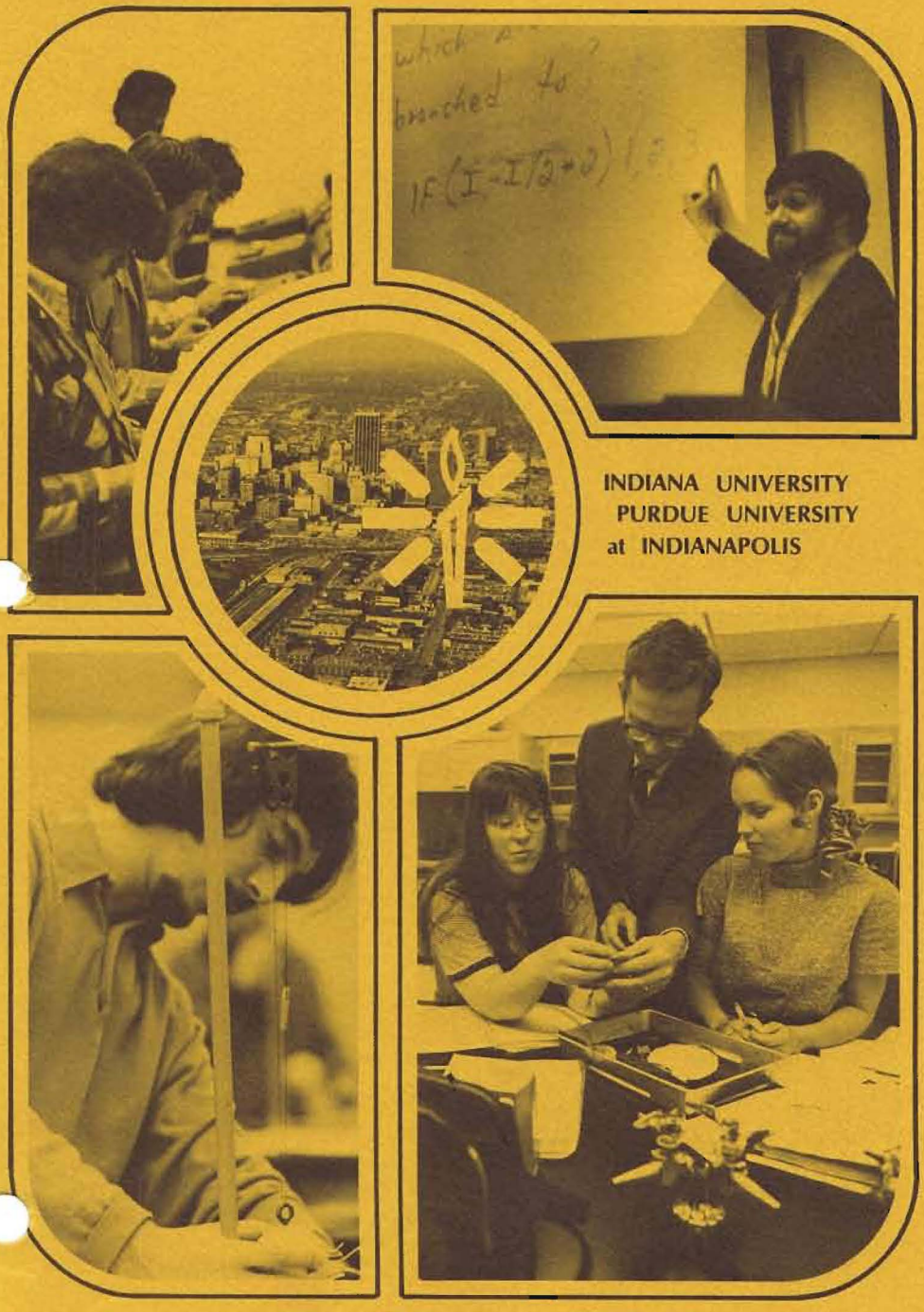
School of Science Bulletin 1974-75



INDIANA UNIVERSITY
PURDUE UNIVERSITY
at INDIANAPOLIS

DEGREE PROGRAMS

BIOLOGY

Bachelor of Arts—Biology	(I.U.)

CHEMISTRY

Bachelor of Arts—25 Sem. Hr. Major	(I.U.)
Bachelor of Arts—Regular Major	(I.U.)
Bachelor of Science—Chemistry	(I.U.)
Bachelor of Science—Chemistry Major	(P.U.)
Bachelor of Science in Chemistry	(P.U.)
Bachelor of Science—Chemistry Teaching	(P.U.)
Master of Science—Chemistry	(P.U.)

GEOLOGY

Bachelor of Arts—Geology	(I.U.)
Bachelor of Arts—Earth Science Teaching	(I.U.)

MATHEMATICAL SCIENCE

Bachelor of Science—Computer Science	(P.U.)
Bachelor of Science—Mathematics	(P.U.)
Bachelor of Science—Mathematics Teaching	(P.U.)
Master of Science—Applied Computer Science	(P.U.)
Master of Science—Mathematics (Option for Teachers)	(P.U.)
Masters of Arts in Teaching—Mathematics	(P.U.)

PHYSICS

Bachelor of Science—Physics	(P.U.)
Bachelor of Science—Physics Teaching	(P.U.)

PSYCHOLOGY

Bachelor of Arts—Psychology	(I.U.)
Bachelor of Science—Psychology	(P.U.)
Master of Science—Industrial Psychology	(P.U.)

MASTER OF SCIENCE—Agriculture

(Extension Education)	(P.U.)

UNIVERSITY CALENDAR 1974-75

FALL SEMESTER—1974

Classes begin	W	Aug 21
Labor Day Holiday	M	Sept 2
Last day to withdraw from a class with W	T	Oct 15
Mid-term Reports	F	Oct 11
Last day to withdraw from class with W or WF	T	Nov 12
Thanksgiving recess—1st day	W	Nov 27
Classes resume	M	Dec 2
Classes end—last day	M	Dec 9
Exams begin	T	Dec 10
Exams end—last day	M	Dec 16
Semester ends	W	Dec 18

SPRING SEMESTER—1975

Classes begin	Th	Jan 9
Last day to withdraw from class with W	W	Mar 5
Mid-term reports	F	Feb 28
Last day to withdraw from class with W or WF	W	Apr 9
Spring recess	M	Mar 3
Classes resume	M	Mar 10
Classes end—last day	W	Apr 30
Exams begin	Th	May 1
Exams end—last day	W	May 7
Semester ends	F	May 9
Commencement	Sun	May 18

SUMMER SESSION I—1975

Classes begin	M	May 12
Memorial Day Holiday	M	May 26
Last day to withdraw from class with W	M	June 2
Last day to withdraw from class with W or WF	Th	June 12
Classes end Summer Session I	M	June 23
Session ends	W	June 25

SUMMER SESSION II—1975

Classes begin	F	June 27
Last day to withdraw from class with W	F	July 18
Last day to withdraw from class with W or WF	W	July 30
Classes end Summer Session II	F	Aug 8
Summer Session II ends	M	Aug 11

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Administrative Officers

INDIANA UNIVERSITY

John W. Ryan, Ph.D., President of the University

Herman B Wells, A.M., LL.D., Chancellor of the University

J. Gus Liebenow, Ph.D., Vice President, and Dean for Academic Affairs

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W. George Pinnell, D.B.A., Vice President and Treasurer

Paul E. Klinge, A.B., Assistant to the President

M. D. Scherer, University Registrar

INDIANA UNIVERSITY-PURDUE UNIVERSITY AT INDIANAPOLIS

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Gerald C. Preusz, Ed.D., Acting Dean for Student Services

John C. Krivacs, M.S., Director of Admissions

Neil E. Lantz, M.S., Registrar

Frank E. Nordby, M.S., Assistant to the Vice Chancellor and Dean for Administrative Affairs, Evening Administration

SCHOOL OF SCIENCE

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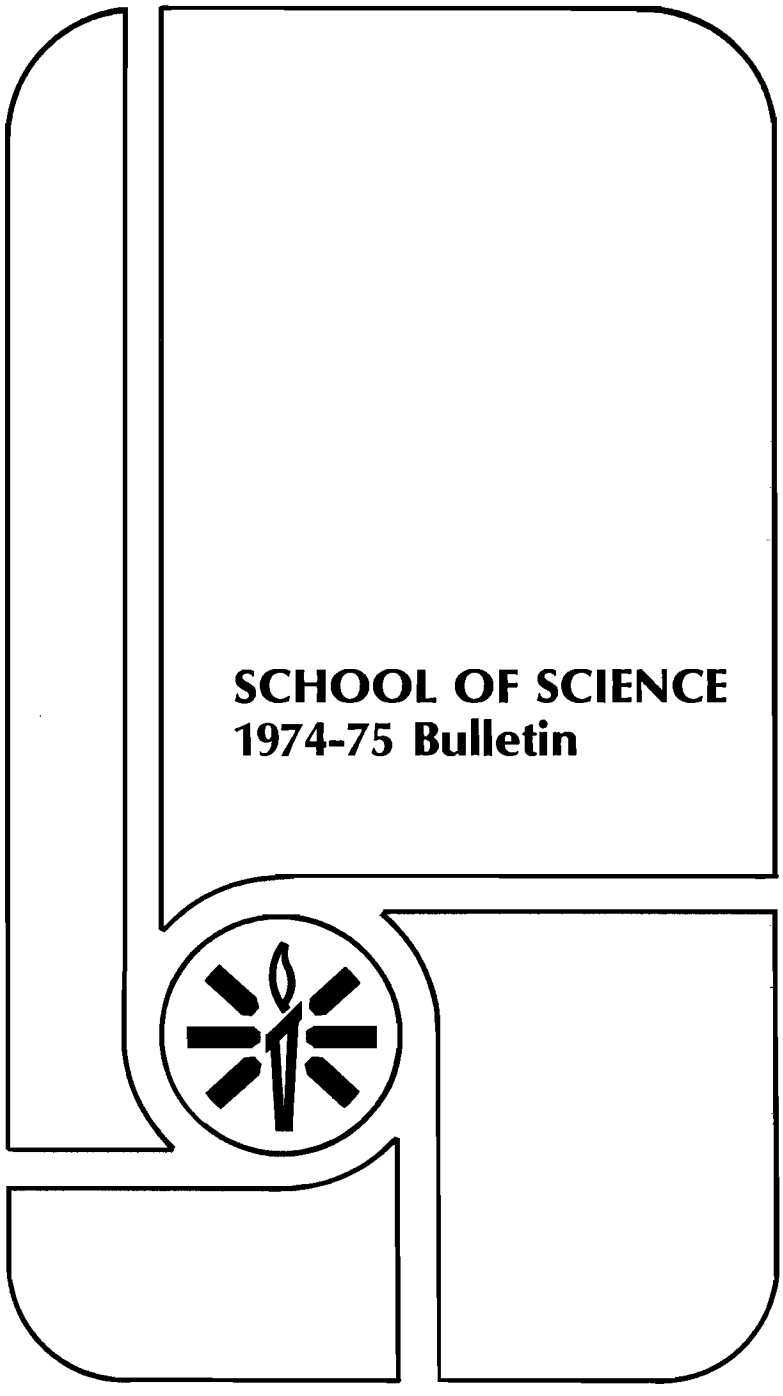
John G. Weihaupt, Ph.D., Assistant Dean for Academic Affairs and Professor of Geology

