## DEGREES


The program in Arts and Sciences is under the direction of the Faculty 4 Philosophy which awards the degrees of Bachelor of Arts, Master of its and Doctor of Philosophy. For this purpose the faculty is organized 20 departments and into the following four groups each of which ajervises several departmental programs and interdepartmental or group \#ggrams:

Humanities<br>Social Sciences<br>Biological Sciences<br>Physical Sciences

## BACHELOR OF ARTS

PLAN OF STUDIES
A student selects the subjects he will study in accordance with his nellectual interests in so far as that is made possible by his degree of reparation. This principle is applied to those entering from high school is well as to more advanced students, but the less advanced students we to spend more time on the basic disciplines related to their major treerest. In following his curiosity and completing the training essential n pursuing it, a student discovers the subject or combination of subjects that he desires to investigate further and it becomes his " major." The planning of studies for the A. B. is there divided into two parts:

1) Before the choice of a major
2) After the choice of a major.

The major may be more or less specialized. More specialized interests we met by majoring under a Department or Interdepartmental committee. Les specialized interests are met by majoring in one of the Group Programs.
The number of majors offered is large. The purpose of this multiplicity is to enable students to fit their studies to their individual needs.

## ADVISERS

At all stages of his program, the student is aided by a member of the ficulty who is assigned to advise him. Students transferring from other colleges or universities may select their major at entrance, subject to the approval of the Department or Group concerned, and are then assigned in adviser in the field of their major. Students entering from high school
in another departmen
which relate to the biol. Courses in geography and geo the consent of the adviser At least 3 year courses
and/or social sciences, as term courses) in the humanit guidance of his adviser. as elected by the student with
The Biological Sciences
degree after four years of residence, Major is designed to lead to the A minimum ones. A request for acceptance as a arements listed above a by the student at the end of acceptance as a group major is initiat satisfactory grades being the only requiremuring the second, year, should remain ample time for the student to to broaden himself or to concentrate in to take elective subjects, eith taking additional advanced courses in areas of particular interest The number and type of electives or by doing research under guidanc ion with the student's adviser. Some students may wish to
degree in less than four years of residete their requirements for the $A \cdot B$ requirements listed above, such students must intion to completing the average, pass an oral examination to must have a high academi major field, and complete a research staff member. An application for ora program under the guidance of be filed through the adviser at least awarding of the degree. The attention term prior to the time of in this program is called to the contion of those who may be interestel below, which is in general to be preferred. B.-M. A. Program, describe The program as
requirements of medical or dental oes not necessarily meet the entrance enter these professions should therefools. The student who plans to particular requirements of the varionore familiarize himself with the is prepared to assist the student in professional schools. The adviser
In arranging a schedule of courses selection of suitable courses. study, General Program I or II as listed on p. 47 would second years factory introduction for Biological Scien on p. 47 would serve as a satis and Introductory Psychology may be taken in year, while Physics $1-2$ would normally be a second the first or second The particular arrangement of courses a second or third year course student in consultation with his adviser.

## COMBINED A. B. - M. A. PROGRAM

This program is designed for qualified students who course of concentrated study in a particu students who want to pursue a do so in the normal time of four resident area of interest, and who can the M. A. degree, in addition to those already years. The requirements for include 1) a thesis based upon original research, and the A. B. degree,

## Arts and Sciences

bency in the area of special interest to be tested by an oral examination. ther details of the program will be worked out with the student's adviser d with the approval of the Biological Sciences Group and of the departant in which the thesis work is to be done.

## INTER-DEPARTMENTAL OR INTER-GROUP PROGRAM

An occasional student, interested in the Biological Sciences, may find that the above programs do not meet his particular interests. For example, de student may wish to combine his interest in the Biological Sciences vih programs available in the Departments of Chemistry, Geography, Geology, or if his leanings are toward the humanities or social sciences, ith programs available in the Department of Philosophy or History. en such overlapping interests are deemed reasonable, it is possible 0 provide the student with a committee to supervise and direct his argram of study so that it will be meaningful and integrated.

