SWARTHMORE COLLEGE

BULLETIN

SECOND CATALOGUE NUMBER

SWARTHMORE, PENNSYLVANIA
Printed for the College
1919

Vol. XVI, No. 4 Sixth Month, 1919

The Bulletin is published quarterly by Swarthmore College, from the College Office, Swarthmore, Pa.

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FIFTIETH YEAR
1918-1919

Commencement, 1919
General College Information
Departments and Courses of Instruction

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SWARTHMORE COLLEGE

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In the SWARTHMORE COLLEGE BULLETIN for December, 1918, the description of the courses of instruction was omitted because of the uncertainty connected with the requirements of the Government covering the courses to be organized for the members of the Students' Army Training Corps. The demobilization of the S. A. T. C. was completed late in December, 1918. Thus the College was able to return to its regular schedule after the Christmas vacation. This number of the BULLETIN includes general information concerning the opening of college in September, 1919, and a description of the courses to be offered during the college year 1919-20.

SWARTHMORE COLLEGE

47th Annual Commencement, Sixth Month 5th to Sixth Month 9th 1919

The most memorable commencement in Swarthmore's history was this of June, 1919. The fact that it was a Victory Commencement, with returned soldiers included among the graduates, a reunion of alumni exceeding in numbers that of many years, and a spirit of pride and rejoicing enveloping the campus—these things alone would have marked it as unusual. In addition, however, the return of two of Swarthmore's most distinguished sons as the speakers of Commencement week made the occasion remarkable.

A. Mitchell Palmer, Attorney General of the United States, delivered the Baccalaureate Sermon on Sunday, June 8, and William C. Sproul, Governor of the State of Pennsylvania, made the Commencement address on the day following. The combination of these two big national figures was an irresistible one, for the men are life-long friends. While undergraduates at Swarthmore they were classmates, roommates, fraternity brothers, members of Phi Beta Kappa together. And since being graduated from Swarthmore with the Class of 1891 they have maintained their comradeship in spite of their adherence to opposed political parties. This made it particularly fitting that the degree of Doctor of Laws be conferred on both men by Swarthmore College at the close of the Commencement program. Attorney General Palmer was presented for his degree by Robert M. Janney, President of the Board of Managers; and Governor Sproul was presented by Provost Edgar Fahs Smith, of the University of Pennsylvania.

The festivities of Commencement Week began with the luncheon given on Thursday, June 5th, to the members of the class of 1919 by President and Mrs. Swain and Dean Richards.

On Class Day, June 6th, the Senior class presented "Washington, the Man Who Made Us," a ballad play by Percy MacKaye. The leading rôle was well filled by Drew Pearson. In the evening the class upset the custom of having presentations made,

and substituted an uproariously successful history in verse of 1919's activities, read by Judson Ballard and illustrated by the class.

Alumni Day, the day following, opened with a business meeting of the Alumni Association at which the elections for the ensuing year were as follows:

President, T. Jay Sproul, '09; Vice-Presidents, Samuel D. Heed, '07; Joseph H. Willits, '11; Elizabeth B. Oliver, '13; Board of Directors to serve for 1919-21, Charles Palmer, '82; Charles T. Brown, '98; David Dwight Rowlands, '09.

After the alumni luncheon Swarthmore was victorious in a baseball game played with Haverford College. The class play was repeated, this time in the outdoor auditorium. Supper was served in the William J. Hall Gymnasium, with ex-Governor Charles R. Miller, of Delaware, as toastmaster.

The Baccalaureate Sermon, delivered by Attorney General Palmer on Sunday morning, June 8, made a deep impression on the many people who crowded Collection Hall to hear it. And later in the day Drew Pearson, as Ivy Orator, stirred and inspired his audience as few Ivy Orators have done. A tea, given by the Seniors to their parents, Faculty, and friends, was included in the day's functions; and Baccalaureate Sunday ended with the last Collection.

Governor Sproul's Commencement Address on Monday, June 9, was a delightful one on the subject of "Common Sense." During the Commencement program President Swain read the following announcement:

"The Committee on the Jubilee Fund at a meeting held Sixth Month, 6, 1919, unanimously adopted the following:

" 'The conditions arising from the war made it necessary to discontinue for the time being the labors of the Committee to raise endowment in an amount requisite to ensure the conditional pledge of the General Education Board. The necessities of the College, as well as good faith with the General Education Board, demand that the work be taken up as speedily as possible and carried to a successful conclusion. It is, therefore, resolved that a committee of five be named to propose a plan for the early resumption of the campaign, with the idea that the ultimate sum shall be one million dollars.

" 'In this connection it is gratifying to announce that the original Worth Fund of $50,000, given by W. P. and J. S. Worth, nearly two years ago, with which to begin at a suitable time a Girls' Dormitory, has been increased and with accumulated interest amounts to over $100,000. The College is now prepared to start a Girls' Dormitory as soon as building conditions will warrant. With part of this Jubilee Million, when obtained, it is expected that there will be erected on the college campus a memorial building to be used as an auditorium with an inscription upon it setting forth a cherished Swarthmore ideal in recognition of conscientious service for humanity. A full statement in regard to this matter will be made later.' "

The announcement of the award of Fellowships, Scholarships, and other college honors for the year was made by President Swain as follows:

FELLOWSHIPS:

Joshua Lippincott Fellowship, Paul Fleming Gemmill, A.B., 1917. John Lockwood Memorial Fellowship, Esther E. Baldwin, A.B., 1909. Hannah A. Leedom Fellowship, Paul M. Cuncannon, A.B., 1915. Lucretia Mott Fellowship, Gladys Amanda Reichard. Martha E. Tyson Fellowship, Dorothea Gillette, A.B., 1914.

PHI BETA KAPPA:

The Swarthmore Chapter of Phi Beta Kappa, an organization for the recognition of high scholarship, has announced the following elections: Elizabeth Neumann Frorer, Phyllis Miki Komori, Edgar Zavitz Palmer, Andrew Russell Pearson, Margaret Elgar Powell, Esther Gertrude Taylor, and Charles Henry Yardley, of the Class of 1919; Marguerite Pendleton Drew and Henrietta Albert Smith, of the Class of 1920.

SCHOLARSHIPS:

Three scholarships are offered for work done in the College during the past year. They are of the value of $200 each for resident and 100 each for non-resident students, and are awarded in each instance to that member of the respective classes who shall be promoted without conditions and shall have the best record of scholarship upon the regular work of the year.

The Deborah Fisher Wharton Scholarship, to a member of the Junior Class, has been awarded to Marguerite Pendleton Drew.

The Samuel J. Underhill Scholarship, to a member of the Sophomore Class, has been awarded to Aline Mathieson Woodrow.

The Anson Lapham Scholarship, to a member of the Freshman Class, has been awarded to Campbell Rogers McCullough.

The University of Pennsylvania Scholarship, given by a friend of Swarthmore College to a student who desires to take work in any department of the University, and having the value of $100, has been awarded for the year 1919-20 to Russell Conwell Gourley.

The Western Swarthmore Club offers in conjunction with the College a competitive honor scholarship of $450 for one academic year. This is awarded to a young man of a western secondary school, and has been awarded for the year 1919-20 to Silas M. Warner, of Warsaw, Indiana.

MEDAL:

The Ivy Medal is given by Owen Moon, Jr., of the Class of 1894. It is placed in the hands of the Faculty without restriction for such disposition as may be deemed best. The Ivy Medal for this year bears the inscription, "Character and Scholarship," and was awarded to Charles Manly Howell.

SIGMA TAU:

The National Engineering Fraternity Sigma Tau this year elected to membership Detlev Wulf Bronk and Howard Malcolm Jenkins, of the Class of 1920.

DELTA SIGMA RHO:

An honorary public speaking organization which was installed in 1911 and to which students are eligible at the end of their Junior year, has elected to membership David Malcolm Hodge, of the Class of 1919.

THE PHOENIX:

The SWARTHMORE COLLEGE PHOENIX has been awarded first prize in the Intercollegiate Newspaper Association competition, as that college paper in the Middle Atlantic States which best fulfilled the requirements of news interest to alumni and student body, of circulation to alumni and student body, of editorial policy, and of general make-up and appearance during the college year 1918-19.

SWARTHMORE COLLEGE CATALOGUE

FIFTIETH YEAR

1918-1919

COLLEGE CALENDAR

1919—1920

Sixth Month 10 to Ninth Month 15..*Summer Recess.*

Ninth Month 15.....Second-day ....Examinations for Admission.

Ninth Month 16.....Third-day .....Examinations for Admission.

Ninth Month 16.....Third-day .....Matriculation, Registration, and Enrollment in Classes.

Ninth Month 17.....Fourth-day ....Examinations for Admission.

Ninth Month 17.....Fourth-day ....College Work begins at 8.00 A.M.

Tenth Month 7.....Third-day .....Meeting of Board of Managers.

Tenth Month 25.....Seventh-day ...Founders' Day. College Work suspended for the day.

Eleventh Month 26...Fourth-day ...College Work ends at 1.00 P.M. for the Thanksgiving Recess.

Twelfth Month 1....Second-day ....College Work resumes at 8.00 A.M.

Twelfth Month 2....Third-day .....*Annual Meeting of Corporation.*

Twelfth Month 19....Sixth-day .....College Work ends at 4.00 P.M. for the Christmas Recess.

First Month 6.....Third-day .....College Work resumes at 8.00 A.M.

First Month 26.....Second-day ....Mid-year Examinations begin.

Second Month 3.....Third-day .....Registration and Enrollment in Classes for the Second Semester, 2.00 to 5.00 P.M.

Second Month 3.....Third-day .....First Semester ends.

Second Month 4.....Fourth-day ....Second Semester begins.

Third Month 9.....Third-day .....Meeting of Board of Managers.

Third Month 19.....Sixth-day .....College Work ends at 4.00 P.M. for the Spring Recess.

Third Month 30.....Third-day .....College Work resumes at 8.00 A.M.

Fifth Month 25.....Third-day .....Final Examinations begin.

Sixth Month 2.....Fourth-day ....Final Examinations end.

Sixth Month 4.....Sixth-day .....Meeting of Board of Managers.

Sixth Month 4.....Sixth-day .....Class Day.

Sixth Month 5.....Seventh-day ...Alumni Day.

Sixth Month 6.....First-day .....Baccalaureate Day.

Sixth Month 7.....Second-day ....*Commencement.*

TABLE OF CONTENTS

THE OPENING OF COLLEGE,

1919-20

The fifty-first college year will open on September 16, 1919.

All students are required to be at the College in time to register and enroll in classs early on Tuesday, September 16. If train connections compel an arrival late in the day, students should arrive on Monday, the 15th.

EXPENSES

The charge for board, room and tuition ranges from *$500 to $600, of which at least $300 is payable in advance. The remainder is due on the first of January. The charge varies in accordance with the size and location of the room. Every student's bill for the first payment is mailed before the opening of the college year, and the student is held responsible for prompt payment in advance. The bill for the second payment is mailed before the first of January. Thirty days after each payment is due 5 per cent. will be added to the amount overdue. In case bills are not paid before the end of the first semester, students owing such bills may be excluded from all college exercises for the second semester. Students withdrawing on or before the end of the first semester receive no benefit from scholarships, as scholarships are credited at the beginning of the second semester. All students choose rooms according to date of application for admission. In order to reserve a room in any one of the dormitories each student must make a deposit of $10 when the room is chosen. This sum will be held as a fund to cover breakage or any other damage to college property, and the loss involved if a student fails to occupy the room reserved for him. When the amount of a student's breakage exceeds $5 the unexpended balance is returned and a new deposit is required.

The necessary furnishings for the rooms in the dormitories are provided by the college, with the exception of rugs, which are to be furnished by the students.

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*See note at bottom of page 14.

The tuition fee for non-resident students is *$200 a year, of which $175 is payable in advance, and the remainder on the first of January.

Special students who enroll for less than the prescribed number of hours will be charged according to the number of hours carried and at the rate of $10 per credit hour.

The charges for room, meals, and tuition are not subject to remission or deduction under any circumstances. Payments are to be made by check or draft to the order of SWARTHMORE COLLEGE, Swarthmore, Pa.

DINING-ROOM RATES

Per college year, $200; per month, $25; per week, $7; single breakfast or lunch, 30 cents; single dinner (except Sunday), 40 cents; Sunday dinner, 50 cents; dinners per month, $10.50; lunches per month, $7.50; breakfasts per month, $7.

The college year for instructors and administrative officers begins with the Saturday preceding Registration Day, and ends with the Saturday following Commencement Day, but does not include the Christmas vacation. Instructors and officers who wish meals before the beginning or after the end of the college year are expected to make arrangements in advance at the Superintendent's office.

The charge for board and room for instructors and administrative officers is $300 per year.

The College is closed during the Christmas recess. Students who desire to remain in Swarthmore or its vicinity at that time may secure board at moderate charge in homes recommended by the faculty. Students who desire to remain at the College during the spring recess will be charged a proportionate sum for board.

Students leaving property in any college building during the summer recess do so at their own risk.

Freshmen are expected to leave the College immediately after

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* On account of increased prices it has been necessary to add $50 to the charge for board, room and tuition for resident students, and $25 to the tuition fee for non-resident students for the college year 1919-1920. Future prices are so uncertain that it is impossible at this time to fix definite rates for more than one year.

their last examination is over in the spring in order that their rooms may be used by Commencement visitors.

Students purchase their own books, which are furnished by the College at the lowest rates obtainable. They also buy their own stationery and drawing implements, and pay a reasonable rate for laundry work done at the College.

A fee of $3 a semester is charged in every laboratory science, except in Chemistry and Engineering.

The fees in the department of Chemistry and Chemical Engineering are as follows: For the course in Assaying, no fee, but students pay for all breakage and all materials used; for the course in Mineralogy $3 a semester; for all other courses in this department $10 a semester. In addition to the above-named fees every student graduating in the department of Chemistry and Chemical Engineering is charged $25 in lieu of fees for apparatus and materials used, in connection with his thesis. This last named fee is payable at the beginning of the second semester of the Senior year.

A fee of $5 a semester is charged for each course in woodworking, forging, and machine practice; a fee of $2 a semester is charged for each course in field practice and surveying; an additional fee of $2 is charged for the annual survey.

A deposit of $5 is required for each course in shop work or founding. This deposit will be retained to cover breakage and loss of tools or supplies, and, after deduction for such items, the balance will be refunded upon the completion of the course.

Each student is charged a fee of $1 a semester for the use of the gymnasium and swimming pools. This amount includes locker rental.

COURSE IN SHORTHAND

If there are twenty or more girls desiring to take two hours' instruction in Shorthand per week during the year 1919-20 with the understanding that no hours of college credit shall be given, the class will be held from 1 to 2 on Tuesday and Thursday. A fee of $10 per semester will be charged. Fees are to be paid in advance at the Superintendent's Office and no fees will be returned if the student fails to complete the course. Students desiring this course should communicate with Miss Harriet E. Worrell, Secretary to the President.

ADMISSION

APPLICATION FOR ADMISSION should be made as early as possible by letter to the Dean of the College. Students are not admitted for a period of less than the current college year, but, when vacancies exist, students may enter profitably upon the work of a sufficient number of courses. All applicants must present satisfactory testimonials of good character from their former teachers, and students coming from other colleges must present certificates of honorable dismissal.

ADMISSION TO THE COLLEGE is granted (1) to candidates who pass satisfactory examinations covering the entrance requirements stated below, pages 17 to 18; and (2) to those who present certificates signed by the principals of duly accredited schools, made out upon forms furnished by the College, affording sufficient evidence that the entrance requirements have been met.

1. EXAMINATIONS FOR ADMISSION must be taken in June if possible. Candidates for admission by examination in June are required to take the examinations of the College Entrance Examination Board. For those who find it impossible to take examinations in June examinations in all subjects will be held at the College in september.

2. ADMISSION BY CERTIFICATE. Graduates of Friends' schools and of public high schools, approved by the faculty and Instruction Committee, will be admitted to the College on certificate of the principal, but are not in every case received without condition. The faculty admits these students *on trial,* and reserves the right to change their classification or to decline to continue their connection with the college if they find them to be insufficiently prepared. The privilege of sending students on certificate may be withdrawn from any school whose pupils are found to be deficient. Principals of other schools who wish to have students admitted on their recommendation should correspond with the Dean on the subject.

Certificates issued by the College Entrance Examination Board will be accepted in place of examinations on the subjects

therein certified to as passed. Information may be obtained by addressing The Secretary of the College Entrance Examination Board, 431 West 117th Street, New York, N. Y.

Graduation from an acceptable four years' high school course or its equivalent is required for admission to the Freshman class on certificate. An applicant may offer substitutes for some of the optional subjects listed below, but in such cases the student is required to substitute for college electives such work as had been omitted in preparatory school. Thus there would be no increase in the number of credit hours required for graduation, but fewer electives could be included in the four-year college course.

ENTRANCE REQUIREMENTS

It is to be carefully noted that the subjects included among the entrance requirements are rated as strictly as possible according to the *time* that should have been devoted to preparatory work in each.

In regard to a *unit* of admission requirements, the faculty of Swarthmore College has approved the following statement, which has been adopted by the National Conference Committee on Standards of Colleges and Secondary Schools, the College Entrance Examination Board, and the Carnegie Foundation for the Advancement of Teaching:

A unit represents a year's study in any subject in a secondary school, constituting approximately a quarter of a full year's work.

This statement is designed to afford a standard of measurement for the work done in secondary schools. It takes the four-year high school course as a basis, and assumes that the length of the school year is from thirty-six to forty weeks, that a period is from forty to sixty minutes in length, and that the study is pursued for four or five periods a week. By this standard a satisfactory year's work in any subject cannot be accomplished under ordinary circumstances in less than one hundred and twenty sixty-minute hours or their equivalent. Schools organized on any other than a four-year basis can, nevertheless, estimate their work in terms of this unit.

The total number of units required on this basis for admission to Swarthmore College is *fourteen and a half.*

AURAL AND ORAL TESTS IN FOREIGN MODERN LANGUAGES

In accordance with a resolution adopted in 1908 by the Modern Language Association of America and a similar one adopted in 1914 by the Association of Modern Language Teachers of the Middle States and Maryland, it is recommended that the schools preparing students for Swarthmore College prescribe adequate aural and oral tests for all candidates who desire to present a foreign modern language in satisfaction of requirements for admission.