SCHOOL OF SCIENCE
1974-75 Bulletin



GENERAL INFORMATION ABOUT IUPUI

Indiana University established its first extension center at Indianapolis in 1916. The Purdue University Indianapolis campus grew out of World War II training programs sponsored by Purdue and began its major operations in 1946. Indiana University established an Indianapolis regional campus in the mid-1960's. The Indianapolis unit of the Indiana University regional campus system was separated from the other units in 1968, when Indiana University at Indianapolis was created by the board of trustees. Less than a year later, in 1969, the boards of both Indiana and Purdue Universities merged their Indianapolis operations to form Indiana University-Purdue University at Indianapolis.

A restructuring of undergraduate programs at IUPUI in the fall semester, 1972, created three new schools, the School of Liberal Arts (humanities and the social sciences), the School of Science (physical, behavioral and life sciences), and the School of Engineering and Technology. Work in the School of Liberal Arts is concentrated at the University Quarter Campus on West Michigan Street, work in the School of Engineering and Technology is entirely at the 38th Street Campus while work in the School of Science is at both locations.

Since IUPUI combines the arts and sciences and the professions, including engineering and technology, it is potentially the most comprehensive public insitutition of higher learning in the state. This broad spectrum of educational opportunities enables its students to prepare for a wide range of careers.

IUPUI has an urban orientation. Most of its students commute, and many of its programs are directly related to metropolitan concerns and aspirations.

IUPUI divisions include the country's largest medical school, a dental school with an international reputation for its research in preventive dentistry, and the state's only graduate-degree-granting school of nursing. These, with associated teaching hospitals, clinics, and research facilities, form the state's major concentration of health care resources.

Other IUPUI units include the only graduate school of social service in the state, the country's oldest school of physical education, a law school with an urban emphasis, and a nationally recognized school of art. Purdue brought to the merger a growing complex of degree programs and the parent institution's traditional strengths in the physical sciences, engineering and technology.

Both the graduate and undergraduate divisions of IUPUI are fully and independently accredited by the North Central Association of Colleges and Secondary Schools. This assures the recognition of IUPUI credits, and graduates being able to study in virtually any school in the nation. However, because of the organization of the school, all degrees are awarded by either Indiana University, or Purdue University, depending upon the course of study.

Indiana University has the primary responsibility for the management functions of IUPUI. The chief executive officer of all Indianapolis operations is the Chancellor who reports solely to the President of Indiana University.

ORGANIZATION AND PURPOSE OF THE SCHOOL OF SCIENCE

The efforts of the School of Science are first of all dedicated to the fundamental purpose of every university: to provide an intellectual climate favorable to the development of productive, creative and responsible citizens. A broad program at the undergraduate level is designed to prepare students for graduate work.

In addition, undergraduate training in one or several of the sciences is considered necessary for subsequent professional work in such fields as medicine and dentistry and an excellent background for business administration, law and those areas of the social sciences where quantitative methods are important.

The School of Science is very much interested in helping people whose goals are not careers in science but a general education with emphasis on the scientific aspects of our culture.

Supplementing the full-time instructional staff with rank ranging from instructor through full professor is a contingent of well-qualified experienced lecturers who are recruited from the reserve of talent existing in the Indianapolis area.

The School of Science offers Bachelor of Arts degrees in Biology, Chemistry, Geology, and Psychology. Bachelor of Science degrees are offered in Chemistry, Computer Science, Mathematics, Physics, and Psychology. Master of Science degrees are offered in Applied Computer Science, Chemistry, Industrial Psychology, and Mathematics (Option for Teachers).

Student Welfare and Responsibility

All colleges and universities establish certain academic requirements which must be met before a degree is granted. These regulations concern such things as curriculums and courses, majors and minors, and campus residence. Advisers, directors, and deans will always help a student meet these requirements, but the student himself is responsible for fulfilling them. At the end of his course of study, the faculty and the Board of Trustees vote upon the conferring of the degree. If requirements have not been satisfied, the degree will be withheld pending adequate fulfillment. For this reason, it is important for each student to acquaint himself with all regulations and remain currently informed throughout his university career.

Program-Planning and Counseling Guidelines

The experience of faculty advisers and of successful students suggests the following guidelines for effective planning of undergraduate programs:

1. Every student should be thoroughly familiar with all academic requirements which must be met before a degree is granted.
2. Every student should seek an appointment with a faculty adviser in his major department on or before the dates established by the University calendar for academic counseling. In such conferences, each student should, as a minimum objective, make certain that he understands a program for successful completion of the degree requirements and that he has made an appropriate plan for the next semester.
3. Each student should understand that the responsibility for making an appropriate academic program and for meeting every degree requirement rests with him; faculty members acting in the capacity of advisers are obligated only to assist students in meeting this responsibility. If any student needs clarification of any of the requirements for his baccalaureate degree, he is urged to obtain that clarification from his faculty adviser or from the Office of the Dean of Science.

Student Conduct

Rules for student conduct are in keeping with the diverse nature of the student body and faith of the university in student responsibility.

A code of student conduct, enacted by the governing Indiana University Board of Trustees, is designed to assure due process for all students requiring disciplinary action. Student conduct is the responsibility of the Dean of each School or academic division. Within the School of Science an Academic Appeals Committee assists the Dean in these matters. The Dean for Student Services has the assignment of implementing central administration action if necessary.

Job Placement

The IUPUI Placement Office has the primary responsibility of assisting students and alumni in obtaining employment. The office maintains a library of company information, employment trends, occupational information, and provides career counseling to aid students with career planning and development.

Companies seeking college graduates interview students on campus during two recruitment periods: September through November and January through March. A list of firms and institutions which will visit the campus is published and circulated early in the Fall Semester. Students interested in interviewing with a company should register with the Placement Office. The Placement Office also serves as a referral agent to many companies and organizations. In specific cases the local placement office works in coordination with the placement services located on the Bloomington and Lafayette campuses.

Summer and Part-Time Employment: Another function of the Placement Office is to provide information regarding part-time and summer employment opportunities for students. Part-time employment listings are posted on job bulletin boards located throughout the University. Students interested in summer employment should register early with the Placement Office.

Housing

Residential housing for IUPUI students is located at the University Quarter Campus with approximately 600 accomodations for single students and 160 apartments for married students. Facilities are available to students from all divisions of IUPUI on a first-come basis. Residential housing is managed by the Department of Housing in the University Quarter. In addition, off-campus housing is available to students throughout Indianapolis. Although the University does not control off-campus housing facilities, the Department of Housing maintains a file of rooms and small private home apartments.

Information for Foreign Students

Foreign students attending Indiana University-Purdue University, Indianapolis are required to register with the Division of International Programs as soon as possible after their arrival in Indianapolis. The Division of International Programs is officially appointed to represent the U.S. Immigration and Naturalization Service on the IUPUI campus, and it is therefore available to foreign students at all times to assist them with matters relating to their visas. In addition, the Division of International Programs is prepared to assist foreign students with any type of problem during their stay at IUPUI, or even prior to their arrival.

The address of the Division is:

Division of International Programs
Indiana University-Purdue University Indianapolis
Union Building—Suite 105
Indianapolis, Indiana 46202

EXPENSES AND FINANCIAL AID

Costs and Fees

The cost of attending IUPUI generally is related to the number of credit hours students take. The fee structure for general academic areas of IUPUI is as follows:

	In-State	Out-of-State
Undergraduate	$20/credit hour	$40/credit hour
Graduate	$25/credit hour	$50/credit hour

A possibility of an increase in student fees of approximately 5% for the Fall Semester, 1974, is under consideration by appropriate authorities. Contact school or department offices for latest information.

There may be other fees, such as laboratory, student activities, late registration, parking, and special fees for certain courses and programs.

Full-time, undergraduate students usually enroll for 15 to 17 credit hours per semester, thus an entire year for an in-state resident costs about $800 for fees, books and class supplies. Other expenses, such as transportation, food and entertainment, vary according to individual needs.

Refunds

Course fees will be refunded under any one of the following conditions:

1. Withdrawal during first week of the semester, 100 percent refund.
2. Withdrawal during second week of the semester, 60 percent refund.
3. Withdrawal during third week of the semester, 40 percent refund.
4. Withdrawal during fourth week of the semester, 20 percent refund.
5. Withdrawal after fourth week of semester, no refund.

Special Examination Fees

With departmental approval, an admitted student, temporary student, or current student who has not paid full fees, may receive course credit by special examination. Fee per course is $5.