## PHYSICAL SCIENCES GROUP

## SCOPE OF THE GROUP

The Group is composed mainly of members of the departments of Chemistry, Geology, Mathematics, and Physics. Members of the Isaiah Bowman Department of Geography, the Chesapeake Bay Institute, and he Department of Biophysics are affiliated with the Physical Sciences Group as well as with other groups. Some members of the faculty of the School of Engineering also belong to this Group. The purpose of his diversity of membership is to provide maximum flexibility in setting ${ }_{20} 0$ courses of study and research programs for the students.

## DEPARTMENTAL MAJORS

Students who have selected the department in which they wish to major will find the requirements and suggested programs of study listed under the appropriate departments in this catalogue. The following two ear program* is suggested for entering students who plan to major in one of the physical sciences, but who have not yet decided upon a pecial field. (Note: Students who think that they might wish to major in geology should take Geology 1-2 in either the first or second year; students who might wish to major in chemistry should take Chemistry 7-8 or $23-24$ and $25-26$ as the second year elective.)
First year:
Mathematics 1-5 or 5-6
Chemistry 1-2
French or German

- Other programs of study are discussed on pp. 46-48.

One year course in social science or the humanities
Elective (optional; for most first year students four courses wil constitute a full schedule)
Second year:
Physics 1-2
Mathematics 6-7 or 7-8 (Mathematics 7-8 required for Geologt majors)
English writing 1-2 (if absolved by previous study or examinatist an elective may be substituted; see Note above)
Elective (see Note above)
After the student has decided upon the course of study that he wito to follow, he should make application through his adviser for acceptame as either a departmental or interdepartmental major. This should be dote not later than the middle of the second year.

## INTERDEPARTMENTAL MAJORS

Athough most candidates for the A.B. degree will wish to be mija in specific departments, there may be some who prefer to acquite s broad training in the physical sciences, thus avoiding specialization; othe students may want to delay specialization or to specialize in a borderis field, and for these students appropriate interdepartmental major prograza can be arranged.

## DEGREE IN LESS THAN FOUR YEARS

A student with an exceptional academic record may, on the rewo mendation of his department or committee, be considered for the awnt of the A. B. degree in less than four years. He will need to demonnaz marked ability for independent work as shown by a paper baxd 0 laboratory or library research or by passing an examination in soe
specialized subject in specialized subject in which he has not had a formal course of instruaios

## 

## GENERAL PROGRAMS FOR THE FIRST TWO YEARS

In order for a student's selection of Major to be approved by 40 Group or Department concerned, he must meet the requiremens in specify. Requirements of the Departments are stated in the Deparmeat announcements. Those of the Groups are best stated in terms of progna for the first two years. The following general programs show hav student may use his first two years to prepare for any one of suad Departmental and Group Majors. Somewhat more specific and spealiet programs are indicated in the Group announcements (pp. 37-40)

## Arts and Sciences

## PROGRAM I

Yath. 1,5 or 5
Cemistry 1-2
iorcign Language
Eoglish Literature, Introductory
course, or History 1-2
course, or History 1-2
Optional elective
students completing satisfactorily the above program are eligible for Cocprance as a major in the Biological Sciences Group Program, Biology, Lognomy or Reology, German, History, Philosophy, Psychology, Political ad to include at least Languages, provided electives and alternatives are Ithe itudent chooses electives so that he the prospective major subject. vain the Humanities and Social Sciences, he will be tolal of five courses tre as a major in Art, English, and Political Scill be eligible for acceptWhat in Social Sciences, and for the Liboratical Science, for the General Group.

