. LOWDEN, Ex-Governor of Illinois  
 DR. CAROLINA HEDGER, Elizabeth McCormick Memorial  
 HON. J. A. O. PREUS, Governor of Minnesota  
 HON. DUNCAN MARSHALL, Minister of Agriculture, Alberta, Canada

Instrumental Music in charge of MR. ABE PEPINSKY and Vocal Music in charge of MISS GRACE BENNETT WYNNE will be interspersed throughout the program. All are invited to the Banquet. Purchase tickets at the Registrar's office before Thursday.

## SATURDAY MORNING

### VETERINARY MEDICINE

9:15-11:05	Disinfection and Disinfectants. What Disinfectants to Select and How to Apply to Wounds and to Farm Buildings. Simple Surgical Operations, Castration of Pigs, Dehorning of Calves, etc. (Demonstration). DR. FITCH, DR. BOYD	9 Vet.
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### HORTICULTURE

8:15-12:05	Pruning, Budding, Grafting, and Plant Propagation—Demonstration and Individual Practice—Under the Direction of the staff of the Division of Horticulture	8 Hort.
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### FARM ENGINEERING

8:15- 9:05	Furnace Heat for the Farm Home. Mr. STEWART	217 Engr.
9:15-10:05	Tractor Power—From the Fuel Can to the Draw-bar. Mr. LARSON	107 Engr.
9:15-10:05	A Septic Tank for the Farm Home. Mr. ROE	217 Engr.
10:15-11:05	Conference and Discussion of Special Problems on Farm Buildings, Drainage, Tractors, and Other Farm Engineering Problems at the Request of Members of the Short Course. Mr. BOSS	107 Engr.

Special topics will be announced during the Week.

Saturday can also be utilized for conferences with the faculty in their various offices.

## ASSOCIATION MEETINGS

The following groups will hold their meetings at University Farm during Farmers' and Home Makers' Week, January 2 to 7, 1922:

Aberdeen-Angus Breeders, Ayrshire Breeders, Brown-Swiss Breeders, Creamery Managers, Farmers' Clubs, Fruit

Growers, Garden Flower Growers, Guernsey Breeders, Hereford Breeders, Holstein Breeders, Home Gardeners, Horse Breeders, Institution Farmers' Club, Jersey Breeders, Livestock Breeders, Poland-China Breeders, Poultry Raisers, Sheep Breeders, Swine Breeders, Red Polled Breeders, Vegetable Growers, Minnesota Grange, Duroc-Jersey Breeders of Minnesota, Minnesota Berkshire Breeders, and Testers of Minnesota Cow-Testing Associations.

For days, hours, rooms, and buildings of the various meetings, see page 23 of this pamphlet.

## EXHIBITS

Many of the divisions will have special exhibits in the divisional buildings. What these exhibits are and where they can be found may be learned by inquiring at the time and place designated in the directory below.

Many general exhibits will be found in rooms 2 and 4 of the Administration Building. Make yourself at home in these rooms any time when the regular program of exercises is not in operation. You will find interesting and instructive exhibits regarding many phases of farming and home-making. The exhibits are largely self-explanatory and easily interpreted.

## DIRECTORY FOR OBTAINING INFORMATION

Persons having special questions to be answered will find indicated below the office at which to call and the hours when it is open.