Insurance

Hospitalization insurance is available to students at a reduced rate. The IUPUI student insurance can only be obtained at the beginning of each semester by making application at the Student Services Office. This insurance program provides hospitalization, surgical, and medical coverage for the student during the calendar year.

Financial Aids

It is the philosophy of IUPUI to encourage students in their educational goals and to reduce financial barriers. The University recognizes that many students and their parents cannot afford to finance a colloege education entirely from their own income and assets. For this reason, a program of financial assistance is available to admitted and enrolled students who have a demonstrated financial need. Aid is available in the form of counseling, scholarships, grants, and loans.

Individuals desiring further information about any of the financial aid programs should write to:

Office of Scholarships & Financial Aids
IUPUI
Room 303, Cavanaugh Hall
925 West Michigan Street
Indianapolis, Indiana 46202

Veterans' Benefits

Students who are eligible for Veterans benefits may enroll under the following scale of benefits:

FALL/SPRING	BENEFITS	SUMMER (6 week session)
12 hours or more	Full benefits	4 hours
9 through 12 hours	¾ benefits	3 hours
6 through 8 hours	½ benefits	2 hours
Fewer than 6 hours	Tuition only	1 hour

For further information, including tutorial assistance availability, consult the Office of Veterans Affairs at 925 West Michigan Street, Indianapolis, 46202.

ADMISSIONS AND TRANSFERS

All students entering the School of Science must have been officially admitted to the university by the Office of Admissions, 1201 E. 38th Street, Indianapolis 46205. Further information and application forms are obtainable at this address. All applications for admission must be accompanied by a $15 non-refundable fee. Checks should be made payable to IUPUI.

IUPUI offers instruction during two semesters and two six-week summer sessions. You may start a program of study with any regularly scheduled session. These begin in August, January, May and July. Admissions are open generally until registration for classes.

BEGINNING STUDENTS

When you are entering directly from high school, your application should be filed at the end of your junior year.

Your acceptance as a new student in the university is influenced by several factors. The Office of Admissions is guided by the following:

1. Graduation from a high school accredited by a State Department of Public Instruction.
2. The extent to which you meet or exceed the minimum subject requirements is indicated below. For admission to the School of Science, your record should include:

Subjects	Semesters
English	6
History or social studies	2
Algebra	3
Geometry	2
Trigonometry	1
Laboratory science	2

You may be admitted with some deficiencies in mathematics or laboratory science. Such deficiencies may be removed by taking courses offered by the School of Science. However, these courses may not be counted as credit toward a School of Science degree.

If your high school offers more than the above mathematics courses, you may benefit from taking analytic geometry (precalculus mathematics). It is advised that one semester of chemistry be included in your laboratory science.

In planning high school electives, the curricula of the various departments of the School of Science contained in this bulletin should be reviewed. Note that some degree programs require German. Thus, some study of German in high school may be valuable (although not required). Departmental counselors at the 38th Street Campus will be glad to help you with your preplanning for admission.

3. Rank in High School class
   a. A resident of Indiana is expected to rank in the upper half of his high school graduating class. Agriculture students must rank in the upper two-thirds of their class. A marginal applicant may be granted admission, admitted on probation, or have admission denied.
   b. An out of state applicant must rank in the top third of his high school graduating class.
4. College Board Scholastic Aptitude Test results
   a. All applicants are required to take the College Board Scholastic Aptitude Test (SAT).
   b. An out of state applicant must rank in the top third of the IUPUI distribution on the SAT.
   c. It is recommended that you take the SAT in the spring of your junior year in high school.
5. Information provided by your high school counselor

If you declare a major at the time of your application for admission, you will be assigned to the appropriate departmental counselor. If you have not selected a major field of study, you will be assigned to the University Division. It is recommended that your preplanning be directed toward a choice of major at the time of admission. Premedical and predental students should declare a chemistry or biology major at the time of admission.

ADVANCED STANDING

The School of Science permits high school students to take university courses following completion of the junior year under specified conditions. To determine whether you qualify for such advanced credit, consult your high school counselor and the Office of Admissions.

On the basis of departmental examinations, advanced credit and/or advanced placement may be awarded. To determine whether you qualify for such consideration, consult the department concerned.

ADULT NON-DEGREE STUDENTS

Adult applicants, especially those with work experience in the field in which they wish to study, receive special consideration. If you are admitted in this category, you may enroll in a maximum of 30 hours, after which you must apply for admission to the university before enrolling in additional classes. All applicable credits earned as an adult non-degree student may be counted toward a School of Science degree.

TRANSIENT STUDENTS

If you are a student enrolled in another university, you may take 12 hours at IUPUI without consent of your own university. It is your responsibility as a transient student to determine whether credit so earned may be applied toward the degree you seek from your own university.

TRANSFERS

FROM OTHER INDIANA UNIVERSITY CAMPUSES

If you are enrolled at another Indiana University campus and wish to enter the School of Science at Indianapolis for the first time, you must indicate this intention by formal notice to the Office of the Dean at the campus at which you are enrolled. This notice must be received no later than June 15, for the fall semester, December 5, for the spring semester or April 15, for the summer sessions. You must have a 2.0 grade point average to transfer.

If you are a student in the School of Science at Indianapolis and wish to attend another Indiana University Campus, you must indicate this intention to the Office of the Recorder, School of Science, AD Building, 1201 E. 38th Street, to secure an inter-campus transfer.

FROM OTHER IUPUI SCHOOLS

If you wish to transfer to the School of Science from another IUPUI school, consult the department in which you wish to major. You are required to have a minimum, cumulative, grade-point average of 2.0 and the signature of the chairman of a School of Science department which approves your request. Obtain a transfer form from your school recorder. Submit the completed form to the Office of the Recorder, School of Science, AD Building, 1201 E. 38th Street. A request for transfer must be completed by June 15, for the fall semester, December 5, for the spring semester, and April 15, for the summer sessions.

FROM OTHER PURDUE UNIVERSITY CAMPUSES

Students in good academic and social standing may transfer from other campuses of Purdue University. Since Indiana University maintains the official records of all students at IUPUI, it is necessary to make an official

application to IUPUI through the Office of Admissions. Students continuing to pursue Purdue degrees at IUPUI will have their records transferred intact and upon receiving a Purdue degree will have a permanent transcript created at Lafayette. Students electing to pursue an Indiana University degree will be processed as regular transfer students from another university.

FROM OTHER COLLEGES AND UNIVERSITIES

If you have earned transfer credit for 12 semester hours and a cumulative grade-point average of 2.0 on a 4.0 scale (3.0 for non-residents of Indiana) in other institutions, you may be admitted to the School of Science as follows. Submit with your application for admission:

1. A copy of your high school record showing satisfactory completion of entrance requirements.
2. An official transcript of work completed in each institution previously attended.
3. Evidence that you are in good academic and social standing at the institution you last attended.

To assure admission for any given semester the application should be received at least 30 days before the beginning of classes.

Credit from other institutions is evaluated by the Office of Admission and its applicability toward degree requirements in the School of Science is determined by the major department.

TRANSFER CREDIT: Acceptability of transfer credits from another college or university is determined by the student's major department. However transfer credit will be allowed for the master's degree only after one semester of satisfactory work in residence at Indiana University or Purdue University.

Foreign Students

Applicants from foreign countries will be considered for admission without taking the American Entrance Examination on the basis of credentials certifying the completion of secondary school. Official translations must accompany transcripts and other credentials not written in English. The applicant must submit evidence of adequate English proficiency by means of the TOEFL Examination. Financial aids for new foreign students are not available.

GRADUATE STUDENTS

To be considered for admission, a candidate must have a baccalaureate degree from an accredited institution, show promise of ability to engage in advanced work, and evidence of adequate preparation to pursue graduate study in his chosen field. Anyone not meeting these requirements should take the Aptitude Test Section of the Graduate Record Examination.

Application should normally be made at least 8 weeks before the beginning of the session in which the student wishes to enroll. The applicant will be advised of action on his application by the Office of the Director of Graduate Studies.

TEMPORARY GRADUATE STUDENT APPLICATION: Application for admission as a temporary graduate student must be made before a student starts graduate work. The temporary graduate student classification is primarily for those casual students who wish to take courses for personal improvement. A student who wishes to become a candidate for an advanced degree should consult with his major department at the time of his application for admission as a temporary graduate student. The major department will advise him of the procedure for obtaining regular graduate student status. Admission as a temporary graduate student is made by the Office of the Director of Graduate Studies in the Union Building. NOT MORE THAN NINE HOURS OF CREDIT EARNED UNDER THIS CLASSIFICATION MAY BE USED IN A PLAN OF STUDY WITHOUT MAJOR DEPARTMENT APPROVAL.

REGULAR GRADUATE STUDENT APPLICATION: Application forms for admission as a regular graduate student may be obtained from the major department. Applicants must submit complete official transcripts of all previous college and university studies and three letters of academic reference for evaluation by the major department.

GRADUATION REQUIREMENTS

Indiana University Baccalaureate Degrees

The faculty of the School of Science is evaluating programs offered by the school, and changes in requirements for the A.B. degree offered by the School of Science may be forthcoming.

Students planning to major in one of the following disciplines should consult with the appropriate department for current information:

Biology
Chemistry
Geology and Earth Science
Psychology

Requirements listed here are strictly for the School of Science at IUPUI.

General Requirements

Listed below are the requirements related to I.U. degrees in the School of Science offered at IUPUI.

1. A minimum of 122 hours (124 for students also satisfying requirements for a teaching certificate). At least 112 hours must be in courses offered by the School of Liberal Arts, the School of Science, or those approved by the department. The remaining 10 hours may be taken in the above areas or in other units of the University, e.g., Business, Education, Herron or Normal College.