## PROGRAM II

## First Year

Wahematics 1,5 or $5,6 *$ © mistry 1-2
Fintuch or German
2Fitical Economy 1 and 5 or Politia) Science 1 and 2 or Political Lonomy 1 and Political Science 1 Thtional Elective

Second Year
Biology 1-2
Forèign Language
Writing (if not absolved)
Two or three electives *

## Physics 1-2

Political Economy 1, 2 or 5 or Political Science 1 or 2
History 1-2
Elective
Writing (unless absolved)

Trose completing satisfactorily
7the Biological Scien actorily Program II are eligible for acceptance hences or as a major in Chemistry (except Proup the General Major in Social Ongaphy, Geology, German, History, Mathematics, Chemistry), English,

Economy, Political Science, Psycholematics, Philosophy, Physics, worided electives and alternatives are used so as to Romance Languages, 2.4 year of the prospective major subject.

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# J. Hopkiws 1955 1955-56 <br> 86 <br> Undergraduate Programs 

## MATHEMATICS

Professor Wintner
Professor Lewis (On leave of absence.)
Professor Chow
Professor Hartman
Associate Professor Morrill
Associate Professor Haviland
Associate Professor Mostow

Associate Professor Mautner (On leave of absence.)
Assistant Professor Ehrenpreis (On leave of absence.)
Assistant Professor Dyer
Dr. Washnitzer, Lecturer
Dr. Schwartzman

All members of the Department of Mathematics belong to the Physical Sciences Group. Students who major in mathematics are presented to this group for degrees (see p. 45).

## REQUIREMENTS FOR THE BACHELOR OF ARTS DEGREE

The formal requirements for acceptance by the Department of Mathematics as a major are a knowledge of the following:

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English Writing
French or German (reading knowledge)
Analytic Geometry and Differential Calculus
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Evidence for the fulfillment of any of these requirements is either the satisfactory completion of appropriate courses or certification by the department involved.
After a student is accepted as a major in the department, his program of study is prepared in consultation with an adviser in the department. In order to obtain an A. B. degree, a major in the Department of Mathematics must satisfy the following minimal requirements:

Mathematics. The candidate should have a knowledge of algebra and of the theory of functions of real and of complex variables, equivalent to that provided by Mathematics 303-304, 310, 325-326, and of one further topic of at least the same level of advancement.

- Sem coun

Physics. The candidate should have a knowledge of at least one topic, beyond General Physics, such as Atomic Physics or Thermodynamics and Kinetic Theory.

General. The candidate should have a knowledge in at least three of the following fields: English literature, philosophy, language (classical or modern in addition to that mentioned above), science (biological or physical, other than physics), social science, history.


## J. Hopkins $1955-56$ u. 87 <br> Mathematics

$[730$

## NATICS (11)

Associate Professor Mautner ( $\mathrm{O}_{\mathrm{n}}$ leave of absence.)
Assistant Professor Ehrenprets (On leave of absence.)
Assistant Professor DyEr
Dr. Washnitzer, Lecturer
Dr. Schwartzman
t of Mathematics belong to the Physical ajor in mathematics are presented to this

## I BACHELOR OF ARTS DEGREE

cceptance by the Department of Nathee of the following:

## lg knowledge)

## ferential Calculus

any of these requirements is either the orate courses or certification by the de
major in the department, his program of with an adviser in the department. In a major in the Department of Mathminimal requirements:
should have a knowledge of algebra and of real and of complex variables, equivas Mathematics 303-304, 310, 325-326, and east the same level of advancement.
1 have a knowledge of at least one topic ch as Atomic Physics or Thermodynamics
uld have a knowledge in at least three English literature, philosophy, language dition to that mentioned above), science her than physics), social science, history.
lents who expect to study mathematics beyond the A.B. degree are dried to obtain a reading knowledge of both French and German. Information about advanced degrees, Master of Arts and Doctor of philosophy, will be found in the circular on Graduate Programs, a copy d which will be mailed upon request.