GENERAL STATEMENT OF SUBJECTS REQUIRED FOR ENTRANCE

1. Elementary Algebra	1½ units	*Required* subjects, *seven and one half* units.
2. Plane Geometry	1 unit	
3. English	3 units	
4. History	2 units	
5. Elementary French	2 units	*Optional* subjects. Of these enough must be offered to *aggregate seven* units.
6. Intermediate French	1 unit	
7. Advanced French	1 unit	
8. Elementary German	2 units	
9. Intermediate German	1 unit	
10. Advanced German	1 unit	
11. Greek	3 units	
12. Elementary Latin	2 units	
13. Advanced Latin	1 or 2 units	
14. Elementary Spanish	2 units	
15. Elementary Science	1 or 2 units	
16. Solid Geometry	½ unit	
17. Trigonometry	½ unit	

UNIFORM CURRICULUM FOR THE FRESHMAN YEAR IN THE COURSES IN ARTS

FRESHMAN YEAR

See Page	*First Semester*		Hours per Week: Class	Lab'y	Credits
	Major Study or Elective		—	—	3
20	English **1**	Composition	2	—	2
21	English **4**	General Introduction	3	—	3
75	Mathematics **251, 252**	Solid Geometry	3	—	3
	or				
77	Astronomy **262**	Descriptive Astronomy	—	—	—
	Language		3	—	3
	Elective		—	—	3
80	Physical Education		2	—	—
		Totals	13	—	17

See Page	*Second Semester*		Hours per Week: Class	Lab'y	Credits
	Major Study or Elective		—	—	3
20	English **1**	Composition	2	—	2
21	English **4**	General Introduction	3	—	3
75	Mathematics **253**	Trigonometry	3	—	3
	or				
77	Astronomy **262**	Descriptive Astronomy	—	—	—
	Language		3	—	3
	Elective		—	—	3
80	Physical Education		2	—	—
		Totals	13	—	17

For the courses required in the Freshman and Sophomore years in Applied Science see pp. 53-54.

DEPARTMENTS AND COURSES OF INSTRUCTION

English

The instruction in this department is under the direction of Professor Harold Clarke Goddard. Edgar White Burrill and Philip M. Hicks are Assistant Professors, Esther Elizabeth Baldwin, Raymond Morse Herrick, and Beulah A. Macmillan are Instructors.

The purpose of the work in English is to impart the ability to write clear, forceful, idiomatic English, and to arouse and foster love of good literature. A special effort is made to keep in view, at all times, the application of the works studied to the life and problems of the present day.

The requirements and electives in Composition may be seen below. Of the courses in English Literature, Course 4 fulfills the prescription in English Literature, and is a prerequisite to all other courses in English; Courses 8, 10, and 12 are open to all students who have completed Course 4; Courses 6, 7, 9, and 11 are open to all students who have completed six additional hours elected from Courses 8, 10, and 12, and also with the consent of the instructor, to Juniors and Seniors whose major subject is not English; Course 14 is open as stated under that course.

1. Composition. Assistant Professor Burrill, Miss Baldwin, Mr. Herrick, and Miss Macmillan.

Two hours a week throughout the year. Offered annually

Prescribed, in the Freshman year, for all candidates for graduation. Short and long themes and regular conferences throughout the year, together with assigned collateral reading.

2. Second Year Composition. Miss Macmillan.

Two hours a week throughout the year. Offered annually

Prerequisite, Course 1. This course continues, along more advanced lines, the work of the Freshman year, emphasis being placed upon expository writing.

3. Narrative Writing. Professor Goddard.

Two hours a week throughout the year. Offered annually

Open only to those who have attained a grade of A or B in Courses 1, or 2. The chief emphasis of this course is on the short story; the analysis of its structure and practice in writing it. In the second semester some time is devoted to the writing of one-act plays. (See, also, under Course 14.)

ENGLISH LANGUAGE AND LITERATURE

4. General Introduction to English Literature. Assistant Professor Burrill, Miss Baldwin, Mr. Herrick, and Miss Macmillan.

Three hours a week throughout the year. Offered annually.

The first semester of Course 4 is devoted, in the main, to a study of various literary types. Representative examples of lyric and narrative poetry, of the drama, novel, and essay are discussed and criticised in the classroom. The second semester is given to a rapid survey of the history of English literature from the Anglo-Saxon to the Victorian period. A large amount of collateral reading and frequent written reports are required during both semesters.

Course 4 is prescribed in the Freshman year, for all candidates for graduation, and is prerequisite to all other courses in English.

6. Chaucer. Professor Goddard.

Three hours a week throughout the year. Offered in 1920-1921.

After an introductory study of Middle English grammar and phonology, Course 6 is devoted to a careful reading of a number of the *Canterbury Tales,* several of the Minor Poems, and the *Troilus and Criseyde.* Brief selections are read from the works of Langland and other writers of the period.

Course 6 must be continued throughout the year.

7. The English Drama. Assistant Professor Burrill.

Three hours a week throughout the year. Offered annually.

Course 7 deals with a selected period or aspect of the English drama. Subject for 1919-20: The Development of the Drama.

Course 7 must be continued throughout the year.

8. Shakespeare. Mr. Herrick.

Three hours a week throughout the year. Offered annually.

A critical study of several selected plays of Shakespeare and more rapid reading of the rest of his works.

Course 8 must be continued throughout the year.

9. Prose Fiction. Professor Goddard.

Three hours a week during the first semester. Offered in 1919-20.

Course 9 deals with a selected period or aspect of English fiction, or takes up in more detail the works of a single author.

10. English Poetry. Assistant Professor Burrill.

Three hours a week throughout the year. Offered annually.

The work of this course is devoted to the English poets of a selected period, the emphasis being placed on the interpretation of individual masterpieces rather than on the study of literary movements. Subject for 1919-20: Victorian Poetry.

Course 10 must be continued throughout the year.

11. English Prose. Professor Goddard and Miss Macmillan.

Three hours a week throughout the year. Offered annually.

The purpose of Course 11 is to present the development of English thought and of the social, political, and ethical ideals of the English people, as embodied in the prose literature of a selected period.

In 1919-20 two courses in English Prose are offered: 11 (*a*) Social Ideals in Contemporary Prose, by Professor Goddard; and 11 (*b*) Victorian Prose, by Miss Macmillan.

Course 11 must be continued throughout the year.

12. American Literature. Miss Baldwin.

Three hours a week throughout the year. Offered in 1919-20.

A survey of the history of American literature, emphasis being placed upon the nineteenth century and upon leading writers.

14. Special Topics. Professor Goddard.

Two hours a week throughout the year. Offered in 1919-20.

The purpose of Course 14 is to cover periods and topics not fully treated in the other courses of the department, and to offer, also, opportunity for the detailed study of selected authors.

Course 14 is conducted on the seminary plan and is intended primarily for Seniors majoring in English; it is open to others only by special permission. In 1919-20 a course in Advanced Composition, open to those who have had Course 3, will be offered in connection with Course 14.

The Philadelphia libraries of particular value in connection with work in the department of English are the following: the Library of the University of Pennsylvania; the Philadelphia Library; the Mercantile Library; the Free Library of Philadelphia.

Public Speaking

The instruction in Public Speaking, given by Assistant Professor Philip M. Hicks, is designed to develop and train the voice as an efficient instrument of self expression and literary interpretation, and to give training in the principles and practice of effective public speaking.

In the belief that frequent practice in speaking is the requisite for the best results, the work is arranged mainly in one hour courses to meet the needs of students who may desire to continue this practice throughout their college term.

The classes meet in small sections in order that each student may receive the personal criticism of the instructor.

15. The Voice. Assistant Professor Hicks.

Two hours a week throughout the year. Offered in 1919-20.

The aim of this course is to develop and strengthen the voice according to the individual needs of the students, to make it a serviceable instrument for speaking and for the interpretation of literature. Students are required to read and to deliver memorized selections before the class. *Cumnock's Choice Readings.*

16. Interpretation. Assistant Professor Hicks.

Two hours a week throughout the year. Offered in 1919-20.

A further study of the expression of literary forms for students who have completed Course 15. Lyric and dramatic verse, prose drama and narratives are given special emphasis.

17. Extempore Speaking. Assistant Professor Hicks.

One hour a week throughout the year. Offered in 1919-20.

This course is designed to help students acquire the ability to present their own ideas clearly and effectively. Representative speeches of business and professional men are studied, and students present short speeches before the class each week. *Extemporaneous Speaking,* Pearson and Hicks.

18. Argument. Assistant Professor Hicks.

One hour a week throughout the year. Offered in 1919-20.

This course continues the weekly practice in speaking, but is confined to the field of informal debate. Foster's *Argumentation and Debating* furnishes the ground work for the course and the speeches take the form of discussions of questions of current interest.

19. Persuasion. Assistant Professor Hicks.

One hour a week throughout the year. Offered in 1919-20.

This course aims to familiarize students with the employment of the various methods of persuasion used in appealing to an audience. Scott, *Psychology of Public Speaking.* Among the topics treated are mental imagery, suggestion, the emotions, the crowd, and memory. Weekly practice in speaking is continued.

20. History of Oratory. Assistant Professor Hicks.

One hour a week throughout the year. Offered in 1919-20.

A survey of the development and practice of the art of Public Speaking, including the lives and works of the great masters of oratory, presented in lectures by the instructor and supplemented by research by the students.

INTERCOLLEGIATE DEBATE

Students enrolling for Intercollegiate Debate may receive from one to three hours' credit at the discretion of the instructor, depending upon the quality of the work done. Candidates for the debate squad must complete all required reading and attend weekly practice during the debating season.

The debates are held under the supervision of the Debate Board, an undergraduate body including all students who have represented the college in forensic contests, and the coach of the debate teams. Teams are chosen to defend both sides of the question, which is selected soon after the opening of college.

Public Speaking Contests and Prizes

The Swarthmore Chapter of Delta Sigma Rho, the national honorary forensic society, elects to membership each spring students who have done distinguished work in debate and other public speaking contests. To be eligible students must have engaged

in forensic activities for two years and must have represented the college in an intercollegiate contest.

The public speaking contests, which are conducted by the Debate Board, are designed to bring out the ability of the students and to stimulate interest in forensic events.

The Oratorical Contest, open to all students, is held in January to select Swarthmore's representative for the annual meeting of the Pennsylvania Oratorical Union, in which contest Lafayette, Lehigh, Ursinus, Muhlenberg, and Franklin and Marshall colleges are competitors.

The *Delta Upsilon Prize* of $25 is also awarded to the winner of the local contest. The sum of $500 has been given to the College by Owen Moon, Jr., Class of 1894, the interest from which is to be used for this purpose.

The *Ella Frances Bunting Prizes for the Extemporaneous Speaking Contests* are provided by a gift of $1,000 from E. M. Bunting, of New York. Two prizes of $25 are offered, one contested for by the men and one by the women students.

The *Phi Kappa Psi Prizes* in oratory, offered by the local chapter of that Fraternity, are open to competition among preparatory schools. The contest is held at the College annually on the first Saturday in May.

French and Spanish

The instruction in this department is under the direction of Professor Isabelle Bronk. Dr. Lander MacClintock is Instructor, Mercedes C. Iribas is Assistant, and Marcelle H. Achard and Geneviève M. E. L. Tarby are Student Assistants.

The courses of study in French are designed to afford a high degree of literary culture, as well as to impart thorough training in the grammar and linguistics of the language. Until the end of the second year, the authors studied are all selected from those of modern times, and the greatest attention is given to colloquial French. The student is then ready to be brought into contact with the more artificial (rhetorical) forms of expression constantly occurring in the higher grades of literature. The fact that French is a living tongue is kept ever in view. For this reason but little English is used in the classroom. Free composition, dictation, memorizing, and conversation are re-

quired throughout the courses. Much attention is given to pronunciation, and the relations of modern French to classical, popular, and low Latin are brought often before the students.

The course in Spanish is arranged with a view to giving, as far as possible, a practical knowledge of this language, and also some idea of the modern literature of Spain.

From eleven to fourteen courses in French are given each year. The class in Course 21 is divided into three sections, the class in Course 22 into four.

Students who are prepared in Elementary French (see page 18) enter Course 22; those who are prepared in Advanced French (see page 25) enter Courses 23 and 24.

Students who elect French as a major study are required to complete the work of five full years, or thirty "hours," and to take Course 30.

The first semester's work in Elementary French and Elementary Spanish will not be accepted toward a degree unless followed by the work of the second semester in the same language.

Some of the lists of works studied, as given below, are subject to a slight modification.

21. Elementary French. Professor Bronk and Dr. MacClintock.

Three hours a week throughout the year. Offered annually.

This course is intended for those who begin French in college. Its aim is to enable the student to read ordinary French with ease, to understand to some extent the language when spoken, and to form simple sentences, both oral and written.

Fraser and Squair, *French Grammar,* Part I. Allen and Schoell, *French Life.* Beginner's Reader.

Open to all students.

22. Reading of Nineteenth Century Prose and Poetry, Grammar, and Composition. Professor Bronk, Dr. MacClintock, and Mademoiselle Achard.

Three hours a week throughout the year. Offered annually.

This course is designed to supplement and extend Course 21. Prose composition and drill upon the essential principles of the grammar are continued; much attention is given to idioms and synoynms; the reading becomes more rapid; and French is made almost exclusively the language of the classroom. A survey is also taken of the different literary movements which prevailed in France during the nineteenth century, and of their causes and effects.

Fraser and Squair, *French Grammar,* Part II. A standard *Prose Composition.* Selected works of Balzac, Bazin, Claretie (Vol. VI, Magill's series), Coppée, Erckmann-Chatrian, Daudet, France (Vol. III, Magill's series), Hugo, Maupassant, Mérimée, or others.

Prerequisite, Course 21.

23. Seventeenth Century History and Literature. Professor Bronk.

Two hours a week throughout the year. Offered annually.

This course is conducted mainly in French. Particular attention is given to the social as well as to the literary tendencies of the time, and the students present reports upon pertinent topics, as well as abstracts of the works read.

Lectures on the history and society of the seventeenth century. Corneille, *Le Cid* and *Horace;* Molière, *Les Précieuses ridicules* and *Le Bourgeois Gentilhomme;* Racine, *Andromaque* and *Athalie;* La Fontaine, *Fables* (ed. Hachette).

Prerequisite, Course 22.

24. Advanced Prose Composition. Dr. MacClintock.

Two hours a week during the year. Offered annually.

The aim of this course is to give increased facility in the writing and speaking of the French language, by means of intensive study of chosen models and translation and paraphrase of English into French. Much free composition is also required. Frequent conference periods care for the students' individual needs.

Koren, *French Composition;* Hill and Smith, *Advanced French Composition.*

25. Seventeenth Century Prose. Dr. MacClintock.

Two hours a week during one semester. Offered in 1918-19.

This course is conducted in French. Informal lectures are given and these are accompanied by discussions of the works studied, by collateral reading, and by reports.

Selections from Descartes, *Discours de la Méthode;* from Pascal, *Les Provinciales* and *Pensées;* from La Rochefoucauld, *Maximes;* from Bossuet, *Oraisons funèbres;* from Madame de Sévigné, *Lettres;* and from La Bruyère, *Les Caractères.*

Prerequisites, Courses 23 and 24.

26. Modern French Comedy. Dr. MacClintock.

Two hours a week during one semester. Offered in 1919-20.

The masterpieces of about fifteen representative dramatists are studied, attention being fixed particularly upon the different manners in which they reflect contemporary life. A comparison is also made of their various styles. The work is in French.

27. Modern France. Dr. MacClintock.

Two hours a week during one semester. Offered in 1919-20.

This course is intended to acquaint the student with France as that country is today, and especially with its intellectual, artistic, and political life. Modern French history is outlined, the organization of French society is considered, music and painting are discussed, and the great social movements studied. Free discussion is encouraged. The classroom work is mainly in French.

28. Victor Hugo. Professor Bronk.

One hour a week during one semester. Offered in 1919-20.

A study of his life and works, by means of selected readings, lectures, and reference work. The course is given in French.

29. Lyric Poetry and Versification. Professor Bronk.

One hour a week throughout the year. Offered in 1918-19.

A study of lyric poetry from Villon to the end of the nineteenth century. An examination of French verse-structure from its origin to the present. The work is given in French. Canfield's *Lyrics* is used as a textbook and is supplemented by further reading from the poets studied.

Prerequisite, Courses 23 and 24.

30. Outline Course in French Literature. Professor Bronk.

Two hours a week throughout the year. Offered in 1919-20.

This course is designed as a review and extension of the courses in literature already pursued. Much attention is devoted to the literary monuments of the Old French period, these being read as far as possible in Modern French translations. The literature of the Renaissance is then taken up, after which consideration is given to the movements and tendencies of later times, the different writers and their works. The outside reading is both wide and varied. This course is conducted in French, by means of lectures, collateral reading, reports, and research work. Pellissier, *Littérature française,* is used as a handbook.

Open to advanced students who are able to speak and understand the French language. Credit for three hours is given.

31. History of the Novel. Professor Bronk.

Two hours a week throughout the year. Offered in 1918-19.

The French novel is here considered both in its origins and development and in its portraiture of life. Morillot's *Le Roman en France depuis 1610 jusqu'à nos jours* is used as a textbook, and about fifteen representative novels are read by the students outside of the class. The course is conducted in French and on the seminary plan.

Open to advanced students with a fairly good command of French.

32. Balzac. Professor Bronk.

One hour a week during one semester. Offered in 1919-20.

A survey of the novel in France and a study of Balzac's representative works. In French.

33. Voltaire and Jean-Jacques Rousseau. Professor Bronk.

One hour a week throughout the year. Offered in 1919-20.

A thorough study of the lives and works of these two writers.

34. Practical Phonetics. Dr. MacClintock.

One hour a week throughout the year. Offered in 1917-18.

A study of French pronunciation, based upon Matzke's *A Primer of French Pronunciation.* This course is especially designed for those preparing to teach French.

35. Elementary French Conversation. Dr. MacClintock.

One hour a week throughout the year. Offered annually.

36. Advanced French Conversation. Mademoiselle Tarby.

Two hours a week throughout the year. Offered in 1919-20.

37. French Conversation and Letter Writing. Mademoiselle Tarby.

Two hours a week throughout the year. Offered in 1919-20.

38. Advanced French Reading and Pronunciation. Mademoiselle Achard.

One hour a week throughout the year. Offered in 1919-20.