2. A minimum cumulative grade-point average of 2.0.
3. A minimum of 30 hours in courses at the 300-400 (junior-senior) level.
4. At least 24 hours must be taken in the major subject area.
5. Not less than 26 credit hours of the work of the senior year must be completed at IUPUI. See departmental advisor for residency requirements in the major field of study.
6. Courses taken on the Pass/Fail option can be applied only as electives in meeting degree requirements.
7. Not more than 60 hours earned in accredited junior colleges may be applied toward a degree.
8. By special permission of the department, credit may be earned through independent study and/or by special credit examination. Ordinarily, students in residence in the university are not permitted to enroll concurrently in courses offered through the Independent Study Division.
9. An application for a degree must be filed in the Office of the Recorder, School of Science.
   a) All credit of candidates for degrees, except that of the current semester, must be on record at least six weeks prior to the conferring of degrees.
   b) The deadlines for filing degree applications for graduation in January, May, or August, is September 1st.
   c) Degrees are conferred in May and September, Commencement is held only in May. Candidates for degrees in August may participate in the May Commencement.
10. A student who fails to complete work for a degree within 6 years from the time of first registration may be required to pass comprehensive examinations on the subjects in his areas of concentration.

Class Standing

Class standing is based on the number of credit hours completed:

Freshman	1 to 25
Sophomore	26 to 55
Junior	56 to 85
Senior	86 or more

Area Requirements

In an age of increasing specialization of functions and divisions of labor, it becomes more necessary than ever before that we maintain a broad base of general knowledge, ideas, skills, etc., that will insure at least a minimum level of general and humane learning. Such a broad base is necessary for an individual to function intelligently within it, to be aware of alternate possibilities open to him, and to learn how to pursue most effectively the goals selected from these possibilities. For this reason, areas I, II, and III (the divisional distribution requirements) are considered essential elements of the B.A. program.

AREA I: ENGLISH COMPOSITION

Every student must demonstrate his ability to use correct, clear, effective English. The student shall satisfy this requirement by completing English W115-116-117 (these are 5-week segments) with a grade of S (satisfactory—no letter grades are given), or by exemption from one or more segments of this course and satisfactory completion of those segments he is required to take. The department of English places entering freshmen in W115, W116 or W117 on the basis of scores on a departmental proficiency examination administered during registration week each semester. Students may apply to take this examination if they have an SAT verbal score of 500 or higher, an ACT composite score of 22, or a record of A and B in high-school English. Students exempted from the entire course will receive 3 hours of S credit in W115-116-117. A $10 fee payment is required and is payable to the bursar's office before the special credit is given. Students exempted from W115-116 will receive credit after satisfactorily completing W117.

AREA II: FOREIGN LANGUAGE

All students seeking the Bachelor of Arts Degree in the School of Science must fulfill the foreign language requirement by either of the following procedures:

1. By successfully completing at IUPUI the first ten (10) hours of work in an approved foreign language, credit for which will apply toward the B.A. degree and for which grades will count in grade point averages, or
2. By demonstrating first-year proficiency in an approved foreign language through examination for which credit may apply toward the B.A. degree (a $10 fee is charged, which is payable at the bursar's office).

    a) **Exempt Without Credit:** The College Entrance Examination Board is used for screening purposes. A $10 fee is charged, payable to the bursar's office. Students with second-year college placement or above will be exempt without credit.

    b) **Exempt With Credit:** Eligible students desiring credit by examination may apply to the respective foreign language department to take the Modern Language Association (MLA) Cooperative Examinations. A $10 fee is charged, payable to the bursar's office. By achieving a score recommended by the appropriate foreign language department, the student will receive ten hours credit toward graduation with a grade of P.

    c) Students placing into the second semester of the first-year college foreign language course will receive ten hours' credit toward graduation upon successful completion of this five-hour course.

    d) A student whose native language is not English may petition the Dean of the School of Science for exemption from the foreign language requirement with or without credit. (see Placement Test).

3. The foreign language requirement taken by examination or course work will apply only to graduation requirements, not requirements for any language major.

4. Departments may require their majors to complete work in foreign languages beyond the first-year level. For such requirements, a student should consult the appropriate departmental listing in this Bulletin.

LANGUAGE EXAMINATIONS: All students who have had a foreign language before entering any campus of I.U. including the IUPUI School of Science may take a language placement test. These are given as Achievement Tests in high school throughout the state on a regular schedule. At IUPUI, these tests are usually given three times a year: before each semester and the beginning of the Summer Session. On the basis of a student's performance on the placement test, the language department concerned will recommend the appropriate level of course work for enrollment. Information regarding the times set for tests may be obtained from the School of Liberal Arts.

SPECIAL CREDIT: If a student places at the third year level on the language placement test as a result of high school or previous language study and completes his first course enrollment at IUPUI in any third year course which requires knowledge of the language with a grade of A or B, he will be eligible to apply for six hours of special credit (F298, G298, S298) plus credit for the third year course in which he is enrolled. If a student places in the second semester of a second year foreign language and completes that semester with a grade of A or B, he can receive special credit (3 hours) for the first semester plus credit for the course in which he is enrolled. If the grade earned is A, he will receive the grade of A for the hours of special credit. If the grade earned is B, he will receive the grade of S for the hours of special credit.

It will be the responsibility of the student to request the language department to forward this information to the Office of the Recorder, School of Science.

AREA III: DISTRIBUTION REQUIREMENTS

Area III distribution requirements will have been completed when a student has satisfactorily taken the following:

4 courses in the Arts and Humanities
4 courses in the Social and Behavorial Sciences
2 courses in the Biological Sciences
2 courses in the Mathematics and Physical Sciences

ARTS AND HUMANITIES
(4 courses)

English
Fine Arts
Folklore
French
History
German
Journalism
Music History and Musicology
Philosophy
Religion
Spanish
Speech and Theatre

Performing arts courses are not accepted as fulfilling Arts and Humanities requirements.

SOCIAL AND BEHAVIORAL SCIENCES
(4 courses)

Anthropology
Economics
Geography
Linguistics
Political Science
Psychology
Sociology

BIOLOGICAL SCIENCES
(2 courses)

Anatomy and Physiology
Biology
Botany
Zoology
Cross-listed course: Psychology B105

MATHEMATICS AND PHYSICAL SCIENCES
(2 courses)

Astronomy
Chemistry
Geology
Mathematics and Computer Science
Physics
Cross-listed courses: Geography G107 and G304

Check departmental course descriptions for courses which are considered repeats. Some courses may not be used to fulfill distributional requirements. Students should also check with their advisors.

Cross-listed courses may count only once in fulfilling requirements. Courses which do not carry Science credit (such as Mathematics M015, and M017) may not be used in the distribution.

The three courses used for the foreign culture option may not be used to fulfill the distributional requirement.

1. In the language departments listed above, only advanced courses of a literary character may be used for the divisional distribution. First-and second-year language courses may not be used to complete the distributional requirement.
2. English W115-117 may not be used to complete the distributional requirements.

AREA IV: CONCENTRATION REQUIREMENT

The student should plan a tentative outline of his concentration program with his major department advisor.

Single Major Area of Concentration

The following are minimum requirements for the area of concentration. Additional and/or detailed requirements are to be found in the departmental listings in this bulletin. The specific departmental requirements which must be fulfilled by each student are those which are published in the bulletin current at the time he enters the university or those in the bulletin current at the time of his graduation, whichever he chooses.

1. At least 24 hours must be taken in the major subject area.
2. Any course in which the student receives a grade below C may not be used to fulfill the concentration area requirement. However, courses in which the student receives a D will count toward the 122-hour total.
3. Courses taken to satisfy the English composition requirement (W117) may not be applied toward the concentration area or distributional requirement.
4. The three courses used to fulfill the foreign culture option may not be used in the concentration area.

Purdue University Baccalaureate Degrees

Programs leading to Bachelor of Science degrees have the following requirements:

1. Satisfaction of university requirements.
2. Completion of the general requirements of the School of Science.
3. Completion of the departmental requirements of the student's major.

University Requirements

1. The completion, either by resident course work, by examination, or by credit accepted from another institution, of the plan of study underlying the degree. Deans of schools may refuse to accept as credit toward graduation any course which was completed ten or more years previously.
2. Resident study at IUPUI for at least two semesters and the completion during this period of at least 32 semester hours of work in courses regularly open to third—or fourth-year students. Students are normally expected to complete the senior year in residence; however, with the approval of the dean of the school concerned, students who have had at least four semesters of resident study may complete up to 20 semester hours of the senior year in another approved college or university. For the purpose of this rule, two summer sessions shall be considered as equivalent to one semester.
3. Registration, either in residence or in absentia, as a candidate for the desired degree during the semester (or summer session) immediately preceding its conferment.
4. Each student shall be required to meet the quality standards in academic work as prescribed by the faculty.
5. The payment of the graduation fee to the bursar on such date as may be specified preceding the end of the session.
6. Attendance at the commencement exercises when such exercises are held.
7. The demonstration of a satisfactory working knowledge of the English language with particular reference to composition and spelling.

General Requirements

Listed below are the general requirements of the School of Science.

1. **A total of 124 semester hours:** An average of 15 1/2 hours per semester is sufficient to accumulate 124 hours in eight semesters. Students with a graduation index less than 3.0 are advised not to take more than 16 hours in any one semester.
2. **English composition:** Eng. W-115, W-116, W-117 and one of Eng. W-118, W-119, or W-120.
3. **Modern foreign language:** Pass a fourth-semester college-level course in a modern foreign language or pass an equivalent proficiency examination. The student who successfully completes the professional semester in a high school teaching curriculum need only pass a second-semester college-level course in a modern language or pass a proficiency examination.
4. **Humanities, social studies, and behavioral sciences:** In specifying this requirement, the school identifies the following three areas:
   a. literature, philosophy, creative arts
   b. history, political science
   c. economics, sociology, psychology.

The minimum requirement is 18 hours chosen from the above three areas as follows:

(1) Choose a two course sequence from a, b, or c above

(2) Choose any two courses (not necessarily a sequence) from an area not chosen in (1).

(3) Choose any other two courses from any of the areas a, b, or c.

Performing arts courses are not accepted as fulfilling this requirement.