## COURSES

Honor sections, as well as regular sections, will be offered in Matematch 6,7 and 8 for the benefit of qualified students desiring a deeper discussion of the topics involved.
Algebra and Trigonometry 1. Four hours weekly, first term. Review of high school algebra; trigonometry.
Intermediate Mathematics 3-4. Four hours weekly through the year.
This course is for students in Business and Industrial Management. It includes algebra, rigsomemery, analytic geometry and calculus.
Analytic Geometry 5.* Four hours weekly, one term.
Anlytic geometry of two and three dimensions, with the aid of vectors and vector notation.
Prerequisite: Trigonometry.
Calculus 6.* Four hours weekly, one term.
Differential calculus of the functions of one real variable.
Prerequisite: Analytic Geometry.
Calculus 7.* Four hours weekly, one term.
Integral calculus of the functions of one real variable.
Prerequisite: Calculus 6 or its equivalent.
Calculus 8.* Four hours weekly, one term.
Functions of two or more real variables, partial derivatives and multiple integrals.
Prerequisite: Calculus 7 or its equivalent.
Elementary Differential Equations and Infinite Series 9.* Three hours weekly, one term.
Prerequisite: Calculus 8 or its equivalent.
Introduction to Advanced Algebra 303-304. Three hours weekly through the year.
This course is designed to introduce the student to the abstract notions of modern algebra. The principal topics are: Groups, rings, fields, vector spaces, polynomials, elements of the theory of algebraic number fields, linear equations, determinants, characteristic roots and rector of a matrix, reduction of quadratic forms, normal forms of matrices.
Prerequisite: Consent of the instructor.
Vector Analysis and Related Topics 308.* Three hours weekly, one term. Prerequisite: Elementary differential equations.

## J. Hop $_{\text {op }}$ kive $1955-56$ <br> Undergraduate Programs

Functions of a Complex Variable 310. Three hours weekly, second term
Cauchy-Riemann differential equations, Cauchy's integral theorem and integral formite power series, analytic continuation, poles, essential singularities, residues and contour tir grals, entire functions.
Prerequisite: Infinite series.
Projective Geometry 319. Professor Chow. Three hours weekly, first tem Principle of duality, theorems of Desargue and Pappus, collineations and correlations, conion and systems of conics, introduction of coordinates.

Introduction to Basic Analysis 325-326. Three hours weekly through the year.
The real number system, limits and continuity, derivatives, Riemann integrals, implicit func tions, infinite series and products, uniform convergence, multiple limits, the elementary fun tions, definite integrals containing a parameter.

Fourier Analysis for Physicists 327. Professor Wintner. Three hours weekly, first term.

Statistics for Physicists 328. Professor Wintner. Three hours weekly, second term.

Courses numbered 601-699 will be found in the circular on Graduate Programs.

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## OCEANOGRAPHY (24)

Chesapeake Bay Institute

Associate Professor Pritchard, Director<br>Associate Professor Montgomery<br>Associate Professor Carritt

The academic program of the Department of Oceanography is at the graduate level. Work in the Department is planned to prepare students for the M. A. and Ph. D. degrees. The program of the Department and requirements for degrees are given in detail in The Johns Hopkins University Circular-Graduate Programs in Arts and Sciences, Business and Industrial Management and Engineering.

The science of oceanography is a complex one. The oceans cover over seventy per cent of the earth's surface to an average depth of over two miles. Within the oceans processes are operating and events taking place that by themselves can be thought of as belonging within one of the basic science fields. The water is in continual motion, being acted upon by gravitational and wind forces. These aspects of the science are studied by workers whose training, both undergraduate and graduate, is in the physical sciences. Life processes, reproduction, growth and death go on in
parts of the $c$ ded to study 1 $s$ in which $t$ derstanding of aphy as many nsfer of energ anographer fri gand describin In order to be pance fields to mapher is a sc fensive trainin defields but C pecialty fits intı Undergraduat odiscuss their uphy as well a:

Professor A
Members of and the stude (see page 37 )

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Each year work of the courses in $\mathbf{r t}$ demand for Baltimore The univers Albright's le

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