39. Elementary Spanish. Miss Iribas.

Three hours a week throughout the year. Offered annually.

This course aims to give a knowledge of the essentials of Spanish grammar, the ability to read ordinary Spanish with ease, and some practice in conversation.

Espinosa and Allen, *Elementary Spanish Grammar;* Harrison, *Spanish Reader;* Tamayo y Bans, *Lo Positivo;* Valdés, *La Algeria del Capitán Ribot.*

The French Library is supplied with the treatises and books of reference necessary to illustrate the courses given. It is enriched annually by important additions.

Occasional public lectures are given by French scholars or men and women of note.

The *Cercle Français* meets from time to time during the academic year.

German Language and Literature

The instruction in this department is under the direction of Professor Clara Price Newport. Edna Harriet Richards is Instructor.

The elementary courses of study in this department are designed primarily to equip the student with a working knowledge of the German language as a key to the treasures of German science, philosophy, and literature, and the more advanced courses are intended to impart a knowledge of the development of German literature and to foster appreciation of its masterpieces.

In the classroom, translation into English is discontinued as soon as possible and expressive reading of the German text is substituted, and German is made the classroom language as early as possible. The idiomatic sentence and modern colloquial language form the basis of the work in composition. Reading and translation at sight are cultivated. The attainment of a correct literary understanding and of genuine appreciation of some of the best things in German literature is regarded as the highest aim.

Other texts may at times be substituted for some of those indicated.

The first semester's work in Courses 41, 42, 43, and 49 will not be accepted toward a degree unless followed by the work of the second semester.

41. Elementary German. Miss Richards.

Three hours a week throughout the year. Offered annually. Schrakamp, *Ernstes und Heiteres;* Vos, *Essentials of German;* Bacon, *Vorwärts;* Leander, *Träumerien;* Storm, *Immensee;* Baumbach, *Der Schwiegersohn.* Persistent training in composition, conversation, and expressive reading.

42. Advanced German. Professor Newport.

Three hours a week throughout the year. Offered annually.

Review of grammar, practice in composition, conversation, and expressive reading, and, principally, reading of some recent short stories, of a representative modern play, of lyrics and ballads, and of one of Schiller's and one of Goethe's masterpieces.

Prerequisite, Course 41 or equivalent.

43. Lessing—Schiller. Miss Richards.

Three hours a week throughout the year. Offered annually.

A survey of the lives and work of these authors with special attention to Lessing's *Minna von Barnhelm, Emilia Galotti,* and *Nathan der Weise, Die Erziehung des Menschengesehlechts,* and to Schiller's ballads and poems, selected prose writings, and five of the dramas.

Prerequisite, Course 12 or equivalent.

44. Goethe. Professor Newport.

Three hours a week throughout the year. Offered annually.

Goethe's *Werke, Goldene Klassiker-Bibliothek.* A careful study of Goethe's life and works. Conducted in German.

Prerequisite, Course 43 or equivalent.

45. Middle High German. Professor Newport.

Three hours a week, first semester.

Survey of the origin and development of German, and translation into modern German of such Middle High German masterpieces as *Nibelungenlied, Der arme Heinrich,* and *Parzival.*

Prerequisite, fluency in reading modern German.

46. Outline Course in German Literature. Professor Newport.

Three hours a week throughout the year. Offered in 1918-19.

A general historical survey of German literature.

Prerequisite, ability to read rapidly and accurately and to comprehend lectures in German.

47. Teachers' Course. Miss Richards.

Two hours a week, second semester.

Phonetics and the American teacher's standard in German pronunciation and syntax. Advanced grammar, study of idioms and synonyms, and advanced composition. Classroom German, textbooks and other teaching material, and methods of modern language teaching.

48. Exhaustive Study of Some Author. Miss Richards.

One hour a week, second semester. Offered in 1918-19.

Conducted in German and intended for students majoring in German.

49. Scientific German. Professor Newport.

Three hours a week throughout the year. Offered annually.

Wallentin, *Grundzüge der Naturlehre;* Helmholz, *Populäre Vortäge;* Wait, *German Science Reader;* Dippold, *A Scientific German Reader.* For students majoring in pure and applied science. This course prepares the student to read the new material along scientific lines which is continually coming out in German books and periodicals.

Prerequisite, Course 42 or equivalent.

50. German Composition and Conversation. Miss Richards.

Two hours a week, first semester.

The work consists first of composition based on a text, and later of letter and theme writing. It is supplemented by dictation, oral or written reproduction of short stories read or told to the class, memorizing of practical literary selections, and of reading and discussion of items in German newspapers.

Prerequisite, Course 42 or equivalent.

51. German Poetry in the Eighteenth and Nineteenth Centuries. Miss Richards.

Two hours a week, second semester.

This course is intended for the rapid reading of the best German lyrics and ballads of the period covered.

Prerequisite, Course 42 or equivalent.

52. Recent German Literature. Professor Newport.

One hour a week, second semester. Offered in 1918-19.

A rapid reading course in important modern authors.

Not open to students who have taken German courses beyond Course 44.

53. German Literature in the Eighteenth Century. Professor Newport.

Two hours a week throughout the year.

A careful study of the life, thought, art, and literature, and of the literary relations of Germany to England and France, during this century. In the first semester the work will center around the "Storm and Stress Period" and in the second semester around the "Romantic Movement."

54. The German Novel. Professor Newport.

Three hours a week, second semester.

History and development of the German novel, with extensive reading and the presentation of theses and discussions.

Prerequisite, fluency in reading and speaking German.

55. The German Drama in the Nineteenth Century. Professor Newport.

Three hours a week, first semester.

The development of the drama in Germany since the plays of Goethe and Schiller, with special attention to Kleist, Grillparzer, Hebbel, Ludwig, Anzengruber, Hauptmann, and Sudermann.

Prerequisite, fluency in reading and speaking German.

56. German "Kultur." Professor Newport.

One hour a week throughout the year.

This course aims to give a clear conception of the economic, political, and intellectual history of Central Europe. The nineteenth century, as a period of rapid changes, engages the main part of the attention of the class. For this course a reading knowledge of German is desirable, but not necessary.

A German club known as *Deutscher Verein* exists as a student organization under guidance of the department, and meets regularly for instructive and entertaining literary and musical programs, for practice in conversation, and for social enjoyment.

Students who desire it are given an opportunity to carry on, under direction, correspondence with students in Germany.

Facilities in Philadelphia and vicinity of especial value to work in the department of German are as follows: the general and special libraries of Swarthmore College, University of Pennsylvania, Haverford, Bryn Mawr, Drexel Institute, Philadelphia Public Library; Germanic collections of the museums in Memorial Hall, Drexel Institute, University of Pennsylvania Museum; services in German at several churches; several daily and weekly newspapers; lectures at the German Society.

Greek and Latin

The instruction in this department is under the direction of Professor Henrietta Josephine Meeteer. Ethel Hampson Brewster is Assistant Professor of Greek and Latin.

The aim of the department is primarily to create an appreciation of the masterpieces of Greek and Latin literature and to trace their influence upon modern thought and letters; and attention is given to the political institutions of both Greece and Rome and their survival in present times, to philosophy and religion, to private and social life, and to art and architecture as exemplified by existing remains in sculpture and painting and in private and public buildings. Use is made of illustrative material belonging to the College, and of the collections in the University Museum in Philadelphia. In connection with Courses 70 and 76 a visit is made each year to the Metropolitan Museum of New York.

Special attention is called to Courses 61 and 62 in Greek and 71 in Latin, which are provided for those who, previous to entering college, have not been able to complete the preparatory work required for admission to the Freshman courses.

Students who enter College with four years of Latin will elect Course 72; those who enter with two or three years of Greek will elect Course 64.

The attention of all students is called to Course 69b in Greek Literature in English, to Course 70 in the Art of the Greeks, to Course 73c in Roman Literature in English, and to Course 76 in the Topography and Monuments of Ancient Rome; for these courses a knowledge of Greek or Latin is not required.

A Teachers' Course in Latin (78) is offered for Seniors who expect to take positions as teachers of Latin and Greek in public and preparatory schools. Those who elect this course must before the end of the Senior year have pursued at least Courses 72a, 72b, 73a, 73b, 73c, 75, and 76; the head of the department will recommend as teachers of Latin only those who have completed these courses satisfactorily. Such students are expected also to take at least Course 61 in Greek.

A valuable book is awarded as a *Freshman Prize* to the student who passes the best competitive examination in the Latin comprised in the average four years' course in the high school; this examination is open to the Freshman members of Course 72.

Students desiring detailed information concerning the courses in Greek and Latin are invited to consult with the instructors.

GREEK

61. Beginners' Course. Grammar; reading of Xenophon, *Anabasis,* Book I. Professor Meeteer.

Three hours a week throughout the year. Offered annually.

This course is provided for those who have not had an opportunity of studying elementary Greek in the preparatory school.

62. Xenophon, *Anabasis,* Books II-IV, and selected readings. Professor Meeteer.

Three hours a week during the first semester. Offered annually.

A continuation of Course 61. Students who complete this course are admitted in the second semester to Course 63.

63. Homer, *Odyssey.* Professor Meeteer.

Three hours a week during the second semester. Offered annually.

The earlier books will be read entire and portions of the later books.

64. (*a*) Selected Dialogues of Plato, including the *Crito, Apology,* and *Phœdo.* Lectures on the doctrines of the various schools of Greek philosophy. Professor Meeteer.

Three hours a week during the first semester. Offered annually.

Students who enter college with at least two years of Greek elect this course.

64. (*b*) Greek tragedy, Æschylus, *Prometheus;* Sophocles, *Antigone;* Euripides, *Alcestis.* Some time will be devoted to a study of the Greek theatre. Professor Meeteer.

Three hours a week during the second semester. Offered annually

[The following works will be read in 1919-20: Æschylus, *Septem;* Sophocles, *Oedipus Tyrannus;* Euripides, *Iphigeneia in Tauris.*]

65. (*a*) Historical Prose; selected books of Herodotus and Thucydides; some account of the early Greek historians. Professor Meeteer.

Two hours a week during the first semester. Offered in 1919-20.

65. (*b*) Theocritus and Bucolic Poetry. Professor Meeteer.

Two hours a week during the second semester. Offered in 1919-20.

66. (*a*) Demosthenes and the Attic Orators. Professor Meeteer.

Two hours a week during the first semester. Offered in 1920-21.

66. (*b*) Selections from the Lyric Poets. Professor Meeteer.

Two hours a week during the second semester. Offered in 1920-21.

68. Greek Prose Composition. Professor Meeteer.

Two hours a week during the second semester. Offered in 1920-21.
The purpose of this course is to give facility in the writing of simple Greek prose.

69. (*a*) The New Testament. Professor Meeteer.

Two hours a week during the first semester. Offered as required.
The peculiarities of Hellenistic Greek will be pointed out. The class will read from a "harmony" of the gospels, and will study selections from the epistles descriptive of the primitive church.

69. (*b*) Greek Literature in English. Professor Meeteer.

Two hours a week during the second semester. Offered annually.
A study, through the medium of translations, of the rise and development of Greek literature in its various forms—the epic, the lyric, the drama, history, philosophy, pastoral poetry, etc. No knowledge of Greek is required. The course is designed to be of suggestive value, especially to advanced students in the modern languages and literatures.

70. The Art of the Greeks. Professor Meeteer.

Two hours a week throughout the year. Offered in 1920-21.
A course of lectures giving an introduction to the various departments of Greek art, especially architecture, sculpture, and painting; the purpose of the course, in part, is to give some preparation for future visits to the great museum collections of Europe and America. A knowledge of Greek is not required. Open to all students except Freshmen. This course is given in alternate years only.

90. The History of Greece. Professor Meeteer.

Two hours a week throughout the year. Offered in 1919-20.
The history of Greece, from the earliest times to the death of Alexander the Great. The course aims to give, through lectures, collateral reading, and reports, a history of Greek civilization. Much attention is paid to art, literature, religion, private life, etc.

LATIN

71. Practical Latin. Assistant Professor Brewster.

Three hours a week throughout the year. Offered annually.
This course is arranged for those who are not prepared to take the regular Freshman elective. It includes a study of grammar, etymology, technical terms, mythology, and selected readings.

72. (*a*) Livy, Book I, and selections from Books II-X; exercises in Latin writing. Assistant Professor Brewster.

Three hours a week during the first semester. Offered annually.
See note under Course 72 *b*.

72. (*b*) Plautus, *Menaechmi;* Cicero, Essays *On Old Age* and *Friendship;* miscellaneous selections. Assistant Professor Brewster.

Three hours a week during the second semester. Offered annually.
Courses 72 *a* and 72 *b* form the regular Freshman elective.

73. (*a*) Horace, *Odes* and *Epodes;* studies in the private and social life of the Romans. Assistant Professor Brewster.

Three hours a week during the first semester. Offered annually.
See note under Course 73 *c*.

73. (*b*) The Letters of Pliny the Younger; selections from Catullus. Assistant Professor Brewster.

Two hours a week during the second semester. Offered annually.
See note under Course 73 *c*.

73. (*c*) Roman Literature in English. Lectures and collateral reading. Elective for Sophomores, Juniors, and Seniors. Assistant Professor Brewster.

One hour a week during the second semester. Offered annually.
For this course a knowledge of Latin is not required.
Courses 73 *a*, 73 *b*, and 73 *c*, form the regular Sophomore elective.

75. Latin Prose Composition. Assistant Professor Brewster.

Two hours a week during the second semester. Offered in 1920-21.
Opportunity is afforded in this course for constant practice in writing and speaking Latin. Attention will be given also to the refinements of Latin style.

76. Topography and Monuments of Ancient Rome. Assistant Professor Brewster.

Two hours a week throughout the year. Offered in 1919-20.
Lectures illustrated with the stereopticon and assigned readings. The different departments of Roman art will be treated briefly, both independently and in their relation to Greek and to modern art; in particular the appearance of the ancient city will be discussed and the extant monuments described. No knowledge of Latin is required for this course; it is hoped it will prove of interest to those who expect some time to visit Rome. Open to all students except Freshmen. This course is given in alternate years only.

77. (*a*) Martial and Petronius. Assistant Professor Brewster.

Two hours a week during the first semester. Offered in 1920-21.

77. (*b*) Tacitus, *Germania* and *Agricola*. Assistant Professor Brewster.

Two hours a week during the second semester. Offered in 1920-21.

77. (*c*) The Letters of Cicero. Assistant Professor Brewster.

Two hours a week during the first semester. Offered in 1919-20.

77. (*d*) Roman Satire. Assistant Professor Brewster.

Two hours a week during the second semester. Offered in 1919-20.

78. Teachers' Course. Assistant Professor Brewster.

Two hours a week throughout the year. Offered annually.

Lectures and reports upon the text of Cæsar, Cicero, Virgil, and other Latin authors commonly read in the preparatory schools. For admission to the course see the introductory announcement above (p. 32).

79. Latin Sight Reading. Assistant Professor Brewster.

Two hours a week throughout the year, one hour credit. Offered annually.

The work of this course is almost exclusively confined to the classroom and requires no outside preparation except for an occasional report upon the life and works of the author studied. Selections from Ovid and from a variety of prose and verse writers will be read in 1919-20. Sight reading tends to make the student rely upon his own memory and ingenuity rather than upon lexicon and grammar, thereby making the study more natural and less difficult.

80. Christian Art and Archaeology. Assistant Professor Brewster.

One hour a week throughout the year. Offered in 1920-21.

Lectures illustrated with the stereopticon. The aim of the course is to give an introduction to Christian Archæology, and to study early Christian architecture, sculpture, painting, and mosaic in their relation to classical art and to the art of the Renaissance.

91. The History of Rome. Assistant Professor Brewster.

Two hours a week throughout the year. Offered in 1920-21.

The history of Rome, from the earliest times to the beginning of the Barbaric Invasions, supplemented by Munro's *Source Book of Roman History* and by selected passages from Roman historians.

History and International Relations

The instruction in this department is under the direction of Professor William I. Hull. Senior students majoring in History are the departmental assistants. Dr. Ethel Hampson Brewster, Assistant Professor of Greek and Latin, conducts Courses 90 and 91, on the History of Ancient Greece and Rome.

The courses are conducted by means of classroom lectures and library work, which are coördinated by the students in written outlines and reports. The purpose of the department is to afford training in the discriminating use of historical materials; to cultivate the historical habit of mind; and to develop a knowledge of European, English, and United States history, as a whole, together with a more detailed knowledge of certain great epochs, institutions, and personages in the history of western civilization.

90. The History of Greece. Professor Meeteer.

Two hours a week throughout the year. Offered in 1919-20.

The history of Greece, from the earliest times to the death of Alexander the Great. The course aims to give, through lectures, collateral reading, and reports, a history of Greek civilization. Much attention is paid to art, literature, religion, private life, etc.

91. The History of Rome. Assistant Professor Brewster.

Two hours a week throughout the year. Offered in 1919-20.

The history of Rome, from the earliest times to the beginning of the Barbaric Invasions, supplemented by *Munro's Source Book of Roman History* and by selected passages from Roman historians.

92. Europe to 1870. General and Diplomatic. Professor Hull.

Two hours a week throughout the year. Offered in 1919-20.

A survey of the general history of Western Europe, with special stress on international relations.

93. The Diplomatic History of England. Professor Hull.

Two hours a week throughout the year. Offered in 1920-21.

A survey of the general history of England, with special stress on international relations.

94. The Great War of 1914: Its Causes and Results. Professor Hull.

Three hours a week throughout the year. Offered annually.

The historical and other causes of the Great War, and the terms of peace proposed and adopted for the solution of the world's outstanding diplomatic problems.

95 (*a*) American Diplomacy: The Old World. Professor Hull.

Three hours a week throughout the year. Offered in 1920-21.

A history of the diplomatic problems in which the United States has been involved, in its relations with the Old World, and of the way in which these problems have been solved.

95 (*b*) The United States: Pan-America and the Monroe Doctrine. Professor Hull.

Three hours a week throughout the year. Offered in 1919-20.

A history of the relations between the United States and the Latin-American Republics, including a special study of the problem of the Monroe Doctrine and its proposed solutions.

96. (*a*) International Law: The League of Nations. Professor Hull.

Three hours a week throughout the year. Offered in 1919-20.

The essentials of the international law of peace, including a careful study of the programme for world government adopted by the two Hague Conferences and developed at the Conference of Paris.

96. (*b*) International Law: The Law of War and Neutrality. Professor Hull.