5. **Mathematics:** At least 11 hours.
6. **Science:** Each student must take at least four courses in laboratory science outside his major area. It is preferable that he take two, two-course sequences in each of two sciences. The courses selected should normally be chosen from the offerings of the departments of Biology, Chemistry, Geology, and Physics. However, students may with the approval of the department of their major, use no more than two computer sciences or engineering courses to partially fulfill the laboratory science requirement.

REQUIREMENTS FOR SECOND BACHELOR'S DEGREE

Normally the holder of a baccalaureate degree who wishes to pursue a further educational goal is encouraged to become qualified for admission to a graduate degree program. In certain cases, however, the Dean of the School of Science may admit a student who has earned a baccalaureate degree to candidacy for a second baccalaureate degree. The student should petition the dean for this privilege before beginning the program. If such admission is granted, the candidate must earn at least 25 additional credit hours in residence and meet the general and departmental requirements of the School of Science degree for which he is a candidate.

Purdue University
Graduate Degrees

Currently, all of the graduate programs offered by the School of Science lead to Master's Degrees awarded by Purdue University.

General Requirements

1. Regular graduate student standing.
2. English requirement satisfied.

   Candidates for advanced degrees whose native language is English satisfy the English requirement (1) if they made no grade below B in undergraduate courses in composition or (2) if they make a scaled score of 600 or higher on the Verbal Aptitude Section of the Graduate Record Examination or 36 or higher on the verbal portion of the Admission Test for Graduate Students in Business. If the English requirement is satisfied in one of the above ways and the information is included as a part of the information submitted with the graduate application, English clearance will be given automatically. If the student takes the G.R.E. or the Admission Test for Graduate students in Business after applying for admission to the Graduate School, the student must be certain the Educational Testing Service sends test scores to the Graduate School.

   Those not cleared as specified above write a test paper for the Committee on Standards in English and are held for further writing if the test paper is not acceptable. Students so held are expected to work toward satisfying the requirement without delay. The student should make certain that the Committee on Standards in English sends the Graduate School notice of satisfaction when completed. See the secretary in the graduate counselor's office for the person to contact for clearance in this manner.
3. Plan of Study—The plan of study shall include a primary area and a related area or areas which are chosen on the basis of the student's interests and needs. A tentative plan of study should be drawn up in advance of registration for the first semester of graduate work. This should be done by the student and his graduate advisor. The formal plan of study should be submitted as soon as possible and before the final semester. The English requirement must be met before the plan of study may be filed.
4. Grades and index requirement—Only grades of A, B, and C are acceptable on a plan of study. An advisory committee may require higher performance than C in certain courses. There is no general Graduate School cumulative index requirement. Specific requirements, if any, are up to the individual departments.
5. Hours of work required—This varies by department from thirty to thirty-six semester hours of credit.
6. Oral and written examinations—The Graduate School has no general requirement for oral and written examinations for the masters degree. In any department the final examinations may be waived if the student meets the minimum requirements of the department. In any event, a

final examining committee is appointed for each candidate for the masters degree. The committee must certify to the Graduate School either that the student has passed the required examinations of the department in which his major graduate study has been taken or that the committee is satisfied with the accomplishment of the student as based on a committee conference.

ACADEMIC REGULATIONS

GRADES

The School of Science uses the following grade system:

A (4.0) Highest passing grade

B (3.0)

C (2.0)

D (1.0) Lowest passing grade

S Satisfactory

F (No credit) Failed the work in a course or failed to complete an official withdrawal

P Passed (See Pass-Fail Option)

F Failing (See Pass-Fail Option) (No credit)

P or F **Pass/Fail:** During the four years of his undergraduate program, any undergraduate student in good standing (not on probation) may enroll in up to a miximum of eight elective courses to be taken with a grade of P (pass) or F (fail). The pass/fail option is open for a maximum of two courses per year, including summer sessions. For this option, the year is defined as September 1 to September 1. The course selected for pass/fail must be an elective. It may not be used to satisfy any of the school area requirements, nor may it be counted as a part of the student's concentration area. The course or courses may be used to meet the 300-400-level course requirement.

A grade of P is not counted in computing grade averages; a grade of F is included. A grade of P cannot be changed subsequently to a grade of A, B, C, or D.

W or WF **Withdrawal or Withdrawal, failing:** A student may officially withdraw from classes without penalty any time during the first one-half of a semester or session; a grade of "W" shall be recorded on the final grade report. A student may withdraw from classes any time during the third one-fourth of a semester or session with a grade of "W" or "WF" as assigned by the instructor of the affected course, reflecting the student's progress to the date of withdrawal. The grade so assigned shall be recorded on the final grade report. A student may not withdraw from classes during the last one-fourth of a semester or session. Exceptions are by written approval of the dean of his school only.

Any student who alters his schedule, whether by personal incentive or by departmental directive, must follow withdrawal procedures. A student who does not follow these procedures is jeopardizing his record by the possibility of incurring a failing grade in a course not properly dropped and/or not receiving credit for work done in a course not properly added.

I **Incomplete:** The grade of I (Incomplete) indicates that the work is satisfactory as of the end of the semester but has not been completed. The grade of Incomplete may be given only when the completed portion of a student's work in the course is of passing quality. Instructors may award the grade of Incomplete only upon a showing of such hardship to a student as would render it unjust to hold the student to the time limits previously fixed for the completion of his work.

Removal of Incomplete: The removal of a grade of Incomplete within a period of time allotted by the instructor will be the responsibility of the student. An Incomplete grade which has not been removed within the time specified by the instructor or as required by university regulations will be converted by the Registrar's Office to the grade specified by the instructor.

Courses Repeated

The School of Science has its own form of computing the grade-point average on the basis of courses retaken.

1. The computation of the grade-point average on the basis of courses retaken is done during the senior year at IUPUI. This computation is based on the rule that only the most recent grade in repeated courses counts in computing the grade-point average.
2. Other types of Academic Bankruptcy, e.g., the deletion of all grades in a single semester, will be considered in only the most unusual circumstances and will never be granted without application to and approval by the appropriate faculty committee.

Petition for Grade Change

Course grades may be changed by petition, from either the student or the faculty member.

1. Faculty petition: A faculty member may request a change of grade for the student. This request can be honored only after initial screening by the Academic Appeals Committee and the written consent from the Dean of the School of Science.
2. Student petition: A student may request a change of grade by filing a petition with the Academic Appeals Committee, and should include:
   a. A statement of attempted but unsuccessful interview with the faculty member and the Chairman of the department.
   b. Supportive evidence for petition.

THE NECESSARY FORMS FOR WITHDRAWAL FROM A COURSE; CHANGE OF CLASS, SCHOOL, OR MAJOR: CHANGE OF GRADE; AND PASS/FAIL OPTION ARE AVAILABLE IN THE DEPARTMENTAL OFFICES OR THE REGISTRATION OFFICE.

CLASS STANDING

Class standing is based on the number of credit hours completed:

Freshman ..... 0 to 26
Sophomore ..... 27 to 55
Junior ..... 56 to 85
Senior ..... 86 or more

CANDIDATES FOR BACCALAUREATE DEGREES

A student is considered to be a candidate in good standing for a baccalaureate degree awarded by the School of Science when he has been admitted as a regular student by the Office of Admissions, his last semester's grade point average (index) is not less than a C (2.0), and his cumulative grade point average (graduation index) is not below this same level.

DEGREES AWARDED WITH DISTINCTION

IUPUI recognizes outstanding performance in course work of any student by awarding bachelor's degrees with distinction. IU degrees are awarded with three levels of distinction: Distinction, High Distinction, Highest Distinction. Purdue degrees are awarded with Distinction and Highest Distinction.

ACADEMIC STANDING

Academic Probation

A full time student is on academic probation when either his semester grade point or cumulative grade point average is below C (2.0). A part time student is on academic probation when his grade point average of 12 credits of consecutive enrollment or cumulative grade point average is below C (2.0).

A student on academic probation will be so advised by letter from the Office of the Dean of the School of Science. The student is informed of all conditions and restrictions required for reestablishing a status of good academic standing.

Dismissal

A student is dismissed from the university when, in the opinion of the Office of the Dean of the School of Science, he has ceased to make progress toward his degree.

A full time student is subject to dismissal when he has failed to attain a C (2.0) average in any two consecutive semesters and when his cumulative grade point average is below C (2.0).

A part time student is subject to dismissal when his grade point average of 15 credits of consecutive enrollment or cumulative grade point average is below C (2.0).

A student who is dismissed will be so advised by letter from the Office of the Dean of the School of Science.

Readmission

A student dismissed for the first time may immediately petition the Office of the Dean of the School of Science for readmission. A student dismissed for the second time may submit a petition for readmission after a period of at least one regular semester.

In order that petitions for readmission have sufficient time for consideration, students eligible to submit them should do so before June 15 for the fall semester, December 5 for the spring semester and April 15 for the summer sessions.

A student who is readmitted will be so informed by letter from the Office of the Dean of the School of Science. He is informed of all conditions and restrictions upon which his readmission depend.

SPECIAL FACILITIES AND SERVICES

LIBRARIES

The IUPUI Library system is composed of six separate libraries which are open to all students enrolled at the University. These are located at the Dental School, Herron School of Art, Downtown Campus, Law School, Medical School, and 38th Street Campus. The Normal College also maintains a reference room of professional physical education materials. The Dental, Herron, Law, and Medical libraries contain specialized collections reflecting their respective curricula. The collections at the Downtown and 38th Street Campuses cover a wide range of academic disciplines from humanities to science, engineering, and technology.

Since procedures vary slightly among the different libraries, students should consult each before checking out books and other materials.

EVENING ADMINISTRATION

The IUPUI Evening Administration Office, 1125 East 38th Street, is the communication link after 5 P.M. for the public, students, faculty, and all the departmental secretaries. Faculty and associate faculty may request services from the departmental secretaries through the Evening Administration Office. For example, test copy can be left at this office, and the prepared tests may be secured from this office after 5 P.M. This office receives requests for and dispenses keys for rooms. Audio-visual requests may be made and film returned to this office. The Evening Administration Office offers all the services of the Registrar's and Admissions Offices after 5 P.M.

