### PROGRAM OF INSTRUCTION AND COURSE OF STUDIES

(Since January 1, 1924)

<table>
<thead>
<tr>
<th>Class</th>
<th>Subject</th>
<th>Attendance</th>
<th>Part.</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st yr</td>
<td>Mathematics</td>
<td>Whole class daily</td>
<td>Half</td>
<td>7.55 to 9.30</td>
</tr>
<tr>
<td></td>
<td>Surveying</td>
<td>Alternates daily with Mathematics for last 30 periods of year with same sections and hours</td>
<td>Half</td>
<td>9.30 to 10.45</td>
</tr>
<tr>
<td></td>
<td>Gymnasium</td>
<td>Whole class daily, except Saturdays</td>
<td>Half</td>
<td>10.45 to 11.35</td>
</tr>
<tr>
<td></td>
<td>Tactics</td>
<td>Whole class Saturdays</td>
<td>Half</td>
<td>11.40 to 12.05</td>
</tr>
<tr>
<td></td>
<td>French</td>
<td>Half class daily, except Saturdays</td>
<td>Fourth</td>
<td>12.00 to 2.00</td>
</tr>
<tr>
<td></td>
<td>English</td>
<td>Half class daily, except Saturdays (Half classes alternate in attendance in French and English)</td>
<td>Fourth</td>
<td>2.00 to 3.00</td>
</tr>
<tr>
<td></td>
<td>Drawing</td>
<td>Half class daily, except Saturdays (Half classes alternate in attendance in English and Drawing)</td>
<td>Half</td>
<td>3.00 to 4.30</td>
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</tbody>
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<tr>
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<th>Part.</th>
<th>Hours</th>
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<tbody>
<tr>
<td>2nd yr</td>
<td>Mathematics</td>
<td>Whole class daily</td>
<td>Half</td>
<td>7.55 to 9.30</td>
</tr>
<tr>
<td></td>
<td>History</td>
<td>Half class daily</td>
<td>Fourth</td>
<td>10.50 to 11.55</td>
</tr>
<tr>
<td></td>
<td>French</td>
<td>Half class daily</td>
<td>Fourth</td>
<td>10.50 to 11.45</td>
</tr>
<tr>
<td></td>
<td>Tactics</td>
<td>Replaces French with same sections and hours for 18 recitations; 9 beginning September 1; 8 ending June 4. (Half classes alternate in attendance in History and in French or Tactics.)</td>
<td>Fourth</td>
<td>10.50 to 11.45</td>
</tr>
<tr>
<td></td>
<td>English</td>
<td>Half class daily, except Saturdays</td>
<td>Fourth</td>
<td>2.00 to 3.00</td>
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<td></td>
<td>Drawing</td>
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<td>3.00 to 4.30</td>
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<th>Hours</th>
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<tbody>
<tr>
<td>3rd yr</td>
<td>Mathematics</td>
<td>Whole class daily</td>
<td>Half</td>
<td>7.55 to 9.30</td>
</tr>
<tr>
<td></td>
<td>History</td>
<td>Half class daily</td>
<td>Fourth</td>
<td>10.50 to 11.55</td>
</tr>
<tr>
<td></td>
<td>French</td>
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<td>Fourth</td>
<td>10.50 to 11.45</td>
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<td></td>
<td>English</td>
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<td>Fourth</td>
<td>2.00 to 3.00</td>
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<td></td>
<td>Drawing</td>
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<td>Half</td>
<td>3.00 to 4.30</td>
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<th>Part.</th>
<th>Hours</th>
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<tr>
<td>4th yr</td>
<td>Mathematics</td>
<td>Whole class daily</td>
<td>Half</td>
<td>7.55 to 9.30</td>
</tr>
<tr>
<td></td>
<td>Surveying</td>
<td>Alternates daily with Mathematics for last 30 periods of year with same sections and hours</td>
<td>Half</td>
<td>9.30 to 10.45</td>
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<td></td>
<td>Gymnasium</td>
<td>Whole class daily, except Saturdays</td>
<td>Half</td>
<td>10.45 to 11.35</td>
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<td></td>
<td>Tactics</td>
<td>Whole class Saturdays</td>
<td>Half</td>
<td>11.40 to 12.05</td>
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<td>French</td>
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<td>Fourth</td>
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<tr>
<td></td>
<td>Natural and experimental philosophy</td>
<td>Whole class daily</td>
<td>Half</td>
<td>7.55 to 9.30</td>
</tr>
<tr>
<td></td>
<td>Laboratory</td>
<td>When ordered</td>
<td>Half</td>
<td>9.45 to 11.55</td>
</tr>
<tr>
<td></td>
<td>Chemistry and electricity</td>
<td>Whole class daily</td>
<td>Half</td>
<td>10.50 to 11.55</td>
</tr>
<tr>
<td></td>
<td>Laboratory</td>
<td>When ordered</td>
<td>Half</td>
<td>10.50 to 11.55</td>
</tr>
<tr>
<td></td>
<td>Spanish</td>
<td>Half class daily, except Saturdays</td>
<td>Fourth</td>
<td>12.00 to 3.00</td>
</tr>
<tr>
<td></td>
<td>Drawing</td>
<td>Half class daily, except Saturdays (Half classes alternate in attendance in Spanish and in Drawing or Tactics)</td>
<td>Fourth</td>
<td>12.00 to 3.00</td>
</tr>
</tbody>
</table>