Three hours a week throughout the year. Offered in 1920-21.

The essentials of the international law of war and neutrality, particularly as exemplified in the two Hague Conferences and in the warfare of the Twentieth Century.

97. History Teachers' Course. Professor Hull.

One or two hours' credit for each semester. Offered annually.

This course is designed for senior majors in the Department of History, and is intended to give the theory and practice of aids, methods, and aims in the teaching of history. The practical work of the course is done in neighboring schools, and in connection with Courses 92 to 96.

Political Science

The instruction in this department is under the direction of Professor Robert C. Brooks.

The fundamental aim of the courses offered in political science is to prepare students for intelligent and effective citizenship.

To this end an effort is made to interpret the political life and movements of our time in city, state, and nation. Particular attention is given to criticisms of existing institutions and proposals for their reform. Governments and parties in the leading foreign nations of the world are considered not only because of their intrinsic importance, but also for the valuable suggestions they may yield for the solution of our American problems.

Though the courses in political science are primarily to produce intelligent and effective citizenship, they should also prove more immediately helpful to those who intend to enter politics, law, public service, journalism, business, or the teaching of civics. Students who expect to devote themselves to advanced study and research in political science should be able to lay the foundations for such work in the undergraduate courses offered by this department.

Unsupported by collateral study in economics and history much of the significance of political science will be lost. Psychology, philosophy, and anthropology are also valuable aids. A reading knowledge of German or French should be acquired as soon as possible by students of political science, and both of these are essential for graduate study in this field. Training in English and public speaking are highly desirable.

Changes in advanced courses to be made from year to year will enable students to take more work in political science than is here scheduled.

101. American Political Parties and Party Problems. Professor Brooks.

Three hours a week during first semester. Offered annually.

A study of the growth, organization, aims, and methods of political parties in the United States, with particular reference to the primary and convention system, financing of parties, and the charges of corruption in American politics and life.

Open to all students except Freshmen.

102. American Federal Government. Professor Brooks.

Three hours a week during second semester. Offered annually.

A study of the present structure and functions of the Federal Government of the United States. Designed as a continuation of Course 101.

Open to all students except Freshmen.

103. Government and Parties in England and Continental Europe. Professor Brooks.

Three hours a week throughout the year. Offered annually.

An outline study of the framework of government and the organization, methods, and aims of the leading political parties of England, France, Switzerland, and Germany. Particular attention is given to the constitutional documents of the countries studied and to the more accessible sources of official information regarding them. Wherever possible, comparisons are drawn between the political institutions and problems of the countries studied and those of the United States.

Open to all students.

104. Municipal Government in England and Continental Europe. Professor Brooks.

Two hours a week during first semester. Offered annually.

A study of municipal government in England, France, and Germany, with the particular purpose of discovering suggestions for the improvement of city government in the United States. Special financial and social problems of city life, such as municipal ownership, taxation of unearned increment, the drift of population to urban centers, the housing problem, sanitation, and provision of facilities for recreation are also discussed.

Prerequisite, Courses 101, 102, or 103, or the equivalent of one of these.

105. Municipal Government in the United States. Professor Brooks.

Two hours a week during second semester. Offered annually.

A somewhat detailed study of municipal organization and functions in the United States. Particular attention will be given to the city of Philadelphia. Reform proposals, such as the commission plan, the city manager plan, short ballot, and the work of bureaus of municipal research will be discussed.

Prerequisite, Courses 101, 102, or 103, or the equivalent of one of these.

107. Political Motives. Professor Brooks.

Two hours a week throughout the year. Offered in 1919-20.

A study of the motives influencing men in their political activities, particularly as revealed in biographies and autobiographies of American leaders, whether in reform or practical politics, of recent date.

Open only to Juniors and Seniors.

109. Political Literature of the Great Settlement. Professor Brooks.

Two hours a week throughout the year. Offered in 1919-20.

A study of the more important current state papers, books, and periodical articles

dealing with the political issues of reconstruction following the war. Particular attention will be given to the ideas and methods of progressive democracy as contrasted with those of revolutionary proletarian dictatorship.

Open only to Juniors and Seniors.

Economics

The instruction in this department is under the direction of Professor Thomas K. Urdahl.

Good citizenship implies intelligent citizenship. The broadest purpose of college instruction in Economics is to contribute to the former by the cultivation of the latter. From this point of view the study of Economics should appeal to all students. In a narrower way, work in Economics should prove useful to those who intend to devote themselves to law, business, journalism, philanthropy, or the public service. Finally, for those who wish to prepare for investigation or teaching in this field, college instruction, with its closer personal relation between student and teacher, should provide suitable preparation for graduate study and research in larger institutions.

Collateral work in Political Science, History, German, and French is strongly recommended for all who intend to devote much time to Economics. A knowledge of general biological theory, of psychology, and of philosophy would add greatly to the value of work done in this department.

No credit will be given in courses which run throughout the year, unless the work of the entire year is taken.

The advanced courses will be changed from year to year, thus enabling students to take more work in the department than is here scheduled.

111. Principles of Economics. Professor Urdahl.

Three hours a week throughout the year. Offered annually.

The first part of this course consists of a study of the fundamental laws and principles of economics; the second part deals with the application of these laws to the public questions of the day, such as those connected with the tariff, taxation, currency, trusts, trade unions, strikes, socialism, and the railroads.

Not open to Freshmen.

112. Money, Credit, and Banking. Professor Urdahl.

Three hours a week during the first semester. Offered in 1919-20.

The work of this course will be divided into three parts: (a) a study of the principles of money, credit, and banking; (b) a study of the exemplification of those principles in the monetary and banking history of certain countries; (c) a study of

present-day currency and banking problems in the United States. As a supplement to the classroom work, visits will be made to the mint and to banking institutions in Philadelphia.

Prerequisite, Course 111 or its equivalent.

113. Public Finance. Professor Urdahl.

Three hours a week during the second semester. Offered in 1919-20.

The subject-matter of this course will be the nature of governmental wants, public expenditures, budgets, and budgetary legislation, the development of tax systems, the different kinds of taxes, the theory of incidence, the problem of distribution, practical ideals for a tax system in the United States, and the theory and extent of public debts.

Prerequisite, Course 111 or its equivalent.

114. Corporation Finance, and Problems of Business. Professor Urdahl.

Three hours a week during the second semester. Offered annually.

The historical development, the changes in structure, the organizing, the financing, the management, the economic and the social problems of business are considered in detail.

Open to all students.

115. Criminology. Professor Urdahl.

Three hours a week during the second semester. Offered 1920-21.

Three general subjects are treated in this course. The first has to do with the theory and data of criminality. The second subject deals with criminal law and criminal procedure. The third relates to penology. Visits are made to the various penal and reformatory institutions in Philadelphia and vicinity.

Open to all students.

116. Modern Philanthropy. Professor Urdahl.

Three hours a week during the first semester. Offered annually.

The large public questions involved in the relief of the indigent and in the care of the insane, the feeble-minded, and other dependents. Visits are made to representative institutions in Philadelphia and vicinity.

Open to all students.

117. Resources and Industries. Professor Urdahl.

Three hours a week throughout the year. Offered annually.

This course consists of a study of the mineral, water, forest, and land resources of the United States with special emphasis on their conservation. Following this the principal agricultural and manufacturing industries of the United States will be studied and discussed. Attention will also be given to the main continental and oceanic routes of travel. The first semester will be devoted to a study of the economic history of the United States. The class will visit some of the leading industrial establishments of the vicinity.

Open to all students.

118. The Development of Economic Theory. Professor Urdahl.

Three hours a week during the first semester. Offered in 1920-21.

The evolution of economic thought from the writings of the mercantilists and physiocrats down to the present day. Especial attention will be given to the various schools of thought and to their influence in shaping public policy.

Prerequisite, Course 111 or its equivalent.

119. The Labor Problems. Professor Urdahl.

Three hours a week during the second semester. Offered in 1920-21.

A study of the history, activities, and structure of labor organizations, and the influence of economic and political theories upon them.

Prerequisite, Course 111 or its equivalent.

120. Economic Problems of War and Reconstruction. Professor Urdahl.

Three hours a week during the second semester. Offered in 1919-20.

Law

The instruction in this department is under the direction of Claude C. Smith, Lecturer in Law.

The courses in law are designed to give to the student an insight into legal reasoning and a general knowledge of the fundamental legal relations which govern our society. It is expected that these courses will serve as a helpful introduction to professional study for those who aim to prepare themselves for the life of the lawyer; that those students who desire to equip themselves for active business life, will be aided by an intelligent study of the principles which lie at the basis of commercial life; and that all will find in the systematic study of the science of the law a broadening influence that will tend to general culture.

126. Business Law. Mr. Smith.

Three hours a week during the first semester. Offered in 1919-20.

This course is based on Sullivan's *Business Law*, and is designed to give the student a working knowledge of the law of contracts and negotiable instruments. Classroom discussion of cases illustrating the principles underlying the law covering these topics is the chief work.

History of Religion and Philosophy

The instruction in this department is under the direction of Professor Jesse H. Holmes.

The object of the courses is to give the student an introduction to the principal religious and philosophical systems of the world, together with a study more in detail of a few of them. The courses offered as electives cover three years. All students are required to take a course of three hours in the study of the Bible.

The work will be varied by lectures, recitations, and preparation of special themes. Several hundreds of lantern slides illustrating various phases of the subject-matter are available, as are also charts, maps, pictures, and a carefully selected library.

131. Bible Study. Professor Holmes.

Two hours a week in first semester, one hour a week in second semester. Offered annually.

Intended to give such general knowledge of the Bible, its origin, contents, and qualities as literature, as should be possessed by all intelligent people. The work of the student will consist largely of indicated readings in the Old and New Testaments. Kent, *Historical Bible,* will be used as a supplementary textbook.

The class work will include lectures, recitations, study of maps, pictures, etc.

132. History of Religion. Professor Holmes.

Two hours a week during the first semester. Offered annually.

A brief study of the principal religious systems of the world. Menzies, *History of Religion,* is followed as textbook, but a large part of the work of the course is carried on in the library.

133. The Religion of the Hebrews. Professor Holmes.

Three hours a week during the first semester. Offered annually.

A study of the Hebrew people, their social and religious customs, their prophets and their literature. It is based upon the study of the books of the Old Testament, Kent, *Historical Bible,* being also used. In the early part of the course attention is given to the origin of the Semites and their early movements, Babylonia, Assyria, and other allied topics.

Open to students who have completed Course 131, and to others who, in the judgment of the instructor, can profitably carry on the work of the class.

134. Life and Times of Jesus. Professor Holmes.

Three hours a week during the second semester. Offered annually.

A study of the social, political, and religious conditions prevailing at the beginning of the Christian era, followed by the life, work, and teachings of Jesus, and the Apostolic age of the Christian Church. Stevens and Burton, *Harmony of the Gospels,* the *Acts of the Apostles,* and the other books of the New Testament, together with Pfleiderer, *Christian Origins,* are made the basis of the work.

Open to students who have completed Course 131, and to others who, in the judgment of the instructor, can profitably carry on the work of the class. Courses 133 and 134 may be substituted for the required course in the Bible Study (131) by Juniors and Seniors.

135. History of Christianity. Professor Holmes.

Two hours a week during the second semester. Offered in 1919-20.

A study of the principal events in the history of the Christian church, and especially in the development of Christian doctrines. Some attention will be given to the history of various Christian sects. Allen, *Continuity of Christian Thought,* Pfleiderer, *Development of Christianity,* have been used as textbooks.

Open to students who have completed Course 131, and to others who, in the judgment of the instructor, can profitably carry on the work of the class.

136. Ethics. Professor Holmes.

Three hours a week, second semester. Offered annually.

An introduction to the various types of ethical theory, with discussion of some applications of ethical principles. Drake, *Problems of Conduct,* has been used as a textbook.

137. History of Philosophy. Professor Holmes.

Three hours a week throughout the year. Offered annually.

After a brief introductory glance at the early Greek philosophies, especial attention is given to Socrates and to the systems of Plato and Aristotle. Some time is devoted to the development of philosophical systems in the period centering about the beginning of the Christian era; the growth, culmination, and decline of scholasticism, are studied, and the appearance of the modern critical spirit. In the second semester the work is directed to the modern systems beginning with Descartes. Especial attention is given to the philosophy of evolution. Thilly, *History of Philosophy*, is used as a textbook.

Open to Juniors and Seniors.

138. Introduction to Philosophy. Professor Holmes.

One hour a week in second semester. Offered annually.

Lectures and recitations on the theory of knowledge, fundamental ideas, the meaning of natural law, the theory of evolution in the inorganic and in the organic world. Russell, *First Course in Philosophy* has been used as a textbook.

Some of the greatest archæological collections of the world are near enough to be made use of by Swarthmore students, and visits to museums, exhibitions, etc., are frequently possible. Especially to be noted is the Archæological Museum of the University of Pennsylvania, with its remarkable collections illustrating the civilizations of Babylonia, Assyria, and Egypt; its display of amulets, charms, etc., from many parts of the world; its Buddhist Temple, and collections of similar materials from among the American Indians, the Esquimaux, and many other peoples.

A Museum of Religions has been started at Swarthmore, which has already a valuable collection of religious curios from China, Japan, India, and elsewhere. Additions to this collection will be welcomed.

Mention should be also made of the great libraries of Philadelphia, and of the lecture courses, often by the great scholars of the world, at Drexel, Franklin, and Wagner Institutes, and at the University of Pennsylvania, in addition to those offered at Swarthmore. The most famous preachers, statesmen, and orators are frequently to be heard in Philadelphia, and the opportunities thus afforded are brought to the attention of students.

Psychology and Education

The work of this department is temporarily cared for by Professor Jesse H. Holmes, and Charles H. Fisher, Professor of Education, State Normal School, West Chester, Pa.

TEACHERS' APPOINTMENT COMMITTEE

A Teachers' Appointment Committee, of which Dean Alexander is the Chairman, was instituted in 1912. The duty of this committee is to assist the graduates of the College in their effort to secure satisfactory teaching positions. This assistance is to be rendered not only to members of each year's graduating class, but also to earlier graduates who have been teaching meanwhile, and having acquired experience, desire more responsible positions than the ones they now have.

THE STATE COLLEGE CERTIFICATE

Students graduating from College and completing the required number of courses in Psychology and Education, including the required observation and teaching, will be recommended by the department for the State College Certificate, which carries exemption from all examinations for positions in the public schools of Pennsylvania, and becomes permanent after three years of teaching. This certificate is accepted by a number of other states.

COURSE OF STUDY

No course in this department should be taken before the Sophomore year. The courses designed for the Sophomore year are Ethics (136), and General Psychology (139); for the Junior year, Educational Psychology (141), History of Education (144), Educational Administration and Management (147); for the Senior year, Principles of Secondary Education (142), Principles of Teaching (143), Observation of Teaching (145), Supervised Teaching (146).

COURSES OF INSTRUCTION

136. Ethics—Theory, Practice, and Teaching. Professor Holmes.

Two hours a week durng first semester. Offered annually.

This course aims to present the principal theories as to the basis of right and wrong, to discuss practical questions such as comes before men and women in business and social life, and in citizenship. The latter part of the year will be devoted to a consideration of methods of developing morals in schools, uses and abuses of self-government, the work of the church and the Sunday schools, boys' and girls' clubs, and other institutions which affect ideals and conduct. Opportunity will be given for observation of such institutions, and in case of those taking the teachers' course, for practice teaching when possible.

139. General Psychology. Professor Holmes.

Three hours a week during the first semester. Offered annually.

This course aims to introduce the student to the science of psychology through modern experimental methods together with lectures, demonstrations, and clinical observations. It also aims to lay the foundations for more advanced work in psychology and courses in other departments that demand a knowledge of the fundamental principles of mental activity. Texts, Pillsbury, Langfeld.

141. Educational Psychology. Professor Fisher.

Two hours a week during second semester. Offered in 1919-20.

This course emphasizes such topics in psychology as are closely related to the work of teaching. Consideration will be given to psychological experiments bearing upon the topics treated.

The observation of pupils and teaching in the public schools of Swarthmore is a necessary part of the course. Text-book, assigned readings, discussions, and reports.

142. Principles of Secondary Education. Professor Fisher.

Two hours a week during second semester. Offered in 1919-20.

A study of the secondary school in the light of the meaning and the aims of education in a democracy. The purpose and the value of the subjects of the curriculum will be discussed from the standpoint of the main objectives of education. The necessary reorganization of secondary education will be considered. Assigned readings, discussions, and reports.

143. Principles of Teaching. Professor Fisher.

Two hours a week during first semester. Offered in 1919-20.

This course deals with the principles of instruction common to the teaching of all subjects in the secondary schools. Consideration will be given to such topics as types of lessons, the recitation, the assignment, the question, lesson plans, supervised and independent study, the use of educational tests and scales, problems in discipline, economy in classroom management.

The work of this course is closely correlated with the observation of teaching. Assigned readings, discussions, and reports.

144. History of Education. Professor Fisher.

Two hours a week throughout the year. Offered in 1919-20.

This course aims to trace the development of educational institutions, practices and theories of the past as a necessary background to an understanding of the problems of the present day. An effort is made to trace the evolution of democracy in education so that the individual may become a conscious participant in that evolution. Educational progress in the United States is especially noted. The course is both cultural and professional. Text-book, assigned readings, discussions and reports.

145. Observation of Teaching. Professor Fisher.

One hour a week during first semester. Offered in 1919-20.

Only those students may take this course who enroll for Course 143. Students will observe in all grades, elementary and secondary, of the public school system of Swarthmore, in order to get a general survey of the whole. Toward the end of the semester students will concentrate their observation upon the subject or subjects that they expect to teach. The course will be conducted by means of individual and group conferences.

146. Supervised Teaching. Professor Fisher.

One to three hours a week during the first or the second semester. Offered in 1919-20.

The teaching will be done in secondary schools in the vicinity of the College. Substitute teaching when done under favorable conditions and approved by the supervisor of teaching may count as credit toward this course. At least one hour credit should be taken by those who intend to teach. The students whose schedules permit it are urged to take additional credit. The course will be conducted by means of individual conferences.

147. School Administration and Management. Professor Fisher.

Two hours a week during first semester. Offered in 1919-20.

This course deals with the organization, legal status, and administrative control of education in the nation, state, county, and local school districts.