A complete set of Bulletins and other University promotional materials are available at the Evening Administration Office.

Phone: 923-1329, Extensions 238 or 260.

COMPUTING SERVICES

The Computing Services Division operates four computer facilities at IUPUI: The Research Computer Center, the Educational Computer Center, the Administrative Data Processing Center, and Hospital Data Processing Center. Of these, the student has access to the Educational Computer Center and the Research Computer Center.

The Educational Computer Center operates an IBM 360/44 devoted exclusively to the processing of student jobs. In addition, the Center also provides an IBM 1620 computer which the student is able to use in a hands-on environment. Unit record equipment, such as sorters and collators, are also available for student use.

The Research Computer Center operates a DEC-10 computer which supports terminal operation from remote terminals throughout the IUPUI campuses. Interactive computing (time sharing, computer assisted instruction) is provided to and for the student through this facility. The DEC-10 also provides a link to the CDC 6600 computer at the Indiana University-Bloomington Campus. A hybrid (analog-digital) computer is part of equipment available on a special projects basis at this facility.

"Clusters" of keyboard terminals located in the Union Building, Cavanaugh Hall, and the AD Building provide access to the DEC-10 as well as other computers in the Indiana University Network.

There are also a number of computer terminals, analog computers, and mini-computers located within the individual departments of the School of Engineering and Technology.

SPECIAL PROGRAMS

SECONDARY TEACHERS' CERTIFICATE

With careful planning, a student may earn a baccalaureate degree in the School of Science and may receive a provisional secondary teacher's certificate, completing the requirements for both in four years. The Secondary School Teacher Certificate, Provisional, qualifies the holder to teach in the subject-matter fields for which it is endorsed in any public secondary school in Indiana. It is granted upon completion of a baccalaureate degree based upon a program of teacher education and the recommendation of the graduating institution. It is valid for five years from the date of issue and may be renewed one time only for a period of two years, provided a minimum of 20 semester hours towards the master's degree on a teacher education program has been accumulated.

Every student who plans to obtain a teaching certificate must pass a speech and hearing test, which is given usually during the first week of fall and spring semesters, and be admitted formally to the teacher education program by the end of his sophomore year. Application forms are available from the student's departmental advisor or from the Division of Education, Marott Building, 902 N. Meridian Street.

A candidate for a secondary teacher's certificate *and* a bachelor's degree must satisfy the appropriate degree requirements of the IUPUI School of Science, the departmental requirements, and the certification requirements. The student must, therefore, plan a complete program with the departmental advisor to insure that all requirements are satisfied.

A candidate for a secondary teacher's certificate must earn a baccalaureate degree which includes 124 credit hours. The student must have an average grade of C or above in all university work taken, in all his education courses (with at least a C in the methods course in his major), and in all the course work of his teaching major and of his teaching minor if he has one.

For a Provisional Certificate the State of Indiana sets the following General Education, Professional Education and Subject Matter Area requirements:

GENERAL EDUCATION

50 credits as follows:

Humanities: 16-18 credits (for example English, Fine Arts, Folklore, Foreign Language, Philosophy, Speech & Theatre)

Social and Behavioral Sciences: 14-16 credits (for example Anthropology, Economics, Geography, History, Political Science, Psychology, Sociology)

Life and Physical Sciences: 14-16 credits (subject matter area meets this requirement; some departments specify lab sciences)

Electives as needed for a total of 50 credits

PROFESSIONAL EDUCATION

At least 18 or 21 credits.
IUPUI courses which meet this requirement are:

EDUC F100—Introduction to Teaching (2 cr.) Must be taken concurrently with EDUC F470 Reading for Honors (1 cr.)
EDUC P280—Human Development and Learning (5 cr.)
EDUC M440-478—Methods of Teaching High School Subjects (one course to be taken in each major area) (3 cr.)
EDUC M462—Methods of Teaching High School Reading (3 cr.) (Required ONLY for Indiana University Degrees)
EDUC S485—Principles of Secondary Education (3 cr.)
EDUC M480—Student Teaching in the Secondary School (6-8 cr.)

Methods courses (M440-M478) must be taken at least one semester before student teaching (M480). Also, P280 must be taken before the methods courses. Application for student teaching should be filed in the Office of the Director of Laboratory Experiences during the first semester of the year immediately preceding that in which the student teaching is to be done. The application must be completed in personal conference with the faculty member in charge of student teaching in the area of the candidate's teaching major. Student teaching requires a full semester for one-half day. A student should take no more than two additional courses while student teaching.

SUBJECT MATTER AREA

Major, 40 credits; minor, 24 credits (minor not required)
Program planning should be done in consultation with student's advisor in his major department.

PRE-PHARMACY PROGRAM

IUPUI does not grant a degree in pharmacy. However, students may complete one year of pre-pharmacy instruction on this campus. The following program is specifically designed for students who expect to apply for admission to the School of Pharmacy and Pharmacal Sciences of Purdue University (West Lafayette Campus).

Pre-Pharmacy Year

First Semester		Second Semester	
(4)	BIOL 108 (Intro to Botany)	(4)	BIOL 109 (Intro to Zoology)
(5)	C 105 (Prin. of Chem)	(5)	C 106 (Quantitative Chem)
(3)	W117 (Basic ENGL Comp)	(3)	MA 154 (College Algebra & Trig)
(3)	MA 153 (College Algebra & Trig)	(1)	W118 (Research Report Writing)
(1)	Elective	(3)	Elective
(16)		(16)	

Students with sufficient backgrounds in mathematics should schedule MA151 or MA 163 instead of MA153-4.

The application for admission must be submitted to Purdue before February 1, to insure consideration for the Fall semester. A student desiring to transfer to another institution may have to adjust his basic program.

PRE-VETERINARY PROGRAM

IUPUI offers an organized, 4-semester curriculum meeting requirements for admission to the School of Veterinary Science and Medicine. This curriculum provides a strong program in the biological and physical sciences which may be used also as a basis for continued training in the School of Agriculture should the degree Bachelor of Science in Agriculture be desired.

The student who has successfully completed 2 years or more of pre-veterinary instruction at IUPUI is then eligible to apply for admission to the School of Veterinary Science and Medicine at Purdue University in Lafayette.

The requirements for admission to the pre-veterinary program are the same as those for students in the School of Agriculture.

Semester 1		
Eng.	W117	3 cr
Chem	C105	5 cr
Math	153	3 cr
or	221	
Biol	108	4 cr
Agr.	101	1 cr
Semester 2		
Chem	C102	5 cr
Phys	218	4 cr
Zool	364	4 cr
Electives		6 cr

Semester 3		
Eng.	W118	1 cr
Chem	C106	5 cr
Math	154	3 cr
or	222	
Biol	109	4 cr
An Sc*	102	3 cr
Semester 4		
Phys	219	4 cr
An Sc	221	3 cr
Spch	C110	3 cr
Electives		6 cr

*Offered every other year—may be replaced by another agricultural elective.

Electives are commonly selected from:

Agricultural Economics
Agronomy
Biology
Business
Economics
Geography
Geology
History
Horticulture
Philosophy
Political Science
Psychology
Sociology

PRE-DENTAL AND PRE-MEDICAL PROGRAMS

Admission to dental and medical schools is highly competitive. The preprofessional student is therefore urged to elect a degree program, rather than to strive for the minimal requirements of these schools. Skilled preprofessional counseling is available in the Departments of Biology and Chemistry, which also offer preprofessional degree programs. This service will assist the student to prepare himself well for the professional school admissions process. It will also suggest alternative, rewarding career opportunities should the application to the professional school be unsuccessful. Graduate students holding non-science degrees, who are electing courses in the School of Science to prepare for professional school, are also invited to use this counseling service.

COOPERATIVE EDUCATION PROGRAM

A career in a science field requires one to have a knowledge of the mathematical and natural sciences, gained by study, experience and practice. The knowledge must be applied with judgment in order to utilize economically the materials and forces of nature for the benefit of mankind.

Cooperative education at IUPUI is an elective plan of education in which a student may alternate periods of academic study with periods of employment in business, government or industry. It contributes essential elements to the educational process and is directly related to one's career field of study. Work assignments provide varied experience with increasing difficulty and responsibility. These experiences cannot be acquired through college laboratory participation or limited work experience during summer vacations. Cooperative education is a formalized educational plan built into any one of many curriculums.

In the co-op calendars shown below, the shaded areas designate the work periods and the blank areas represent semesters or summer sessions on campus.

If a science student selects Plan A, he attends classes the fall and spring semesters of his freshman year. He works in industry during the summer and returns to the campus for the fall semester, thus alternates work and campus studies as shown on the line "Plan A."

Plan	Year and Semester													
	1st year			2nd year			3rd year			4th year			5th yr.	
	F	S	SS	F	S	SS	F	S	SS	F	S	SS	F	S
Plan A			■		■		■		■		■			
Plan B				■		■		■		■		■		

If a student selects Plan B, he attends the summer session immediately following his freshman year. He then works in industry during the fall semester, thus alternates work and campus studies as shown on the line "Plan B." In both plans, the co-op spends two summer sessions working in industry and two summer sessions studying on campus.