**Notes:**
- First term, September 1 to December 31: 95 periods with Saturday recitations and 4057.580 hours without Saturday recitations.
- Second term, January 2 to June 4: 130 periods with Saturday recitations and 4057.580 hours without Saturday recitations.
- Semi-annual examination, December 26 to 31.
- Annual examination, June 5 to 12.
- Second period, January 2 to June 4: 130 periods with Saturday recitations and 4057.580 hours without Saturday recitations.
- Replaces Drawing for 30 periods from March 11.

**Total:** 134.6 hours math

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1st yr Math: 134.6 hours math
2nd yr Math: 262.1 hours math
3rd yr Math: 262.1 hours math
4th yr Math: 262.1 hours math

Total Math Hours: 858.8 hours
text "Precision of Measurements and Graphical Methods"—Goodwin, 1919 edition. In addition to the theoretical instruction, three or four laboratory exercises are presented in this subject.

General physics.—Seventy periods in all. The subjects of elementary mechanics, properties of matter, wave motion, sound and light, etc., in General physics are assigned to this department. The text used is "General Physics."—Ferry—and the subjects enumerated are given to the extent they are covered in that text. In addition numerous original problems are presented and solved. Laboratory apparatus is used for the qualitative demonstration of practically every principle covered in these subjects. Numerous formal laboratory exercises are likewise given as a part of this course.

Upon completion of the advance and partial review of the above-described work a written general review of approximately 15 periods is given, followed by the semiannual examination. This completes the work of the first term.

SECOND TERM

Technical mechanics.—Seventy periods. The text used is "Technical Mechanics"—Maurer. The upper part of the class takes the entire text. The lower part of the class covers certain selected problems and portions of the text including articles 33 to 60. Numerous original problems are presented in addition to those given in the text. In connection with this subject several laboratory exercises of a more or less advanced nature are presented.

Hydraulics.—Approximately 20 periods. The text used is "Textbook on Hydraulics"—Russell. The upper part of the class takes the entire text. The lower part of the class usually covers Chapter IX and certain of the more difficult problems.

Aerodynamics.—Fifteen periods. "The Airplane"—Sedell, is used as a text and is supplemented by various Air Service information circulars, aeronautical magazines, and reports of the Advisory Committee for Aeronautics. The entire text is taken, and is supplemented by approximately 40 original problems.

Astronomy.—Twelve periods. The text used is "An Introduction to Astronomy"—Moulton. This course is conducted as a combination reading and lecture course. A portion of each period is devoted to a lecture in which full use is made of astronomical slides. The remainder of the period is devoted to conferences and question. The entire text is covered.

Upon completion of the advance and partial review of the work indicated above a written general review of approximately 15 periods is given, followed by the annual examination. This completes the work of the second term.

DEPARTMENT OF MATHEMATICS

THIRD AND FOURTH CLASSES

The course in mathematics begins with the fourth-year class and continues through the third-year class.

In the fourth-year class and completion of the second-year course, and then with trigonometry. Plane analytical geometry is begun.

In the third-year class and solid analytical geometry and descriptive geometry are completed in alternation. The calculus and least squares finish the course.

The course in algebra covers the entire subject as generally taught in college, but the student is expected already to have mastered elementary algebra to include the progressions and the solution of the quadratic equation. Elementary geometry includes the books that relate to the plane and those that relate to space, but the student is expected to have mastered the former. Trigonometry includes the complete solution of plane and spherical triangles. Analytical geometry includes the discussion of the general equation of the second degree in the plane and the particular forms of the equation of the second degree in space.

Descriptive geometry includes the orthographic projections of the right line, the plane, rigid surfaces and surfaces of revolution, tangent planes and intersection of surfaces. It also takes the subjects of shadows and shadows, perspective, isometric projections, and spherical projections.

The course in differential and integral calculus covers the ground of the usual college text-book, including briefly the subject of ordinary differential equations.