Practical problems of school management will be considered. The chief aim of the course is to acquaint the prospective teacher with the various relations that an individual teacher has to an organized system of education. Text-book, assigned readings, and discussions.

TEACHERS' COURSES GIVEN BY OTHER DEPARTMENTS

78. Teachers' Course in Latin. Assistant Professor Brewster.

Two hours a week throughout the year. Offered annually.

Lectures and reports upon the text of Cæsar, Cicero, Virgil, and other Latin authors commonly read in preparatory schools.

Observation and practice teaching.

Prerequisites, Latin 72a, 72b, 73a, 73b, 75, 76; two courses in Education or Psychology for those who wish credit in Education.

98. Teachers' Course in History. Professor Hull.

One or two hours' credit for each semester. Offered annually.

This course is designed for Senior majors in the Department of History, and is intended to give the theory and practice of aids, methods, and aims in the teaching of history.

Art

The instruction in this subject is under the direction of the Department of Greek and Latin. Courses are given by Professor Meeteer and Assistant Professor Brewster.

The aim of the courses offered is to study the historical development of architecture, sculpture, painting, and the allied arts, as a part of the history of Western civilization, in order to show the share that these arts have had in the creating and fixing of ideals, and in the development of craftsmanship. The principal types and examples of these arts are studied as masterpieces of achievement, especially for their cultural enjoyment.

The work consists of illustrated lectures and indicated reading.

70. The Art of the Greeks. Professor Meeteer.

Two hours a week throughout the year. Offered in 1920-21.

A course of lectures giving an introduction to the various departments of Greek art, especially architecture, sculpture, and painting; the purpose of the course, in part, is to give some preparation for future visits to the great museum collections of Europe and America. A knowledge of Greek is not required. Open to all students except Freshmen. This course is given in alternate years only.

76. Topography and Monuments of Ancient Rome. Assistant Professor Brewster.

Two hours a week throughout the year. Offered in 1919-20.

Lectures illustrated with the stereopticon, and assigned readings. The different departments of Roman art will be treated briefly, both independently and in their relation to Greek and to modern art; in particular the appearance of the ancient city will be discussed and the extant monuments described. No knowledge of Latin is required for this course; it is hoped it will prove of interest to those who expect some time to visit Rome. Open to all students except Freshmen. This course is given in alternate years only.

80. Christian Art and Archæology. Assistant Professor Brewster.

One hour a week throughout the year. Offered in 1920-21.

Lectures illustrated with the stereopticon. The aim of the course is to give an introduction to Christian Archæology, and to study early Christian architecture, sculpture, painting, and mosaic in their relation to Classical art and to the art of the Renaissance.

152. Renaissance Painting in Italy. Professor Meeteer.

One hour a week throughout the year. Offered annually.

Italy's definite contribution to the development of Western Art from 1300 to 1580; painting as an expression of the social forces of the time.

Biology

The instruction in this department is under the direction of Professor Spencer Trotter. Samuel Copeland Palmer is Assistant Professor.

The courses in Biology are designed to give a broad and liberal view of the facts of life as a part of the general system of culture. The successful completion of the several courses as part of the general work for the degree of A.B. is preparatory to the study of Medicine, Forestry, or of Agriculture. Students are thus enabled to enter the technical schools of the leading universities in the above-named branches.

Special work in the dissection of the human body is likewise afforded students who are preparing for the study of Medicine.

Courses in both Physics and Chemistry are required as entrance by the medical schools.

The courses are arranged so as to present a logical sequence

throughout the four years of college work for students making Biology their major subject.

Students making Biology their major will be required to take one year each in Chemistry or Physics, and the equivalent of two college years in a modern language.

The requirement by the foremost medical schools of the country of two years' preparation in Biology is fulfilled by these courses in Swarthmore College.

These courses likewise lead to the post-graduate work of the university.

The Museum of Biology and Geology is an adjunct to the department of Biology. The Academy of Natural Sciences, Logan Square, Philadelphia, affords valuable matter for study and reference both in its collections and library. The museum of the Wagner Free Institute of Science, Seventeenth Street and Montgomery Avenue, Philadelphia, contains valuable aids to study. The library of the University of Pennsylvania, and the Philadelphia Library, corner Locust and Juniper Streets, are available for consultation and research. The Wistar Institute of Anatomy, Thirty-sixth Street and Woodland Avenue, contains valuable material for study in connection with the premedical courses.

155. General Biology. Professor Trotter and Assistant Professor Palmer.

Three hours a week throughout the year. Offered annually. Open to Freshmen only. Class limited.

(*a*) Zoölogy. Professor Trotter.

First Semester.—This is an outline study of the structure, classification, distribution, and general natural history of animals. Two lectures a week. Two hours laboratory.

(*b*) Botany. Assistant Professor Palmer.

Second Semester.—A course in botany designed to give the student a broad view of the whole field of plant growth, structure, development, distribution, and classification. Two lectures a week, two hours' laboratory work, including field work in May and June.

156. Animal Morphology. Professor Trotter and Assistant Professor Palmer.

Three hours a week throughout the year. Offered annually.

A careful and detailed study of the animal types with laboratory study of the more important groups. Two lectures a week, three hours laboratory.

Open to students above Freshman Class. Class limited.

Prerequisite, 155 or its equivalent.

(*a*) Vertebrates. Professor Trotter.

First Semester.

(*b*) Invertebrates. Assistant Professor Palmer.

Second Semester.

157. Mammalian Anatomy and Physiology. Professor Trotter.

Three hours a week during Second Semester. Offered annually.

Two lectures on anatomy and physiology with special reference to the human mechanism. Three hours laboratory.

Open to Students above Freshman Class. Class limited.

Prerequisites, 155 and 156 or their equivalents.

158. Human Anatomy. Professor Trotter.

Three hours a week throughout the year. Offered annually.

Advanced work in osteology, the dissection of the cadaver, and a study and dissection of the human brain. Standard textbooks on anatomy. A laboratory course of six hours a week throughout the year.

Open only to Students preparing for the study of Medicine.

Prerequisites, 155, 156 and 157.

A minimum of six hours a week is required in this course.

159. Advanced Zoölogy. Professor Trotter.

Three hours a week throughout the year. Offered annually.

Systematic work on the collections in the Museum.

160. Anthropology. Professor Trotter.

Three hours a week during Second Semester. Offered annually.

A course of lectures on the zoölogical relations of man, his history as a species, and a review of the natural history of mankind (race, culture, and geographical distribution), professor's "notes," consultation of various authors, written reports on assigned subjects.

Open to Seniors and Juniors.

Prerequisite, 155 or its equivalent.

162. Embryology. Assistant Professor Palmer.

Three hours a week throughout the year. Offered annually.

Study of the development of a vertebrate with special reference to the chick. The growth of the chick is followed closely from the primitive streak stage to four days. Drawings are required showing the various stages of growth in whole mounts and in selected sections along both transverse and sagittal planes. In connection with this course students are instructed in the proper methods of fixation, staining, and sectioning of tissues and in the use of the camera lucida. A minimum of six hours a week laboratory work is required for this course.

Open to Juniors and Seniors.

Prerequisite, 155, 156.

163. Fundamental Problems in Biology. Assistant Professor Palmer.

Two hours a week throughout the year. Offered annually.

(*a*) *First Semester.* Evolution and Related Subjects.

(*b*) *Second Semester.* Genetics and Eugenics.

A lecture course devoted to the discussion of the principles of plant and animal breeding. There will be given also a review of the history of our domesticated animals.

164. Advanced Botany. Assistant Professor Palmer.

Three hours a week throughout the year. Offered annually.

(*a*) *First Semester.* Cryptogamic Botany.

In this course the development of sex in plants is the keynote of study. Carefully selected forms are secured to bring out this feature in the laboratory. Sach's classification of the Thallophytes is used as the basis of this course.

(*b*) *Second Semester.* Systematic Botany.

A course in field work devoted entirely to the classification of the local flora. Trees, shrubs, ferns, and the spring flowers are carefully studied.

166. Biology in Relation to Disease. Assistant Professor Palmer.

Two hours a week throughout First Semester. Offered annually. Open to Students above Freshman Class.

170. Geology. Professor Trotter.

Two hours a week during First Semester. Offered annually.

Lecture course on the fundamental principles of geology and physiography. *Open to Students above Freshman Class.*

Chemistry and Chemical Engineering

The instruction in this department is under the direction of Professor Gellert Alleman. H. Jermain Creighton is Assistant Professor of Chemistry and Allen I. Myers is Instructor in Chemistry.

This department does not aim to develop specialists in any particular branch of chemistry, but presents opportunities for a comprehensive general training in this science.

The successful completion of the courses in Chemistry will enable the student to enter upon graduate work at any leading university, or will be of material assistance to him in various technical pursuits in which he may be engaged. Those intending to prepare for the medical profession will find it advantageous to follow several of the elementary courses here offered.

The new and commodious chemical laboratory, with its splendid equipment, lends every advantage to thorough and modern instruction in this department.

Students who major in Chemistry and Chemical Engineering must have a reading knowledge of German before entering upon the chemical work pursued during the third year. They should also be thoroughly familiar with elementary mathematics.

The course in Chemistry, as Applied Science, is prescribed for the first and second years. The course in Chemical Engineering is prescribed for your years.

Students may major in Chemistry, in a course in Arts, requiring 124 hours for graduation; in Chemistry, as Applied Science, requiring 132 hours for graduation; in Chemical Engineering, requiring 140 hours for graduation.

171. General Inorganic Chemistry. Professor Alleman, Assistant Professor Creighton, and Mr. Myers.

Three hours a week throughout the year. Offered annually.

Lectures, demonstrations, written exercises, individual laboratory practice, and weekly conferences on the general principles involved in elementary chemistry. This course includes work similar to that outlined in Smith, *General Chemistry for Colleges.*

In the laboratory each student performs about two hundred experiments which are selected from Smith and Hale, *Laboratory Outline of General Chemistry.* Credit in this course is not assigned until the completion of the entire course at the end of the year.

172. Qualitative Analysis. Assistant Professor Creighton.

Three hours a week throughout the year. Offered annually.

The theory and practice involved in the detection of the chemical elements. Special attention is paid to the application of the electrolytic dissociation theory to analysis, and the metallic and nonmetallic elements are studied more fully than in Course 171. Demonstrations, conferences, and individual laboratory work. The textbooks used are A. A. Noyes, *Qualitative Analysis,* and Talbot and Blanchard, *Electrolyic Dissociation Theory;* Baskerville and Curtman, *Qualitative Analysis,* is also recommended. During the second semester, students make Quantitative determinations of a number of typical ions and become familiar with the elementary principles of Quantitative Analysis.

The equivalent of nine hours of laboratory work per week through the year, carrying a credit of three hours for each semester. Credit in this course is not assigned until the completion of the entire course at the end of the year. Prerequisite, 171.

173. Elementary Quantitative Analysis. Professor Alleman and Mr. Myers.

Three hours a week during one semester. Offered annually.

Complete analysis of potassium chloride, copper sulphate, calcite, haematite, apatite, sphalerite, clay, Portland cement, and coal.

For students taking Engineering as their major subject. Nine hours of laboratory work per week throughout one semester, carrying a credit of three hours. The time is arranged to suit individual requirements. Prerequisite, 172.

174. Quantitative Analysis. Professor Alleman.

Three hours a week throughout the year. Offered annually.

Demonstrations and laboratory work involving methods in gravimetric and volumetric analysis.

Required of students who select Chemistry as their major subject; open as an elective to all others who have taken Courses 171 and 172 at this institution, or their equivalent elsewhere. The equivalent of nine hours of laboratory work per week throughout the year, carrying a credit of three hours for each semester. The time is arranged to suit individual requirements. Prerequisite, 172.

175. Advanced Quantitative Analysis. Professor Alleman.

Three hours a week during the second semester. Offered annually.

Examination of foods and food products, and their adulterants. Work in toxicology, analysis of sewage, and the sanitary analysis of water.

Required of students who select Chemistry as their major subject; open as an elective to all other students who have had sufficient knowledge of chemistry to follow the course. The work on sewage and water analysis is particularly adapted to students in engineering. The equivalent of nine hours of laboratory work per week during the second semester, carrying a credit of three hours. The time is arranged to suit individual requirements. Prerequisite, 174.

176. Physical Chemistry. Assistant Professor Creighton.

Three hours a week during the second semester. Offered annually.

Lectures and laboratory work. The work covered in the lecture course includes the thermodynamic laws; the gaseous, liquid, and solid states of matter; physical mixtures; the theory of dilute solutions; the kinetic theory of gases; the relation between chemical structure and physical properties; chemical statics and dynamics; and thermochemistry. Stress is laid on the applications of thermodynamics to chemical processes. In the laboratory students make observations on the behavior of solutions, determine molecular weights by physical methods, measure velocities of reactions and familiarize themselves with the use of the refractometer, the spectroscope, and the polariscope. The following books are recommended: Nernst, *Theoretical Chemistry;* Jones, *Elements of Physical Chemistry;* Young, *Stoichiometry;* Washburn, *Principles of Physical Chemistry.*

Two lectures and three hours per week of laboratory work. Required of students who select chemistry as their major study. Prerequisites, 174 and 272.

177. Organic Chemistry. Professor Alleman and Mr. Myers.

Three hours a week throughout the year. Offered annually.

Lectures, demonstrations, written exercises, and laboratory work. This course includes the work as outlined in Remsen, *Organic Chemistry.* In the laboratory, students make and study the various organic preparations as given in Remsen, *Organic Chemistry.*

Required of all students who select Chemistry as their major subject.

178. Organic Chemistry (Advanced Course). Professor Alleman and Mr. Myers.

A continuation of Course 177. Lectures and laboratory work. In the laboratory, students make all the preparations (not previously made in Course 177), as given in Gattermann, *Praxis des Organischen Chemikers.* A knowledge of German is required.

Required of all students who select Chemistry as their major subject.

180. Electro-Chemistry. Assistant Professor Creighton.

Three hours a week during the first semester. Offered annually.

Lectures and laboratory work. The laboratory work in this course is arranged so that the student may obtain exact practical information regarding the application of electricity to chemical manufacture, and become proficient in the measurement of electrical conductivities and electromotive forces, and in making electro-chemical analyses. The laboratory course also includes the testing of Faraday's laws and the measurement of transport numbers, the absolute migration velocity of ions, decomposition voltage and heat of neutralization. The following textbooks are recommended: Abegg, *Electrolytic Dissociation;* Le Blanc, *Textbook of Electro-Chemistry;* Oettel, *Electro-Chemical Experiments and Exercises in Electro-Chemistry;* Fisher, *Praktikum der Elektrochemie,* and Smith, *Electro-Chemical Analysis.*

Required of all students who select Chemistry as their major subject; open as an elective to all other students who have a sufficient knowledge of chemistry and of physics to follow the course. Prerequisite, 174 and 176.

The number of students in this course is limited to six.

181. Assaying. Professor Alleman.

One hour a week during the first semester. Offered annually.

Fire assays of ores of gold, silver, lead, zinc, copper, and of numerous metallurgical products. The textbook used is Furnam, *Practical Assaying.*

Three hours of laboratory work per week during the first semester, carrying a credit of one hour.

182. Mineralogy. Professor Alleman.

Two hours a week during the second semester. Offered annually.

This course consists of lectures on crystallography and descriptive mineralogy; and the determination of minerals by the blow-pipe. Moses and Parsons, *Mineralogy. Crystallography and Blow-pipe Analysis,* is used as a guide. Prerequisite, 170.

183. Physical Chemistry (Advanced Course). Assistant Professor Creighton.

One hour a week during the first semester. Offered annually.

A continuation of Course 176.

Chemical Engineering

The extensive demand made on the part of various industries for men trained both in Engineering and Chemistry has influenced the establishment of a course which will afford preparation along these special lines. The course, as arranged, includes all the prescribed work required for the degree of A.B. Ample opportunity is also afforded the student in the choice of elective studies. The course, faithfully followed, will give the student a liberal education, and, in addition, special training in Chemical Engineering. The course as outlined follows:

UNIFORM CURRICULUM FOR THE FRESHMAN AND SOPHOMORE YEARS IN APPLIED SCIENCE

The curriculum for the first and second years of the four-years' courses leading to degrees in the Departments of Mechanical, Civil, Electrical, and Chemical Engineering is the same in every respect. For the first and second year students in Chemistry as applied science and in Chemical Engineering follow the same courses as given below except that women students are required to take certain electives instead of the prescribed courses, where specified.

FRESHMAN YEAR

See Page	*First Semester*		Hours per Week: Class	Lab'y	Credits
69	Shop **203***.....	Pattern-making.....	—	6	2
75	Mathematics **251**.....	Solid Geometry.....	3	—	3
75	Mathematics **252**.....	Algebra.....	3	—	3
20	English **1**.....	Composition.....	2	—	2
21	English **4**.....	General Introduction.....	3	—	3
51	Chemistry **171**.....	General Inorganic.....	2	3	3
67	Drawing **191**.....	Engineering.....	—	6	2
80	Physical Education.....	.....	2	—	—
		Totals.....	15	15	18

Second Semester

69	Shop **203** and **204***.....	Pattern-making and Foundry	—	6	2
76	Mathematics **253**.....	Trigonometry.....	3	—	3
75	Mathematics **252**.....	Algebra.....	2	—	2
20	English **1**.....	Composition.....	2	—	2
21	English **4**.....	General Introduction.....	3	—	3
51	Chemistry **171**.....	General Inorganic.....	2	3	3
67	Drawing **192**.....	Engineering.....	—	6	2
80	Physical Education.....	.....	2	—	—
		Totals.....	14	15	17

* Women majoring in Chemistry may substitute an elective for Shop Work and Drawing.

SOPHOMORE YEAR

See Page	*First Semester*		Hours per Week: Class	Lab'y	Credit
67	Drawing **193***.....	Descriptive Geometry.....	—	6	2
69	Shop **205** and **206***.....	Forge work and Machine work	—	6	2
76	Mathematics **254**.....	Analytical Geometry.....	3	—	3
51	Chemistry **172**.....	Qualitative Analysis.....	1	6	3
	Group 2†.....	.....	3	—	3
79	Physics **271**.....	General Physics.....	2	2	3
69	Mechanical Engineering **213**	Materials of Construction...	2	—	2
80	Physical Education.....	.....	2	—	—
		Totals.....	13	20	18

Second Semester

68	Drawing **194***.....	Empirical Design.....	—	6	2
69	Shop **206***.....	Machine work	—	6	2
76	Mathematics **255**	Differential Calculus.....	3	—	3
51	Chemistry **172**.....	Qualitative Analysis.....	1	6	3
	Group 2†.....	.....	3	—	3
79	Physics **271**.....	General Physics.....	2	2	3
70	Civil Engineering **223** or Elective*.....	Surveying.....	—	4	2
71	Annual Survey **230***.....	Long Survey.....	—	—	1
80	Physical Education.....	.....	2	—	—
		Totals.....	11	24	19

* Women majoring in Chemistry may substitute electives for Drawing, Shop, and Surveying.
† The courses to be followed in Group 2 are determined by the student's previous training in these languages.