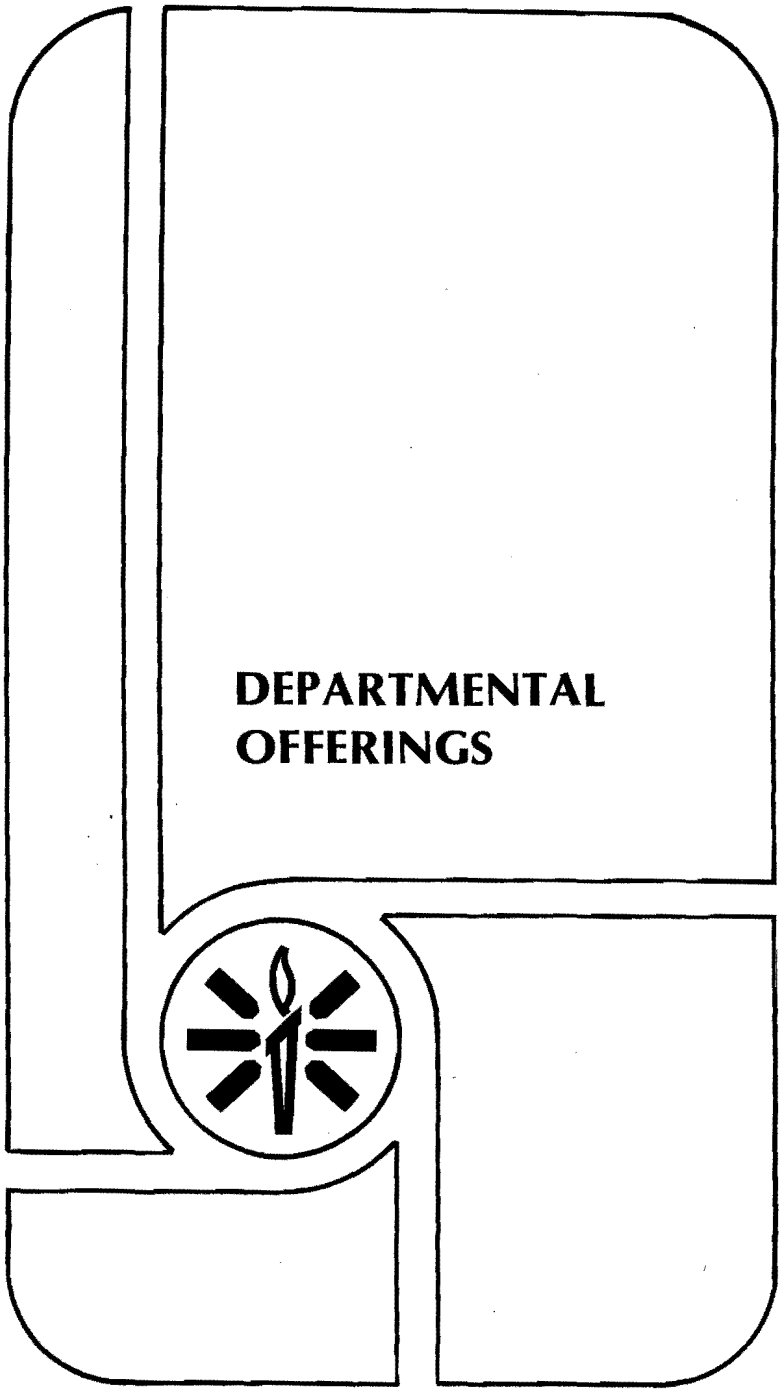
Once a student has accepted cooperative employment with a company, he will be encouraged to continue with the company throughout the program. Students will not be permitted to change employers indiscriminately.

A student should apply directly to the cooperative education coordinator for information and specifics of program implementation.

MILITARY TRAINING PROGRAM

ROTC programs are offered (not required) by the Air Force, which offers courses which lead to a commission as an officer upon graduation. Military courses are pursued in conjunction with the academic curriculum and receive academic credit; however, these credits may not be applied toward fulfillment of his degree objective.

Men with evidence of honorable discharge or separation from active duty in the armed forces may apply for credit in basic armed forces training if they desire to use ROTC as an elective sequence.


DEPARTMENTAL
OFFERINGS

DEPARTMENT OF BIOLOGY

PROFESSORS: Samuels (Chairman), Sanborn; ASSISTANT PROFESSORS: Courtis, Keck, Kirk, Lees, Pflanzer; INSTRUCTOR: F. Juillerat.

Requirements For The Major*

The student who is a major in Biology would be expected to meet the basic requirements for the School of Science, plus requirements from within the department and also from certain areas outside the department.

1) Requirements from within the department:

An A.B. in Biology includes 25 hours of work in the major field beyond the 100-level introductory sequence. Any student majoring in the department would be expected to complete *one* of the sequences from *each* area below, plus sufficient elective courses (at least) to complete the required number of hours.

AREA	SEQUENCE	CREDIT HOURS
Introductory courses	1) BIOL 103-104 (preferred)	6
	2) BIOL 108-109**	8
	3) Z 103	5
Structural & Developmental Biology	1) BIOL 260-261; 466-467 (Above sequence preferred.)	8
	2) Z 215; BIOL 295; 466	9
Environmental Biology	1) BIOL 285	3
Cell Biology	1) BIOL 420-421	4
Genetic Biology	1) Z 364	4
Electives		To fulfill major. To be selected in consultation with departmental advisors.

2) Requirements from outside the department:

In addition to the above, the following area requirements from outside the department are required:

MATHEMATICS

Through 2 semesters of calculus. Starting point and program to be worked out with departmental advisor based on SAT scores and/or background history of student. (Suggested: MATH 221-222 or MATH 163-164; Statistics, such as STAT 311, is also strongly suggested.)

*See also the General Requirements for School of Science.

**Acceptable in cases of transfer from another department or institution where these courses are normal to that curriculum (i.e., Agriculture-Purdue). A student beginning his biology curriculum *should not* elect this sequence.

PHYSICS

2 semesters of basic Physics. (Suggested: PHYS 152-251 (PU) or PHYS 218-219 (IU).

CHEMISTRY

Through 2 semesters of Organic Chemistry with laboratory. Basic Chemistry sequence to be worked out with departmental advisor based on SAT scores and/or background of student. (Suggested: CHEM 255-255L-256-256L or CHEM 261-265A-262-266L or CHEM 341-343 and CHEM 342-344; plus prerequisite basic sequence or background to enter selected sequence above; a course in Analytical Chemistry is also strongly suggested—determination to be made in consultation with department advisor).

Fulfillment of the following area is strongly suggested:

COMMUNICATIONS SKILLS

2 semester courses dealing with communication of data, to be selected in consultation with departmental advisor (courses might include: foreign language in addition to the 10 hours required by School of Science, photography, graphics, drawing, computer science, logic, etc.)

Departmental Foreign Language Requirement: No requirement beyond the first year. (See Communication Skills, above).

COURSES IN BIOLOGY

103 PRINCIPLES OF BIOLOGY (3 Cr)
P: None. Fall, Spring; day, night.
This course provides a strong background in quantitative and chemical aspects with an emphasis placed on experimental approaches to the study of living things.

104 PRINCIPLES OF BIOLOGY (3 Cr)
P: 103. Continuation of BIOL 103.

108 INTRODUCTION TO BOTANY (4 Cr)
P: None. Fall, Spring; day.
This course probes the functions of plants on the cellular and total organism levels, examines the roles of plants in the environment, and surveys the major plant groups alive today.

109 INTRODUCTION TO ZOOLOGY (4 Cr)
P: None. Spring; day.
Course aims include a knowledge of the general diversity of animal organisms, of how they exist, and of how structure and function correlate.

201 BIOLOGY OF MAN (2 Cr)
P: None. Fall; day.
Two-semester sequence in human biology with emphasis on anatomy and physiology providing a solid foundation in body structure and function.

202 BIOLOGY OF MAN (2 Cr)
P: 201. Continuation of BIOL 201. Spring; day.

203 BIOLOGY OF MAN (3 Cr)
P: None. Fall; day.
Same as BIOL 201 with an accompanying laboratory.

204 BIOLOGY OF MAN (3 Cr)
P: 203. Continuation of BIOL 203. Spring; day.

220 INTRODUCTION TO MICROBIOLOGY (3 Cr)
P: One year general chemistry and one semester of life science. Spring; day.
The isolation, growth, structure, functioning, heredity, identification, classification, and ecology of microorganisms, their role in nature and significance to man.

221 INTRODUCTION TO MICROBIOLOGY (4 Cr)
P: Same as BIOL 220.
The isolation, growth, structure, functioning, heredity, identification, classification, and ecology of microorganisms, their role in nature and significance to man.

260 STRUCTURAL BIOLOGY (2 Cr)
P: BIOL 108 and 109; or BIOL 103 and 104; or equivalent. P or C: BIOL 261. Fall; day.
A description of biological structure at diverse levels of organization from molecules to multicellular organisms with emphasis on the relationship of structure and function.

261 LABORATORY IN STRUCTURAL BIOLOGY (2 Cr)
P: Same as BIOL 260. C: BIOL 260. Fall; day.
Structure of plants and animals, with emphasis on comparative and phylogenetic relationships.

285 ENVIRONMENTAL BIOLOGY (3 Cr)
P: One year of life science and one year of general chemistry. Spring; day.
A study of interactions, (physical and biological), mineral use, structure, population genetics, and energetics of a nonspecific ecosystem model.

295 SPECIAL ASSIGNMENTS (2 Cr)
P: Same as BIOL 260 and 261. Fall; day.
Plant portions of BIOL 260 and BIOL 261 for students with credit in Z215.

420 CELL BIOLOGY (2 Cr)
P: One semester of life science and one semester of organic chemistry with laboratory. C: BIOL 421. Fall; day.
Composition, structure, heredity, and growth of cells. Analysis of the cell concept in biological terms.

421 LABORATORY IN CELL BIOLOGY (2 Cr)
P or C: BIOL 420. Fall; night.

466 DEVELOPMENTAL BIOLOGY (2 Cr)
P: BIOL 260 and BIOL 420. Spring; night.
Principles of development of plants and animals.

467 LABORATORY IN DEVELOPMENTAL BIOLOGY (2 Cr)
P or C: BIOL 466. Spring; night.
Descriptive and experimental study of the development of plants and animals.