- (1) Home Economics, 201 Home Ec., 8:15 to 12 and 1 to 5.
- (2) Farm Crops and Farm Management, 21 Admst., 8:15 to 12 and 1 to 5.
- (3) Animal Husbandry, 8 Stock P., 8:15 to 12 and 1 to 5.
- (4) Dairy Husbandry, 33 Dairy H., 8:15 to 12 and 1 to 5.
- (5) Bee Keeping, Farm H., 1 to 5.
- (6) Entomology and Economic Zoology, 301 Admst., 8:15 to 12 and 1 to 5.
- (7) Farm Engineering, Information table near main entrance, Engr., 8:15 to 12 and 1 to 5.
- (8) Horticulture, 111 Hort., 9 to 12 and 2 to 5.
- (9) Plant Pathology, Plant Diseases, 33 Plant P.; Seed Testing, 22 Plant P., 8:15 to 12, and 1 to 5.
- (10) Poultry Husbandry, 118 Vet., 8:30 to 12 and 1 to 5:30.
- (11) Soils, 152 Chem., 8:15 to 12 and 1 to 5.
- (12) Agricultural Education, 209 Admst., 8 to 12 and 1 to 5.
- (13) Veterinary, Vet., 8 to 12 and 1 to 5.
- (14) Forestry, 205 Hort., 8:15 to 12 and 1 to 5.
- (15) Agricultural Economics, 318 Admst., 8:15 to 12 and 1 to 5.
- (16) Short Courses, 209 Admst., 8 to 12 and 1 to 5.
- (17) School of Agriculture, 207 Admst., 8 to 12 and 1 to 5.
- (18) College of Agriculture, 25 Plant P., 8:15 to 12 and 1 to 5.
- (19) Agricultural Extension, 1 Admst., 8 to 12 and 1 to 5.
- (20) Agricultural Biochemistry, 103 Chem., 8:15 to 12, and 1 to 5.

## DIRECTORY OF ASSOCIATIONS AND CONFERENCES

Meeting	Day	Hours	Building	Room
Aberdeen-Angus Breeders* . . . . .	5	10:15-12:05 2:00- 4:20	Stock Pv.	West
Ayrshire Breeders* . . . . .	5	10:15-12:05 2:00- 4:20	Dairy H.	32A
Brown-Swiss Breeders* . . . . .	5	10:15-12:05 2:00- 4:20	Dairy H.	37
Creamery Managers . . . . .	5	10:15-12:05 2:00- 4:20	Dairy H.	39
Farmers' Clubs . . . . .	5	5:30-	Cafeteria	
Fruit Growers . . . . .	4	8:15-12:05 2:30- 5:20	Hort.	8 & 102
Garden Flower Growers. . . . .	5	8:15-12:05 2:30- 5:20	Hort.	8 & 102
Guernsey Breeders* . . . . .	5	10:15-12:05 2:00- 4:20	Dairy H.	40
Hereford Breeders* . . . . .	5	10:15-12:05 2:00- 4:20	Stock Pv.	East
Holstein Breeders* . . . . .	5	10:15-12:05 2:00- 4:20	Admst.	Assembly
Home Gardeners . . . . .	3	8:15-11:05	Hort.	8 & 102
Horse Breeders* . . . . .	4	10:15-12:05 2:00- 4:00	Stock Pv.	3
Institution Farmers' Club. . . . .	3-4-5		Eng.	308
Jersey Breeders* . . . . .	5	10:15-12:05 2:00- 4:20	Dairy H.	32B
Livestock Breeders* . . . . .	6	10:15-12:05 2:00- 4:20	Stock Pv.	Center
Poland China Breeders* . . . . .	4	4:00-	Stock Pv.	1
Poultry Raisers . . . . .	4	2:00- 4:20	Vet.	9
Sheep Breeders* . . . . .	4	10:15-12:05 2:00- 4:00	Stock Pv.	West
Swine Breeders* . . . . .	4	10:15-12:05 2:00- 4:00	Stock Pv.	East
Vegetable Growers . . . . .	6	8:15-12:05 2:00- 5:20	Hort.	8 & 102
Berkshire Breeders* . . . . .	4	10:15-12:05	Stock Pv.	1
Duroc-Jersey Breeders* . . . . .	4	10:15-12:05	Stock Pv.	Center
State Grange . . . . .	3-4		Engr.	312
Cow-testers . . . . .	4	8:15-10:05 5 8:15- 9:05	Dairy H.	32B
Red Polled Breeders* . . . . .	5	10:15-12:05 2:00- 4:20	Stock Pv.	3

\* Special program may be obtained in Room 2-9 Admst. Bldg.

END