JUNIOR YEAR

See Page	*First Semester*		Hours per Week Class	Lab'y	Credits
79	Physics **272**	Advanced Physics	2	3	3
28	German		3	—	3
	or				
24	French		—	—	—
51	Chemistry **174**	Quantitative Analysis	—	9	3
52	Chemistry **177**	Organic Chemistry	2	3	3
35	History		—	—	—
	or				
39	Economics **111**	Elementary Economics and Railroad Transportation	3	—	3
72	Electrical Engineering **237**	Direct Current Theory	2	—	2
72	Electrical Engineering **238**	D. C. Lab	—	3	1
		Totals	12	18	18
	Second Semester				
72	Electrical Engineering **238**	Direct Current Laboratory	—	3	1
72	Electrical Engineering **237**	Direct Current Theory	2	—	2
28	German		3	—	—
	or				
24	French		—	—	3
51	Chemistry **174**	Quantitative Analysis	—	9	3
52	Chemistry **177**	Organic Chemistry	2	3	3
35	History		—	—	—
	or				
39	Economics **111**		—	—	3
	Elective		—	—	2
		Totals	7	15	17

SENIOR YEAR

See Page	*First Semester*		Hours per Week Class	Lab'y	Credits
52	Chemistry **180**	Electro Chemistry	2	3	1
53	Chemistry **181**	Assaying	—	3	3
39	Economics **111** or **112** or **113**		3	—	3
	or				
35	History		—	—	—
52	Chemistry **178**	Adv. Organic Chemistry	2	3	3
29	German **49** or Elective	Scientific German	2	—	2
	Elective		1	—	1
	Elective		3	—	3
42	Religion and Philosophy **131**	Bible Study	2	—	2
		Totals	15	9	18
	Second Semester				
71	Engineering **232**	Experimental Laboratory	—	4	2
39	Economics **111** or **112** or **113**		3	—	3
	or				
35	History		—	—	—
52	Chemistry **178**	Adv. Organic Chemistry	2	3	3
42	Religion and Philosophy **131**	Bible Study	1	—	1
	Thesis (Chemical)	Laboratory Research	—	12	4
	Elective		2	—	2
		Totals	8	19	15

Engineering

CIVIL, MECHANICAL, AND ELECTRICAL

The instruction in this department is under the direction of Professor George F. Blessing. Lewis Fussell is Assistant Professor of Electrical Engineering, Charles G. Thatcher is Assistant Professor of Mechanical Engineering, Ernest C. White is Assistant Professor of Civil Engineering and John J. Matthews is Instructor in charge of Shop Work.

The courses in Engineering are designed to train men in the fundamental principles that underlie the branch in which they are majoring, and to give such engineering and practical work as time and equipment will permit.

The location of the College near Philadelphia and the important manufacturing centers in its vicinity enables students to visit a great variety of industrial and engineering works.

A man must supplement a technical course by experience in practice and contact with real engineering work before he can attain his power as an engineer, and it is hoped that these visits will prove of value to the student when he begins practical engineering work.

The success of an engineer has come more and more to depend upon his ability to meet men of education and culture on equal terms; hence, courses in liberal arts are carried throughout the four years in the belief that they will ultimately benefit the students. The technical courses of study are arranged and conducted with the purpose of imparting a liberal preparation for immediate usefulness in the office, drafting room, or field. When circumstances permit, undergraduates are encouraged to engage in engineering work during the summer vacation. The experience and maturity so gained are of great value in subsequent collegiate and professional work.

The instruction in this department is given both by lectures and recitations; in the drafting room, the field work, the laboratory, and shop the aim is to adapt the instruction to the individual needs of the student.

THE EQUIPMENT

The Field Equipment for practice in surveying includes transits, levels, plane tables, compasses and other auxiliary apparatus of the best makes and latest designs.

Engineering Library and Club Room. This is a large, beautifully furnished room on the second floor of Beardsley Hall. It is equipped with electrical connections for stereopticon lantern or motion picture machine. The book shelves in this room contain about one thousand volumes of technical works in which is included transactions of engineering societies and bound volumes of the most important technical papers and journals. Current issues of all the leading engineering magazines are also to be found on the reading tables.

Drafting Rooms. The drafting rooms are equipped with drawing tables, stools and cabinets. In addition to the above equipment this department has a ten-inch Sibley wood turning lathe, with many extra parts, and a duplex power driven pump for the use of Freshmen in sketching. The Junior and Senior drawing rooms are also equipped with filing cabinets containing blue prints and other data to aid the student in the design courses.

The Engineering Laboratories. The Materials Laboratory contains a 15,000-pound Olsen testing machine, and a larger one having a capacity of 100,000 pounds. Both machines are fitted for tests in tension, compression and deflection. In addition, there is a 50,000-pound Olsen torsional testing machine, and micrometers for measuring elongation, compression and deflection; a Fairbank's cement testing machine with a complete equipment for making tests on cement; a White-Souther endurance testing machine, a Shore scleroscope, an Upton-Lewis endurance testing machine and a complete equipment for the heat treatment of metals.

For tests in mechanical engineering the equipment consists of steam and gas engine indicators, planimeters, tachometers, steam and coal calorimeters, pyrometers, gauge and indicator testing apparatus. This laboratory also contains oil and grease testing apparatus, a Junker calorimeter for gas and liquid fuel tests and gas analysis apparatus.

In the Gas Engine Laboratory the apparatus consists of a five-horse-power Otto gas engine, a ten-horse-power Quincy gasoline

and kerosene engine, a four-cylinder twenty-horse-power Rutenber automobile engine direct connected to a Tracy fan dynamometer, a ten-horse-power Mietz and Weiss fuel oil engine and a vertical fifty-horse-power two-cylinder Bruce-Macbeth gas engine. The above engines are fitted for testing with Prony brakes indicating apparatus, etc. This laboratory also contains a "Recco" Rider Ericsson hot-air engine.

The Steam Engine Laboratory contains a fifty-horse-power 8 in. x 13 in. x 10 in. Ideal tandem-compound high-speed engine, a 10 in. x 24 in. Wetherell-Corliss engine, a seven-kilowatt horizontal Curtis turbine direct connected to a direct-current dynamo installed with a separate switchboard. This laboratory also contains a 5 in. x 8 in. vertical slide-valve engine. The above engines can be run condensing or non-condensing. The condensing apparatus consists of a Wheeler surface condenser. The steam engine equipment in the College power plant consists of two one-hundred-horse-power and one sixty-five-horse-power Harrisburg high-speed engines.

The boiler room contains four one-hundred-and-twenty-five-horse-power horizontal return tubular boilers fitted with turbo blowers and automatic damper regulator. For testing the boilers the plant is equipped with a Wilcox automatic feed water weigher, coal weighing apparatus, flue gas analysis apparatus, etc.

The equipment of the Hydraulic Laboratory consists of a D'Olier centrifugal pump direct connected with a ten-horse-power direct current motor and fitted with necessary apparatus for conducting a complete test such as weirs, nozzles, gauges, etc. A fifteen-horse-power Christiana turbine water wheel fitted with Prony brake, hook gauges, weirs, etc. A small impulse water wheel of the Pelton type.

The Direct Current Laboratory contains a plug type switchboard supplied with direct current power and connected with the alternating switchboard so that the equipment in both laboratories may be used in either. It makes possible the rapid connection in parallel or series of all the apparatus. The mechanical power for this room is derived from a twenty-five-horse-power variable speed induction motor, and the direct current power from the substation located in the adjoining room. This

is equipped with two twenty-five-kilowatt one-hundred-and-ten-volt direct current generators of Westinghouse make driven by two thirty-five-horse-power three-phase General Electric induction motors; and one fifty-kilowatt General Electric induction motor-generator set. In addition to the usual control apparatus there is installed a Tirrill automatic voltage regulator, giving very steady voltage. The apparatus includes shunt, series and compound wound motors and generators, motor-generators and variable speed motors of various types, together with the necessary starting, field, and load rheostats. The meters are of the most accurate type, the range being from .001 to 500 amperes and from .001 to 750 volts.

The Alternating Current Laboratory has a switchboard similar to but larger than the one in the direct-current laboratory. It is supplied with direct current and with twelve different alternating voltages, the latter being obtained from a bank of three twenty-KV-A step-down transformers. In addition to this single- and three-phase supply a pair of Scott transformers of four-KV-A rating deliver two-phase power, and a 7.5-KV-A synchronous generator in the laboratory supplies one, two, three, six or twelve phases. The main power supply comes from the power plant, where two seventy-five KV-A and one fifty KV-A revolving field alternator develop three-phase power at twenty-three hundred volts. A good modern switchboard is rendered doubly useful for teaching purposes, since there are more than the usual number of switchboard meters which make checking and comparison more effective. Here also there is a Tirrill voltage regulator. In the laboratory in addition to the resistances, inductances, and condensers (one hundred and forty microfarads) there are transformers, single- and three-phase induction motors of several types, a repulsion motor, an inductor generator, two synchronous converters, a synchronous motor, synchronous generator and a variable frequency motor generator set giving from twenty to seventy cycles per second.

Single-phase and three-phase induction potential regulators give close voltage control. There are a number of high-grade ammeters, voltmeters, and wattmeters which make it possible to read closely any current from .1 to 400 amperes and any pressure from 10 to 3,000 volts. A vibrating reed frequency

meter, a synchroscope, a contact device for wave form, a power factor meter, recording and integrating meters are available. A fully equipped General Electric oscillograph is freely used to show wave shape and phase relations.

For the work in illumination there are a Bunsen photometer of semi-portable type, a three-meter Queen photometer with Lummer-Brodhun screen, revolving head, etc.; a portable Sharp-Millar illuminometer. Many types of lamps and types of glassware are at hand and a study is made of the various types of lighting around the college to determine where each would be best applied for interior or outdoor work.

SHOP WORK

This work extends through two years for all engineering students, and may be continued if desired.

The Machine Shop occupies a large portion of the second floor of Beardsley Hall and it has a floor area of 3,300 square feet. It is well lighted and is arranged so that the machine and bench work are entirely separated. A large tool room is centrally located and is in charge of an assistant, who supplies individual tools on a check system, as is done in commercial shops.

The machine shop contains an excellent assortment of tools, including screw-cutting engine lathes; speed lathes, simple and back-geared; a planer; a complete universal milling machine with milling cutters; a shaper; a twist-drill grinder, and two vertical drill presses; a lathe-center grinder; plain and swivel vises; lathe chucks, universal and independent, also drill chucks; chucks for milling machine and vises for planing; surface plates; standard gauges and a complete equipment of small tools.

The equipment of the machine shop includes two Hamilton engine lathes, 16 in. x 6 ft.; a Lodge and Shipley lathe of similar size, a Whitney wet tool grinder, and a 16 in. x 8 ft. Champion engine lathe of rugged design for the demonstration of high speed cutting tools. This lathe is double back geared, has taper turning attachment, compound rest and quick change gear device giving forty changes of threads without removing a gear. The gearing on all lathes is covered by guards or casings to prevent accidents.

The Woodworking Shop extends through the entire length of

the third floor of Beardsley Hall, and has a floor area of more than 3,300 square feet. The work benches are fitted with quick-acting vises and other accessories and are provided with drawers and tool cabinets in sufficient number to assign each student a container for his tools and exercises. The plan of individual assignment of tools and supplies is followed here, and each student is provided with a complete set of tools.

All of the woodworking machinery is of the latest design and each unit has a direct motor drive, and is equipped with approved safety devices. The equipment includes the following machines·

24-inch Oliver Hand Planer and Jointer.
36-inch Oliver Single Surfacer.
38-inch Oliver Band Saw.
Oliver Universal Wood Trimmer.
Colburn Universal Circular Saw.
Mummert, Wolf, and Dixon Oil Tool Grinder.
6-inch Bench type Oliver Hand Jointer.
Post Drill Press and Boring Machine.
24-inch Oliver Wood Turning Lathe.
8 12-inch Oliver Motor Head Wood Turning Lathes.

The tool room is equipped with all small tools and necessary stock for a complete course in elementary pattern making and wood working.

The Forge Shop. This equipment consists of ten fires, and one additional master fire. These forges are operated on the down-draft principle, and were designed and constructed for this shop by the Buffalo Forge Company. The forge shop is situated on the ground floor of the building and covers an area of more than 1,000 square feet.

The Foundry is also located on the first floor, and has a floor space of more than 1,500 square feet. A gas heated cupola or furnace is in use for melting metals in crucibles. The additional equipment consists of moulding benches, flasks and other accessory apparatus.

Fees. A fee of five dollars for each semester will be charged for each course in woodworking, forging and machine practice. A fee of two dollars for each semester will be charged for each course in field practice and surveying. An additional fee of two dollars will be charged for the annual survey.

A *Deposit* of five dollars will be required of each student enrolling for a course in shop work or founding. This deposit will be retained to cover breakage and loss of tools or supplies, and, after deducting for such items, the balance will be refunded upon the completion of the course.

BEARDSLEY HALL

This building is of concrete block construction with reinforced concrete floors, columns, and stairs. It is three stories high. In architectural design it is simple and effective, representing the latest and best type of factory building construction.

The ground floor contains the forge shop, the foundry, a tool room, a room used for experimental and research work on the heat treatment of metals, a store room for stock, a vault for records, a lavatory, and a locker room equipped with steel lockers.

On the second floor is located the main machine shop, equipped with high grade metal working machines, tool room and departmental offices. This floor also contains a class room and an engineering library, where the student will find a large collection of technical books and periodicals.

The third floor, which is similar in plan and dimensions to the second floor, contains the woodworking department. It also contains a tool room, a stock room, offices and a safety museum.

THE MAJOR IN ENGINEERING

The engineering courses extend through four years; and, in this respect, differ from the other major courses offered in the College, which are elected at the beginning of the second year and extend through the three subsequent years. The students in Engineering have thus their entire course arranged with the advice and consent of their course adviser in Engineering.

The major in Engineering may be taken in one of three courses: Mechanical, Electrical, or Civil Engineering. The courses of study constituting the major in Engineering are given in detail below.

The work for the first two years is common to all students in Mechanical, Electrical, and Civil Engineering and includes work

in English, Pure Mathematics, Physics, Chemistry, Drawing and Shop Work.

The work offered in the shops throughout the several courses is intended to teach the principles of manufacturing and to familiarize the student with methods and processes of the mechanic arts. The student works in the various shops of the department, and completes in each a series of practical exercises. He thus obtains some knowledge of the nature and properties of the various materials he employs, and becomes familiar with the use and care of the more important hand and machine tools.

A complete checking, cost, and time-keeping system is in operation throughout the shops. The system is in charge of a shop clerk, and each student is required to spend a part of his time in the office to familiarize himself with the system. The object is to make the shop courses not only a means of developing the powers of observation and judgment, together with the acquisition of mechanical skill, but to familiarize the student with business methods and make the shops serve as a laboratory for work in Industrial Organization.

During the third year the Mechanical Engineering students take up work in Kinematics of Machinery and Drawing, while those in Civil Engineering are assigned Field Practice, and Elementary Structural Design. During the fourth year, opportunity is offered for more definite specialization in the branches of Mechanical, Electrical, and Civil Engineering as indicated in the courses outlined.

ADVANCED DEGREES IN CIVIL, MECHANICAL, AND ELECTRICAL ENGINEERING

The advanced degrees of Mechanical Engineer (M.E.), Electrical Engineer (E.E.), and Civil Engineer (C.E.), may be obtained by graduates who have received their Batchelor's degree in engineering upon the fulfilling of the requirements given below:

1. The candidate must have been connected with practical engineering work for three years since receiving his first degree.

2. He must have had charge of engineering work and must be in a position of responsibility and trust at the time of application.

3. He must make application and submit an outline of the thesis he expects to present, one full year before the advanced degree is to be conferred. After this application is made he will receive an outlined course of study to pursue during the year.

4. The thesis must be submitted for approval, and satisfactory evidence given that the reading requirement has been met one calendar month before the time of granting the degree.

5. Every candidate shall pay a registration fee of $5 and an additional fee of $20 when the degree is conferred.

Courses of Study

I. *Civil Engineering.*

Freshman year. See pages 53 and 54.

Sophomore year. See pages 53 and 54.

JUNIOR YEAR

	First Semester		Hours per Week		
See Page			Class	Lab'y	Credits
69	Mechanical Engineering **215**	Mechanics of Materials	3	—	3
76	Mathematics **256**	Integral Calculus	3	—	3
	Group **2**		3	—	3
79	Physics **272**	Advanced Physics	2	3	3
72	Electrical Engineering **237**	Direct Current Theory	2	—	2
70	Surveying **224**	Field Practice	—	6	2
72	Electrical Engineering **238**	Direct Current Laboratory	—	3	1
		Totals	13	12	17

Second Semester

See Page					
69	Engineering **215**	Mechanics of Materials	3	—	3
76	Mathematics **257**	Analytic Mechanics	3	—	3
	Group **2**		3	—	3
72	Electrical Engineering **237**	Direct Current Theory	2	—	2
72	Electrical Engineering **238**	Direct Current Laboratory	—	3	1
68	Civil Engineering **196**	Structural Design	—	6	2
71	Mechanical Engineering **232**	Experimental Laboratory	—	4	2
79	Physics **272** or Elective	Advanced Physics	2	3	3
		Totals	13	16	19

SENIOR YEAR

	First Semester		Hours per Week		
See Page			Class	Lab'y	Credits
71	Civil Engineering **226**	Railroads	2	6	4
68	Civil Engineering **198**	Structural Design	2	3	3
	Group **3**		3	—	3
71	Engineering **225**	Hydraulics	3	—	3
70	M. E. **216** or Elective	Steam Machinery	3	—	3
42	Religion and Philosophy **131**	Bible Study	2	—	2
		Totals	15	9	18

Second Semester

71	Civil Engineering **226**	Railroads	3	—	3
	Group **3**		3	—	3
	Elective		3	—	3
71	Civil Engineering **228**	Concrete Construction	3	—	3
68	Civil Engineering **198**	Structural Design	—	9	3
	Thesis or Elective	Laboratory Research	—	6	2
42	Religion and Philosophy **131**	Bible Study	1	—	
		Totals	13	15	18

II. *Mechanical Engineering.*

Freshman year. See pages 53 and 54.