The method of least squares, given to selected sections, includes the deduction of the facility curve, the formula for the error, and the distribution of error.
This department embraces the subjects of chemistry, heat, and electricity.

The course begins September 1 of the third academic year and extends throughout this year; exercises, restatements, laboratory work, or recitations take place on all week days.

Commencing September 1, general chemistry and heat occupy the time until the close of the term in December; restatements or other exercises being had daily. During this term all members of the class whose progress, as shown by their restatements, warrant it, are given laboratory practice in chemistry. This practice begins with chemical manipulations and proceeds to the usual general order of elementary laboratory work. The laboratory exercises are two hours long. It is generally possible to give all parts of the class some laboratory experience, but the amount of the work, however, varies with the aptitude of the student from a few hours to 50 or more.

This term closes with an examination upon the essential parts of the entire course, which all cadets who have not shown a required proficiency in daily work must take.

The course in heat is short, but it is a comprehensive elementary course intended to embrace what is most applicable to subsequent work at the academy and what is most useful in general education.

In chemistry the course is a descriptive general one, based upon a concise statement of the more essential principles of chemistry, and justifies that class of information deemed most important to cadets, together with an accurate and logical treatment of many useful applications of chemistry.

Beginning January 1, the subject of electricity is taken daily. This term also closes with an examination, covering the essential parts of heat during this term, which all cadets who have not shown a required proficiency in daily work must take.

The course in electricity is a brief exposition of the leading electrical phenomena and their relation to each other. It includes a study of the general principles of the subject and of the typical machines, generators, motors, and transformers, together with the more important uses of electricity. The laboratory exercises give experience with a number of the machines and in the use of a great variety of apparatus employed in the numerous forms of electrical measurements. In this term the laboratory work is a part of the electrical course, and all cadets enter the laboratory. All laboratory work is performed under the immediate supervision of an instructor.

Textbooks

Elementary Lessons in Heat—Tibbets. Practical Chemistry (Laboratory man.

Descriptive General Chemistry—Tibbets. Elements of Electricity—Robinson.

Standard works on the respective subjects are always available for reference, both to cadets and instructors.
<table>
<thead>
<tr>
<th>Year</th>
<th>1st Sem</th>
<th>1st Sem</th>
<th>2nd Sem</th>
<th>2nd Sem</th>
<th>3rd Sem</th>
<th>4th Sem</th>
</tr>
</thead>
<tbody>
<tr>
<td>Math</td>
<td>80.75</td>
<td>76.50</td>
<td>80.75</td>
<td>110.50</td>
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<tr>
<td>Survey</td>
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<tr>
<td>Gym</td>
<td>80 x 50 = 4000</td>
<td>109 x 80 = 8720</td>
<td>125 x 50 = 6250</td>
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<tr>
<td>Tactics + riding</td>
<td>15 x 50 = 750</td>
<td>21 x 45 = 945</td>
<td>10 x 75 = 750</td>
<td>8 x 15 = 120</td>
<td>600</td>
<td>20 x 100 = 2000</td>
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<tr>
<td>French</td>
<td>129 x 60 = 7740</td>
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<td>Philos</td>
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<td>Lab</td>
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<td>Chem &amp; Biology</td>
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<td>Eng. in</td>
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<td>M. &amp; A.</td>
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<tr>
<td>Law</td>
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<tr>
<td>Hygiene</td>
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Total all 4 yrs. 206,700 min = 3,445 hrs.

\[4 + b + c + d + e + f = 16,875\]
\[w + x + y + z = 17,010\]

Sum of all K's \((225 - 47) \times 85 + 47 \times 95 + 12 \times 75 = 19125 + 900 = 20025\)

Sum of all Ms \(\frac{1}{2} \times 189 \times 75 + 6 \times 75 = 7087.5 + 450 = 7537.5\)
1st Sem
\[
\begin{align*}
\frac{1}{2} \times 80 \times 25 &= 2400 \\
\frac{1}{2} \times 15 \times 75 &= 562.5 \\
- \frac{1}{2} \times 14 \times 60 &= -420 \\
\hline 
\text{Total} &= 3382.5 \\
\end{align*}
\]

2nd Sem
\[
\begin{align*}
\frac{1}{2} \times 109 \times 60 &= 3270 \\
\frac{1}{2} \times 21 \times 75 &= 787.5 \\
\hline 
\text{Total} &= 4057.5 \\
\end{align*}
\]

Typical 4 1/2 yrs - Sched

Engin 7:55 - 9:20

Ord + Gun 8:30 / 9:20

Ord, Gun 10:00 - 11:55

Etc.