Sophomore year. See pages 53 and 54.

JUNIOR YEAR

	First Semester		Hours per Week		
See Page			Class	Lab'y	Credits
69	Engineering **215**	Mechanics of Materials	3	—	3
76	Mathematics **256**	Integral Calculus	3	—	3
	Group **2**		3	—	3
79	Physics **272**	Advanced Physics	2	2	3
72	Electrical Engineering **237**	Direct Current Theory	2	—	2
68	Mechanical Engineering **195**	Kinematic Drawing	—	6	2
69	Mechanical Engineering **214**	Kinematics	2	—	2
72	Electrical Engineering **238**	Direct Current Laboratory	—	3	1
		Totals	15	11	19

Second Semester

See Page					
69	Engineering **215**	Mechanics of Materials	3	—	3
76	Mathematics **257**	Analytic Mechanics	3	—	3
	Group **2**		3	—	3
72	Electrical Engineering **237**	Direct Current Theory	2	—	2
72	Electrical Engineering **238**	Direct Current Laboratory	—	3	1
71	Mechanical Engineering **232**	Experimental Laboratory	—	4	2
68	Mechanical Engineering **195**	Kinematic Drawing	—	3	1
79	Physics **272** or Elective	Advanced Physics	2	3	3
		Totals	13	13	18

SENIOR YEAR

First Semester

See Page			Hours per Week		
			Class	Lab'y	Credits
70	Mechanical Engineering **217**	Machine Design	3	—	3
68	Mechanical Engineering **197**	Machine Design Drawing	—	6	2
	Group **3**		3	—	3
71	Engineering **225**	Hydraulics	3	—	3
72	Mechanical Engineering **233**	Experimental Laboratory	—	4	2
70	Mechanical Engineering **216**	Steam Machinery	3	—	3
42	Religion and Philosophy **131**	Bible Study	2	—	2
		Totals	14	10	18

Second Semester

70	Mechanical Engineering **217**	Machine Design	2	—	2
68	Mechanical Engineering **197**	Machine Design Drawing	—	6	2
	Group **3**		3	—	3
	Elective		2	—	2
72	Mechanical Engineering **233**	Experimental Laboratory	—	4	2
70	Mechanical Engineering **219**	Power Plants	3	—	3
74	Mechanical Engineering **249**	Principles of Manufacturing	1	—	1
	Thesis or Elective	Laboratory Research	—	6	2
42	Religion and Philosophy **131**	Bible Study	1	—	1
		Totals	12	16	18

III. *Electrical Engineering.*

Freshman year. See pages 53 and 54.

Sophomore year. See pages 53 and 54.

JUNIOR YEAR

First Semester

See Page			Hours per Week		
			Class	Lab'y	Credits
73	Mathematics **256**	Integral Calculus	3	—	3
	Group **2**		3	—	3
79	Physics **272**	Advanced Physics	2	3	3
69	Engineering **215**	Mechanics of Materials	3	—	3
72	Electrical Engineering **237**	Direct Current Theory	2	—	2
	Elective		—	—	2
72	Electrical Engineering **239**	Illumination	1	2	2
72	Electrical Engineering **238**	Direct Current Laboratory	—	3	1
		Totals	14	8	19

Second Semester

See Page					
76	Mathematics 257	Analytical Mechanics	3	—	3
	Group 2		3	—	3
72	Electrical Engineering 237	Direct Current Theory	2	—	2
72	Electrical Engineering 238	Direct Current Laboratory	—	3	1
69	Engineering 215	Mechanics of Materials	3	—	3
71	Mechanical Engineering 232	Experimental Laboratory	—	6	2
	Elective		—	—	2
79	Physics 272 or Elective	Advanced Physics	2	3	3
		Totals	13	12	19

SENIOR YEAR

First Semester

See Page			Hours per Week		
			Class	Lab'y	Credits
73	Electrical Engineering 240	Alternating Current Theory	3	—	3
73	Electrical Engineering 241	Alternating Current Laboratory	—	3	1
	Elective		—	—	2
	Group 3		3	—	3
71	Civil Engineering 225	Hydraulics	3	—	3
73	Electrical Engineering 242	Central Stations and Power Transmission	3	—	3
73	Electrical Engineering 246	Conferences	1	—	1
70	Mechanical Engineering 216	Steam Machinery	3	—	3
		Totals	16	3	19

Second Semester

73	Electrical Engineering 243	Polyphase Currents	3	—	3
73	Electrical Engineering 244	Polyphase Laboratory	—	3	1
73	Electrical Engineering 245	Electric Railways	3	—	3
	Group 3		3	—	3
	Elective		—	—	3
70	Mechanical Engineering 219	Power Plants	3	—	3
73	Electrical Engineering 246	Conferences	1	—	1
	Thesis or Elective		—	—	2
		Totals	13	3	19

191. Engineering Drawing.

Six hours a week during the first semester. Two hours' credit.

Linear drawing, lettering, model and object sketching of machine parts.

Open to Freshmen.

192. Engineering Drawing.

Six hours a week during the second semester. Two hours' credit.

This work is intended to instruct the student in the making and reading of commercial working drawings. The character of the work is such as is followed in the best modern drafting rooms, and attention is given to standard conventions, tabulations, titling, etc.

Open to Freshmen.

193. Descriptive Geometry.

Six hours a week during the first semester. Two hours' credit.

This work consists of lectures, recitations, and drawing-board work upon the presentation of lines, planes, and solids; tangencies, intersections, sections, develop-

ments and isometric projection. It is intended to give the student an understanding of the theory of projection and the principles necessary to the proper delineation and interpretation of constructive drawings. Work is done in all quadrants, but the practical problems, introduced to illustrate the application of the subject to subsequent work in design, are shown in the third quadrant.

Open to Sophomores: prerequisites, Courses 192 and 251.

194. Empirical Design and Machine Drawing.

Six hours a week during the second semester. Two hours' credit.

Machine drawing and empirical designing, an extension of the work in 192. Proportioning of machine details as fixed by practice and empirical methods. Making and using standard data sheets. Making of assembly drawings. The general aim of the course is to give the beginner a drill in the proportioning of such parts as are fixed by common practice, empirical formulae, rather than by mathematical theory and to apply the work of 192.

Open to Sophomores; prerequisites, Courses 192 and 193.

195. Kinematic Drawing.

Six hours a week during the first semester and three during the second. Three hours' credit.

Drawing-board application of Course 214. Solution of mechanism by means of instant centers, designing of cams, gears, linkages, etc. Drawing of velocity and acceleration diagrams.

Open to Juniors in M. E.; prerequisite, Course 194, and must be taken with Course 215.

196. Elements of Structural Design.

Six hours a week during the second semester. Two hours' credit.

Computation of stresses in trusses, mainly by graphic methods. The forms and strength of joints and fastenings used in heavy framing. Besides the graphic analysis of simple beams and roof trusses, complete detail designs and working drawings of joints to resist large tensile stresses, and of a wooden roof truss for given specifications. Elements of designing in structural steels.

Required of Civil Engineering Students only. Open to Juniors; prerequisites, Courses 193 and 194, and must be taken with Course 215.

197. Drawing and Design.

Six hours a week during each semester. Two hours' credit for each semester.

Drawing-room problems in elementary machine design illustrating the work as given in 195. In this course the student for the first time undertakes the design of a complete machine, laying out the general outlines, proportioning the details theoretically, and modifying his results by practical considerations. All computations necessary for the complete design must be carefully and systematically made and kept. Working drawings of the most important details and a finished assembly drawing of the machine are completed.

Open to Seniors in M. E.; prerequisites, Courses 193 and 194, and must be taken with 217.

198. Structural Design.

Six hours during first semester. Three hours' credit. Six hours during second semester. Three hours' credit.

Computation of stresses; types and details of bridge and roof trusses; reports, drawings; complete design of a plate girder and a through Pratt railway bridge.

Open to Seniors in C. E.; prerequisite, Course 196.

199. Topographical Drawing.

Three hours a week during first semester. One hour's credit.

A topographic map will be drawn from the field notes of the annual survey.

Open to Seniors in C. E.; prerequisite, the annual survey.

203. Pattern Making.

Six hours a week during first semester and alternates with 204 during second semester. Two hours' credit for first semester and one hour's credit for second semester.

A preliminary course of instruction in the use of hand and machine tools for wood-working, followed by graded instruction in pattern-making, construction of core boxes, etc.

Open to Freshmen.

204. Foundry Work.

Three hours a week during the second semester. One hour's credit.

Moulding, mixing, and casting of metals and core-making, etc. The student is required to produce castings from the complete set of patterns made in Course 203.

Open to Freshmen.

205. Forge Work.

Three hours a week during the first semester. One hour's credit.

Forging, welding, tool-dressing, tempering, etc., and a study of press and die work and "drop forgings."

Open to Sophomores.

206. Machine Work.

Three hours a week during the first semester and six during the second. One hour's credit for first semester and two for the second.

Use of measuring tools, hand and machine tools, fitting and assembling. Operation and use of jigs and other manufacturing fixtures.

Open to Sophomores.

207. Machine Work.

One week preceding the opening of college.

Open to Juniors and Seniors. A continuation of 206.

213. Materials of Construction.

Two hours a week during the first semester.

This course consists of a study of the physical properties and methods of manufacture of the various materials used in engineering construction. It does not treat of the strength of materials as given in the course on Mechanics of Materials. [215.]

Open to Sophomores; prerequisite, Course 171.

214. Kinematics.

Two recitations a week during the first semester. Two hours' credit.

Theory of mechanism, instant centers, cams, gears, linkages, etc. Velocity and acceleration diagrams.

Open to Juniors; prerequisite, Course 194.

215. Mechanics of Materials.

Three recitations a week during first semester. Three hours' credit. Two recitations and one lecture a week during second semester. Three hours' credit.

This course continues throughout the year and credit will not be given for a single semester.

This course treats of the resistance of materials, center of gravity, moment of inertia, riveted joints, mechanics of beams, columns, shafts; combined stresses, temperature stresses, impact and resilience.

Open to Juniors; prerequisites, Courses 256 and 213.

216. Steam Machinery.

Three hours a week during the first semester. Three hours' credit.

The course covers the elementary consideration of the behavior of gases and vapors; theoretical heat engines; application of theory to steam engines; principles governing the transfer of heat from hot gases to water; principles of combustion; boiler furnaces and grates; types of boilers; feed-water heaters, economizers, super heaters, advantages of condensing; types of condensers, condenser pumps, etc.

Open to Seniors; prerequisites, Courses 171, 256, 272, and 273.

217. Machine Design.

One lecture and two recitations a week during the first semester. Three hours' credit.
One lecture and one recitation during the second semester. Two hours' credit.

Analysis of complete machines. Selection of mechanism for specified work and study of practical considerations involved. Analysis of energy and force problems in machines. Determination of driving devices as based on work to be done. Proportioning of detailed parts as dictated by stress and practical considerations. Application of the laws of Mechanics and Kinematics to the design of machines and a discussion of empirical design and modifications due to practical considerations.

Open to Seniors; prerequisites, Courses 214 and 195, and must be taken with 197.

218. Pumping Machinery.

Two hours a week during second semester. Lectures, recitations and problems. Two hours' credit.

This course consists of the theory of air compressors, design of distributing systems and compressed air plants; study of machines for pumping liquids, with a description of types, together with a description of pumping plants to meet given conditions. Special attention will be given to centrifugal and turbine pumps, and the complete calculations and part design of a high-pressure, multi-stage turbine pump will be included.

Open to Seniors; prerequisites, Courses 216 and 225.

219. Power Plants.

Two hours a week during second semester. Lectures, recitations and problems. Two hours' credit.

This course consists of the description, function and operating combinations of boilers, engines, heaters, condensers, economizers, piping systems, etc.

Open to Seniors.

223. Surveying.

Six hours a week durinv the second semester. Two hours' credit.

Theory and field work; land surveying; leveling; laying out of buildings; study of construction and adjustment of surveying instruments; drawing of a map from the field notes.

Open to Sophomores; prerequisite, Course 253.

224. Surveying.

Six hours a week during the second semester. Two hours' credit.

Theory and field work. Problems involving the accurate use of chain, tape, transit and level; city surveying.

The field work includes the use of the stadia for both traverse and topography.

Open to Juniors; prerequisite, Course 223.

225. Hydraulics.

Three hours a week during the first semester. Three hours' credit.

Fluids at rest. Hydrostatic pressure. Pressure of water against walls and dams. Steady flow of liquids through pipes and orifices and over weirs. Fluid friction. Loss of head. Steady flow of water in open channels. Kutter's formula and diagrams based thereon. Theory of various kinds of hydraulic motors, etc.

Open to Seniors; prerequisites, Courses 256 and 257.

226. Railroads.

Recitations and field work during the first semester. Four hours' credit. Lectures, recitations and problems during the second semester. Three hours' credit.

First Semester.—Circular curves; transition curves; turnouts, cross-sections. Complete surveys will be made for the location of a section of railway; cross-sections will be taken and structure surveys made. Each student will make a map and profile of the entire line with an estimate of the qualities and cost, including grading, track and structures.

Second Semester.—Lectures, recitations, and problems. The construction, maintenance and operation of railroads.

Open to Seniors; prerequisite, Course 223.

227. Municipal Engineering.

Two hours of recitations, lectures and problems per week, during second semester, two hours' credit.

(a) Study of the design, construction, and operation of municipal waterworks and sewerage systems: water and sewage purification; garbage disposal; (b) Roads and pavements.

Open to Seniors; prerequisites, Courses 223 and 225.

228. Concrete Construction.

Three hours' lectures and recitation during the second semester. Three hours' credit.

Study of reinforced construction and design; properties of the material; general theory; tests of beams and columns; working stresses; use of diagrams and tables, in building construction. Complete design of one bay of a reinforced concrete factory building.

229. Engineering Problems.

One hour's credit each semester.

Problems such as occur in ordinary engineering practice, chosen to show the application of the principles of both mechanics and hydraulics to practical design. These problems cover a wide range of subjects and afford opportunity for both analytical and graphical solutions. Computations and reports.

230. The Annual Survey.

One week preceding the opening of college. One hour's credit.

Topographic surveying.

Open to Sophomores and required with Course 223.

231. The Annual Survey.

One week preceding the opening of college.

Topographic surveying; precise measurement; triangulation.

Open to Juniors and required with Course 224.

232. Experimental Laboratory.

Four hours a week during second semester. Two hours' credit.

Use of engineering computing devices. Experiments involving the parallelogram of

forces, center of gravity of plates, systems of levers; the mechanical strength of materials, tension, torsion, transverse and compression tests. The study of the variation of mechanical strength with differences in composition or heat treatment applied to steel and cast irons, demonstration of modern methods of tempering, annealing, heat treating, etc. Reports are required to be written up neatly and fully, and must include all the data and results of tests, together with conclusions. The preparation of the report is considered an important part of the course.

Open to Juniors; prerequisites, Courses 171, 215, 256, 272, 273.

233. Experimental Laboratory.

Four hours each semester. Two hours' credit each semester.

This course covers laboratory work, recitations and written reports. The course covers calibration of indicator springs, steam gauges, thermometers, dynamometers, viscosity and friction tests of lubricants, tests and heating values of coals, tests of various forms of Calorimeters, measurements of water, valve setting, efficiency tests of steam boilers, Corliss simple engine, Ideal compound engine, steam heaters and condensers, pump and water wheels, gas engines, etc.

Open to Seniors; prerequisites, Courses 216 and 232.

234. Gas Machinery Design.

Two lectures a week and one three-hour drawing period. During first and second semester. Three hours' credit.

The course consists of the rational and empirical design of internal combustion engines and gas producers. The drawing period to cover the practical application of principles discussed in the lectures.

Open to Seniors, prerequisites, Courses 214, 215 and 232.

235. Gas Power Machinery.

Two lectures a week, second semester. Two hours' credit.

General theory and important points in the design and operation of internal combustion engines and gas producers. Description of existing commercial types, study of relative advantages and consideration of questions of economy.

Open to Seniors.

236. Steam Turbines.

One lecture a week during second semester. One hour's credit.

Classification of turbines and description of leading features of various types. Calculations involved in turbine design. Adaptability to special conditions of service and discussion of building, erecting and testing.

Open to Seniors; prerequisite, Course 216.

237. Direct Current Theory.

Two hours a week throughout the year.

A detailed study of the theory of direct currents, direct-current generators, motors and their applications.

238. Direct Current Laboratory.

One hour a week throughout the year.

The testing of direct-current generators, motors and apparatus.

To accompany Course 237.

239. Illumination.

Two hours a week for the first semester.

Photometrical measurements of light sources, with the theory of light distribution.

Open to Juniors taking Engineering and Science Courses.

240. Alternating Current Theory.

Three hours a week for the first semester.

The theory of alternating currents with especial reference to single-phase generators, motors, and transformers.

Prerequisites, Courses 237 and 238.

241. Alternating Current Laboratory.

One hour a week for the first semester.

A laboratory course including the testing of single-phase generators, motors, transformers, meters, etc.

To accompany Course 240.

242. Central Stations and Power Transmission.

Three hours a week for the first semester.

A study of the electrical design, installation, equipment and economic operation of central stations with the theory of transmission and of the lines used in the distribution of electric power.

Prerequisites, Courses 237 and 238.

243. Polyphase Currents.

Three hours a week for the second semester.

An elementary course in the theory and application of polyphase machinery and appliances.

Prerequisites, Courses 240 and 241.

244. Polyphase Laboratory.

One hour a week for the second semester.

A laboratory course in the testing of polyphase machinery and appliances.

To accompany Course 243.

245. Electric Railways.

Three hours a week for the second semester.

A study of the equipment and operation of trolley lines and the electrification of steam roads.

Prerequisites, Courses 237 and 240.

246. Conferences.

One hour a week throughout the year.

A seminary course in which papers are presented on definite problems in electrical engineering, with a discussion of methods of solution. This course is supplemented by trips to electric stations in which an opportunity is afforded to observe practical solutions of the problems considered.

247. Social Engineering.

One hour a week throughout the year.

A study of betterment work in the industries. Safety, hygiene, coöperation, profit-sharing, pensions, social insurance, housing, education, recreation and affiliated questions are considered.

248. Efficiency.

Three hours a week during the second semester. One hour's credit.

This work consists of a study of the principles of efficiency. Records, plans,

schedules, dispatching, standardized conditions and operations, etc., are considered and applied both to the individual and the shop organization.

249. Principles of Manufacturing and Factory Management.

One hour during the second semester. One hour's credit.

Theory of measuring tools, shop tools and equipment; shop processes; manufacturing methods; theory of cost and time-keeping systems; factory management.

Open to Seniors in M.E.

Mathematics and Astronomy

The instruction of this department is under the direction of Professor John A. Miller. Ross W. Marriott* and John H. Pitman are Assistant Professors. Earle B. Miller is Acting Assistant Professor. Caroline H. Smedley is Acting Instructor of Mathematics and Research Assistant in the Observatory. Ethelwyn Bower is Acting Instructor. Rev. Walter A. Mátos is Voluntary Observer. Murat Louis Johnson is non-resident lecturer in the Mathematics of Insurance.

The courses in Mathematics are designed to meet the wants of students desiring later to do graduate work in the best universities; to teach mathematics in the preparatory schools; to pursue engineering or other technical courses; to enter professions requiring a knowledge of Mathematics, such as actuarial work, expert accounting, ballistic engineering, etc. The college requirement of six hours of Mathematics for all candidates for graduation may be satisfied by passing three hours of Course 252 and Course 253, or by passing Courses 251 and 252, or by passing six hours of Astronomy. The first of these three alternatives is recommended. Students majoring in Mathematics will take the first year Courses 252 and 253.

A description of the instrumental equipment for astronomy may be found in the Swarthmore College Bulletin for December, 1918, pp. 22-24. The teaching staff is at present devoting as much time as is consistent with their teaching duties to studies in stellar parallax with the twenty-four-inch telescope, and in comet photography with the photographic telescope. Results of these studies are published in the Sproul Observatory publications, and various scientific journals.

Students interested in either of these problems may work with advantage in conjunction with one of the professors.

*Absent on leave for Government work, 1918-1919.

The observatory is open to visitors on the second and fourth Tuesday nights of each month, except those Tuesday nights that fall in a vacation period. This affords an opportunity of seeing in the course of a year, many celestial objects of various types.

The Mathematical and Astronomical Club, an association of students in Mathematics and allied subjects, and instructors in Mathematics, meets on the first and third Tuesday of each month in the lecture room of the Sproul Observatory. At these meetings, reports are given by students on subjects usually not presented in the classroom. Active participation in the club by students majoring in the department is urged.

A departmental library is located on the first floor of the Observatory. It contains about two thousand volumes and is sufficiently complete to make it a good working library. It is reasonably supplied with standard treatises, particularly those published in the last two decades. It contains complete sets of nearly all the American Mathematical and Astronomical periodicals, and sets, some of which are complete, some of which are not, of the leading English, German, and French periodicals. This library receives in exchange for the publications of the observatory, the publications of many of the leading observatories of the world.

The departmental library has been repeatedly enriched through the benefactions of Professor S. J. Cunningham. Upon her retirement in 1906, she donated her private library. In 1908 she gave a fund which is being spent for the library, and in 1910 she gave a fund the income of which will be devoted to the purchase of books and periodicals. A fund given by Senator William C. Sproul has made possible the purchase of complete files of various astronomical periodicals and other astronomical publications.

COURSES IN MATHEMATICS

251. Solid Geometry. Assistant Professor Pitman.

Three hours a week during first semester. Offered annually.

Phillips and Fisher, *Solid Geometry.*

252. Algebra. Assistant Professors Pitman and Miller.

Three hours a week during first semester, and two hours a week during second semester. Offered annually.

The fundamental operations and their laws of combination. A short review of

factoring and simultaneous equations. The transformation theorems; remainder theorem; symmetric functions; differences; permutations and combinations; binominal theorem; series; theory of equations; determinants and elimination. Fine, *College Algebra.*

253. Trigonometry. Assistant Professors Pitman and Miller, Miss Smedley and Miss Bower.

Three hours a week during first semester; repeated in second semester. Offered annually.

The trigonometric ratios; reduction of trigonometric identities; solution of trigonometric equations; inverse functions; solution of triangles and use of tables. Palmer and Ieigh, *Trigonometry.*

254. Analytic Geometry. Professor Miller.

Three hours a week during the first semester. Offered annually.

Theory of Cartesian and Polar coördinates; the straight line; the conic sections; the general equation of the second degree; an introduction to the Analytic Geometry of three dimensions. Wilson and Tracey, *Analytic Geometry.*

Prerequisites, Courses 252 and 253.

255. Differential Calculus. Assistant Professors Pitman and Miller.

Three hours a week during second semester. Offered annually.

A study of text, supplemented by an occasional lecture. Granville, *Differential and Integral Calculus.*

Prerequisite, Course 254.

256. Integral Calculus. Assistant Professor Miller.

Three hours a week during the first semester. Offered annually.

A study of text, supplemented by lectures. Granville, *Differential and Integral Calculus.*

Prerequisite, Course 255.

257. Analytical Mechanics. Professor Miller.

Three hours a week during second semester. Offered annually.

Composition and resolution of forces; center of gravity; moments; velocity; acceleration; collision of bodies; the integration of simple equations of motion. One of the purposes of the course is to develop facility in applying mathematical formulæ and methods to the investigation of physical phenomena. Miller and Lilly, *Analytic Mechanics.*

Open to students who have credit in Course 256.

258. Theory of Equations and Determinants. Assistant Professor Miller.

Two hours a week during first semester. Offered annually.

Cajori, *Theory of Equations.*

Prerequisite, Course 254.

259. Solid Analytic Geometry. Assistant Professor Pitman.

Two hours a week during second semester. Offered annually.

Fine and Thompson, *Coördinate Geometry,* supplemented by lectures.

Prerequisite, Course 255.

260. Advanced Calculus. Professor Miller.

Three hours a week during first semester. Offered annually.

Total and partial derivatives; theory of infinitessimals; development of series;

definite integrals; approximations. The aim of the course is three-fold; to ground the student in the elementary work which has preceded it; to afford the merest introduction to the theory of functions; and to develop skill in the application of the principles of the Calculus to Geometry, and Mechanics. Osgood, *Calculus*.

Open to students having credit in 257, 258, and 259.

261. (*a*) The Mathematics of Investment and Insurance. Professor Miller and Mr. Johnson.

Two hours a week during second semester. Offered annually.

The theory of compound interest; annuities; sinking funds; interest rates; theory of Probability; mortality tables. Completion of this course, Courses 251-256, and an introduction to the theory of Finite Differences should enable the student to proceed with the examinations for admission to the Actuarial Society of America. Skinner, *Mathematical Theory of Investment*.

Prerequisite, Course 252.

261. (*b*) Navigation. Professor Miller.

Three hours a week during first semester. Given in 1917-18.

The determination of latitude and longitude from sextant observations; sailings, mercator charts; compass deviation. This course is given in alternate years, alternating with Course 261 (c).

261. (*c*) The Theory of Ballistics. Professor Miller.

Three hours a week during first semester. Given in 1918-19.

The theory of exterior ballistics. This course is given in alternate years, alternating with 261 (b).

265. Differential Equations. Assistant Professor Miller.

Three hours a week during second semester. Offered annually.

A study of ordinary and partial differential equations, with their applications to geometrical, physical, and mechanical problems. Cohen, *Differential Equations*.

Prerequisite, Course 256.

266. Mathematical Analysis. Assistant Professor Marriott.

Three hours a week during first semester, and two hours a week during second semester. Given in 1916-17.

An introduction to higher mathematical analysis, including the number concept from a standpoint of regular sequences; number fields and domains; properties of functions of real and complex variables, linear transformations and collineations; matrices and invariants. The course is intended as a transition from the elementary to the higher mathematics.

Open to Seniors and Graduates majoring in Mathematics.

COURSES IN ASTRONOMY

262. Descriptive Astronomy. Professor Miller.

Three hours a week throughout the year. Offered annually.

A study of the fundamental facts and laws of Astronomy, and of the methods and instruments of modern astronomical research. The course is designed to give information rather than to train scientists. A study of the textbook will be supplemented by lectures illustrated by lantern slides from photographs made at various observatories. The class will learn the more conspicuous constellations and have an opportunity to see the various types of celestial objects through the telescope. The treatment is non-mathematical. Young, *The Manual of Astronomy*.

Prerequisite, *Solid Geometry*.

263. Practical Astronomy. Assistant Professor Pitman.

Hour to be arranged.

Theory and use of the transit instrument; determination of time; the latitude of Swarthmore; theory of the determination of longitude. Intended for students of Astronomy and Engineering and those desiring to take the civil service examinations for positions in the United States Coast and Geodetic Survey.

Prerequisites, Courses 255 and 262.

264. Orbit Computation. Assistant Professor Pitman.

Three hours a week during second semester. Given in 1918-19.

Central orbits; computation of the orbit of a comet or an asteroid. Leuschner's *Short Method.*

Open to Juniors and Seniors having credit in 267.

267. Method of Least Squares. Assistant Professor Pitman.

Three hours a week during first semester. Given in 1917-18.

The law of errors; the probability curve; adjustment of observations; weights and probable errors. The theory will be applied to practical problems in astronomy. A few supplementary lectures will be given on the methods of interpolation and mechanical quadratures.

Merriman, *Least Squares.*

Open to Juniors and Seniors.

268. Special Courses.

Graduate students may work in conjunction with one of the professors on any problem upon which a professor is working. The student is encouraged to familiarize himself with the literature of the problem in hand and to ground himself in its fundamental principles.

Undergraduate students are directed in the preparation of papers for which it is necessary to make a rather extensive examination of the accessible literature touching a given subject.

269. Celestial Mechanics. Professor Miller.

Three hours a week during the second semester. Given in 1918-19.

Moulton, *Introduction to Celestial Mechanics.*

Physics

The instruction in this department is under the direction of Assistant Professor Winthrop R. Wright.

The department aims to give a thorough and general training in the subject during the first two years that will enable one to pursue intelligently the study of engineering and the more advanced courses in Physics. This training also affords preparation for teaching Physics in high schools and preparatory schools.

Instruction, in most of the courses, is supplemented by rigorous laboratory work. The apparatus used in connection with this is modern and mostly new. The laboratory is well equipped for

advanced work in the study of light, electricity, and magnetism.

Students who major in Physics must be prepared to do faithful and painstaking work. They should, if possible, start the work in the freshman year. They must have a reading knowledge of either French or German before entering the work of the Junior year.

The advanced courses in Physics will afford the student the necessary preparation for post-graduate study in any one of the universities or for research work in the numerous industrial and government laboratories.

No credit will be given for the first semester's work in Courses 271 and 272 unless followed by the work of the second semester.

THE COURSES IN PHYSICS

271. General Physics.

Three hours throughout the year. Offered annually.

Two hours of lecture and three hours of laboratory work each week. The solution of practical problems involving the various laws which are studied forms a regular and important part of the student's work.

Open to Freshmen.

272. Advanced General Physics.

Three hours throughout the year. Offered annually.

Two hours of lecture and three hours of laboratory work each week. Problem work will be assigned throughout the year.

Open to students who have passed Course 271, or who, in the opinion of the instructor, are prepared for this more advanced work.

273. Magnetic and Electrical Measurements.

Three hours for first semester. Offered annually.

One or two hours of lecture at the pleasure of the instructor and from three to five hours of laboratory work each week. The course is designed for familiarizing the student with the construction and use of modern standard electrical and magnetic measuring instruments. The laboratory work consists in measuring with accuracy, resistance, electromotive force, current, capacity, inductance, and magnetic properties. Both practical and theoretical problems dealing with subjects of electricity and magnetism are assigned regularly.

Open to students who have passed Course 272.

274. Theories of Magnetism.

Three hours during second semester. Offered in 1919-20.

Two hours of lecture and three hours of laboratory each week. The laboratory work consists in studying the magnetic properties of iron and other metals and the variation in these properties produced by various heat and mechanical treatments.

Open to students who have passed Course 273.

276. The Conduction of Electricity Through Gases.

One hour a week during first semester. Offered annually.

One hour of lecture each week. The subject is developed historically and deals with the Cathode Ray, the Canal Rays, and the X-rays, and their relation to the α, β, and γ radiations given out by radium and other radio-active substances. The purpose of the course is to familiarize the student with some of the modern views concerning the constitution of matter.

Open to students who have passed Course 272.

277. Light.

Two hours a week during second semester. Offered in 1919-20.

One hour of lecture and three hours of laboratory work each week. The subject is developed, and the various phenomena explained, in accordance with the wave theory. The laboratory work consists in reproducing and obtaining a photographic record of these phenomena.

Open to students who have passed Course 272.

Physical Education

The Physical Education of the college is under the direction of E. LeRoy Mercer, M.D., Assistant Professor of Physical Education. He is assisted in the courses for women by Miss Helen Culin, Miss Elizabeth Lanning, and Dr. Mary R. Hadley Lewis.

The aim of the department of Physical Education is to promote the general physical well being of the students, and to assist them to gain the hygienic, corrective, and educative effect of rightly regulated exercise.

In order that this object may be better attained, and to assist the director in gaining a definite knowledge of the strength and weakness of the individual, a careful physical examination and medical inspection (eye, nose, and throat) is required, which serves as a basis for the work.

All students must take the prescribed work in Physical Education. It is strongly recommended that, before entering College, each student undergo a thorough visual examination and be fitted with glasses, if there is a need for them.

For a general statement in regard to the facilities for physical training at Swarthmore see Swarthmore College Bulletin for December, 1918, pp. 24-25.

REQUIREMENTS FOR MEN

Two hours a week of regular prescribed work are required of all men in the first and second year classes.

Intercollegiate contests in various athletic and aquatic sports

are conducted by the Athletic Association, but under the oversight of the Athletic Committee and the Director of Physical Education, who may at any time forbid any man entering a contest whose physical condition is not satisfactory.

COURSES FOR MEN

1. Physical Education. Dr. Mercer.

Two hours a week throughout the year (two sections).

This course is required of all first-year men, who may elect from the following during the fall months, opening of college to Thanksgiving recess: Football, lacrosse, cross-country, track, and tennis.

Ending of Thanksgiving recess to spring recess: The classes meet in the gymnasium and the work consists of gymnastics and athletics so fitted to the students' life that it will be both beneficial and pleasant.

Ending of spring recess to Commencement, election may be made from the following: Baseball, lacrosse, track, and tennis.

Freshmen will be required to attend one swimming period weekly.

2. Physical Education. Dr. Mercer.

Two hours a week throughout the year (two sections).

This course is required of all second-year men. The plan and nature of the work is similar to Course 1, but more advanced.

3. Physical Education. Dr. Mercer.

Juniors and Seniors, one hour each week (optional).

From Thanksgiving recess to the spring recess, gymnastic exercises and recreative games.

4. Hygiene. Dr. Mercer.

One hour a week from Thanksgiving Recess to Spring Recess.

This course is required of all first-year men. Offered annually.

REQUIREMENTS FOR WOMEN

One hour of exercise each day except Sunday is required of all resident and non-resident women students throughout their college course. Two of these periods of each week must be spent in supervised classwork—field hockey in the fall, classwork and basketball in the gymnasium in the winter, tennis, and track athletics in the spring. On the other four days of the week some form of outdoor exercise must be taken. This may be tennis, riding, cross-country tramps, or swimming. Exceptions to these requirements are made only for physical disability and at the discretion of the physician in charge, in which case suitable work is prescribed. Exercise in the gymnasium, swimming and all athletic sports are under the personal supervision of the instructor.

First-year students are required to attend a course of lectures in Hygiene, given once a week during the first and second semester.

Application for information in regard to the regulation dress for athletics and gymnastics should be made to the Dean.

COURSES FOR WOMEN

1. First Year Gymnastics. Miss Culin.

Two hours a week from Thanksgiving to the Spring Recess. Offered annually.
Required of first-year students.
Elementary educational gymnastic games, and folk-dancing.
In addition, one hour of swimming a week is required of first-year students.

2. Second Year Gymnastics. Miss Culin.

Two hours a week from Thanksgiving to the Spring Recess. Offered annually.
Required of second-year students.
Educational gymnastics (more advanced than Course 1), gymnastic games, and folk-dancing.
One period a week of swimming is required, in addition.

3. Third Year Gymnastics. Miss Culin.

Two hours a week from Thanksgiving to the Spring recess. Offered annually.
Required of third-year resident students.
Educational gymnastics (more advanced than Course 2), gymnastic games, and folk-dancing.
One period a week of swimming is required, in addition.

4. Fourth Year Gymnastics. Miss Culin.

Two hours a week from Thanksgiving to the Spring Recess. Offered annually.
Required of fourth-year resident students.
Educational gymnastics (more advanced than Course 3), gymnastic games, and folk-dancing.

5. Advanced Elective Gymnastics. Miss Culin.

One hour a week from Thanksgiving to the Spring Recess. Offered annually.
Open only to members of the class gymnastic squads in addition to the two required hours a week.
Advanced apparatus work, advanced marching, and gymnastic games.

6. Beginners' Elective Gymnastics. Miss Culin.

One hour a week from Thanksgiving to May.

7. Beginners' Elective Dancing. Miss Lanning.

One hour a week from Thanksgiving to May. Offered annually.
Open to all students as an elective in addition to the two required hours a week.
Æsthetic dancing and advanced folk dancing.

8. Advanced Elective Dancing. Miss Lanning.

One hour a week from Thanksgiving to May.
Open to students who have an elementary knowledge of dancing.
Æsthetic dancing and advanced folk dancing.

9. Special Corrective Gymnastics. Dr. Mercer and Miss Culin.

Advised for students who need special attention because of poor carriage, slight curvatures, or weak arches.

Daily work on the part of the student in addition to a period once a week with the instructor.

10. Swimming.

Ability to swim is a part of the requirement in Physical Education.

11. Varsity Hockey. Miss Culin.

Three hours each week from September to Thanksgiving.

12. Varsity Basketball. Miss Culin.

Three hours a week from Thanksgiving to Spring Vacation.