520 CELL BIOLOGY (2 Cr)
Graduate standing; see BIOL 420 above.

521 LABORATORY IN CELL BIOLOGY (2 Cr)
Graduate standing; see BIOL 421 above.

566 DEVELOPMENTAL BIOLOGY (2 Cr)
Graduate standing; see BIOL 466 above.

567 LABORATORY IN DEVELOPMENTAL BIOLOGY (2 Cr)
Graduate standing; see BIOL 467 above.

595 SPECIAL ASSIGNMENTS (arr.)
P: Graduate standing. Fall, Spring.
Special work, such as directed readings, independent study or research, supervised library, laboratory, or field work, or presentation of material not available in the formal courses in the department.

A210 HUMAN ANATOMY (5 Cr)
P: None. Fall, Spring; day.
Lecture and laboratory studies of the histology and gross morphology of the human form, utilizing a cell-tissue-organ system-body approach.

B403 PLANT FUNCTION (2 Cr)

P: One course in general botany or general biology *and* one course in organic chemistry with lab; or consent of instructor. Spring; night.

A study of water relations, photosynthesis, respiration, growth, development, flowering and some urban induced stress phenomena in higher plants.

B404 LABORATORY IN PLANT FUNCTION (2 Cr)

P: As for BIOL B403. P or C: BIOL B403. Spring; night.

The laboratory is designed to develop expertise in some instrumentation in the study of whole plants, excised organs, isolated organelles, and enzymes.

B481 PROSEMINAR IN ANIMAL BIOLOGY (1 Cr)

P: Upper division standing in Science or Engineering and consent of the instructor. Spring; day.

Guided individual presentations on topics in an area of current importance not included in other courses.

B482 PROSEMINAR IN PLANT BIOLOGY (1 Cr)

P: Upper division standing in Science or Engineering and consent of instructor. Spring; day.

Guided individual presentations on topics in an area of current importance not included in other courses.

B483 PROSEMINAR IN MICROBIOLOGY (1 Cr)

P: Upper division standing in Science or Engineering and consent of instructor. Fall; day.

Guided individual presentations on topics in an area of current importance not included in other courses.

L111 CONTEMPORARY BIOLOGY (3 Cr)

P: None. Fall, Spring; day, night.

Selected principles of biology with emphasis on issues and problems extending into every day affairs of the student.

L369 HEREDITY, EVOLUTION, AND SOCIETY (3 Cr)

P: None. Fall, Spring; day, night.

Basic concepts and principles of evolution, genetics, and development. Problems of the individual and society raised by current genetic knowledge and technology. Cannot be taken for credit by those who have credit in Z364.

L490 SPECIAL ASSIGNMENTS (arr.)

See BIOL 595 above; for upper division undergraduates in science.

M250 MICROBIOLOGY: LECTURE (3 Cr)

P: One year of biology; one year of general chemistry. Spring; night.

Introduction to microorganisms: cytology, nutrition, physiology, ecology, genetics and life history. Importance of microorganisms in applied fields including infectious disease.

M255 MICROBIOLOGY: LABORATORY (2 Cr)

P: M250, preferably concurrently. Spring; night.

Laboratory experiments and demonstrations to yield proficiency in aseptic cultivation and utilization of microorganisms; experimental investigations of biological principles in relation to microorganisms.

P204 HUMAN PHYSIOLOGY (5 Cr)

P: None. Fall, Spring; day.

Lectures and laboratory work related to cellular, musculoskeletal, neural, cardiovascular, gastrointestinal, renal, endocrine, and reproductive function in man.

Z103 ANIMAL BIOLOGY (5 Cr)

P: None. Fall, Spring; day, night.

Basic principles of biology, growth, reproduction, energy transport, heredity as they occur in animals. Survey of the animal kingdom emphasizing structure as related to function as well as taxonomic relationships.

Z215 DEVELOPMENTAL ANATOMY (5 Cr)

P: Introductory Biology course with grade of C or higher. Fall, Spring; day, night.

Comparative study of the development of structure in vertebrates, including man.

Z270 ROLE OF BIOLOGY IN SOCIETY (2 Cr)

P: None. Fall; night.

The principles of ecology are studied as they relate to pollution. Student reports of local problems and action.

Z271 ROLE OF BIOLOGY IN SOCIETY (2 Cr)

P: None. Spring; night.

The principles of ecology are studied as they relate to population dynamics and control. Student reports in interdisciplinary problem solving approaches.

Z364 GENETICS (4 Cr)

P: One introductory biology course. Fall, Spring; day, night.

Principles of genetics at the molecular, cellular, organismal and population level.

DEPARTMENT OF CHEMISTRY

PROFESSORS: Fife, Nevill and Welcher; ASSOCIATE PROFESSORS: Boaz, Boschmann, Cutshall, Metz, Rabideau and Wyma; ASSISTANT PROFESSORS: Cady, Fricke, Gebauer, Raichart and Wilson. DEPARTMENTAL COUNSELORS: Professors Boaz and Fife.

The Department of Chemistry provides instruction that leads to degrees in chemical technology, an associate degree (for details, see the Bulletin of the School of Engineering and Technology), and in chemistry: Bachelor of Arts degrees, Bachelor of Science degrees, and Master of Science degrees. Two Bachelor of Science degrees (IU and PU) carry certification by the American Chemical Society Committee on Professional Training (see pages 40 and 41).

The Department of Chemistry offers special courses in cooperation with the Continuing Education Department which can be taken either on a credit or non-credit basis. Offered at both the graduate and undergraduate levels, the individual courses are given when there is sufficient demand or need. The professional chemist with a degree will find them useful in keeping up with the latest developments in a particular field or in broadening his knowledge and background, and the student presently working toward a degree may enrich his educational program with a "special topic" course or an interdisciplinary course.

C101 is elected by students in IU programs which require only one semester of chemistry (e.g., degree requirement in physical science, 3-year nursing, education). Students required to complete two semesters of chemistry take the sequence C101-C102 (e.g., 4-year nursing). C105-C106 is required for students pursuing advanced work in scientific fields (e.g., chemistry, biology, geology). Credit not given for both C101 and C105. Admission to C106 on a basis of C101 not granted.

Purdue students expecting to major in Biology, Chemistry or Physics should take the sequence C105-C106. Students in engineering should take C111-C112 or C105-C106, if qualified. Students in home economics take C101-C102, those in prepharmacy C105-C106, and students in agriculture C105-C106. C101-C102 is designed for students who do not need chemistry as a tool subject.

DEGREES OFFERED

The following degrees in chemistry are offered.* To enter the curriculum in chemistry, a student should have completed a minimum of two years of high school algebra, one-half year of trigonometry, one year each of chemistry and physics, and three to four years of a modern foreign language. The choice of a particular degree program in chemistry should be made in consultation with a departmental counselor. The level, time and sequence of courses in the chemistry curriculum is rigid. Thus, all study plans should be made with the assistance of the chemistry counselor.

*All degrees carry the general requirements of the university granting the degree. These are described elsewhere in this bulletin.

IU 25-hour A.B. with Major in Chemistry

For students requiring knowledge in chemistry as a basis for work in other fields. Suitable for students planning chemical industry positions as laboratory technicians. Recommended to premedical students with minimum requirements and 7 elective hours: C342, C344, 2 hours of C301-C302 or C209.

Chemistry Requirements (Area IV)

Recommended: C105, C106, C310, C341, C361, C363; Physics P221-P222; Mathematics M215-M216.

Minimum requirements: C105,C106, C341, C343, C360, 7 elective hours of chemistry, 4 of which must be selected from: C310, C342, C344, C362, C363, C430, C483; Physics P201-P202;Mathematics ~~M221 and M223.~~ M221 - 222

IU A.B. WITH MAJOR IN CHEMISTRY

For students planning to become professional chemists. Not recommended to students planning to pursue graduate studies in chemistry.

Chemistry Requirements (Area IV)

C105-C106, C341, C343, C342, C344, C361, C362, C363, C430, 3-9 hours of advanced chemistry (e.g., C400, C410, C443, C483: Physics P201-P202; Mathematics M215-M216.

IU B.S. IN CHEMISTRY

For students planning to become professional chemists. Recommended to students planning to pursue graduate studies in chemistry. Available only to students of high academic standing, with permission of Departmental Counselor at the beginning of the junior year. This degree carries certification by the Committee on Professional Training of the American Chemical Society.

General Course Requirement (IU B.S. only)

Area I: English W115, W116, W117

Area II: 13 hours of German, including G231

Area III: 2 courses in Arts and Humanities
2 courses in Social and Behavioral Sciences
1 course in Biological Science
Area IV Fulfills requirement in Mathematics and Physical Sciences

Chemistry Requirements (Area IV)

45 hours of chemistry, including C105-C106, C310, C341, C342, C343, C344, C361, C362, C363, C400, C430 and 13 hours of advanced work (e.g., C410, C443, C483; Mathematics M215-M216, M311; Physics P221-P222.

Other Requirements

1. Mathematics: MA161, MA162 or MA213, MA214; MA221, MA222 — 10-12 credits
2. Biology: BIOL 103, BIOL 104 — 6 credits
3. Physics: PHYS 218, PHYS 219 or PHYS 152, PHYS 251 — 8-9 credits
4. Science Minor: BIOL 260 and either BIOL 285 or BIOL 520, BIOL 521 — 7-8 credits
   or Three of GEOS 111, 112, 243, 473 — 9 credits
   or MA261, MA262 — 8 credits
   or PHYS 342, PHYS 342L — 4 credits

PU B.S. WITH MAJOR IN CHEMISTRY

Recommended to students planning to be professional chemists, secondary school science teachers, and those desiring non-research industrial positions (e.g. sales). Not recommended to students planning to pursue graduate studies in chemistry.

Chemistry Requirements

C105, C106, C341, C342, C343, C344, C361, C362, C363, C310, C430—35 credits

Other Requirements

1. Mathematics: MA163, MA164, MA261 — 14 credits
2. Physics: PHYS 152, PHYS 251 — 9 credits
3. At least 2 additional courses in a laboratory science outside chemistry. May be chosen from e.g. Biology (BIOL 103, 104) or Geosciences, Physics.

PU B.S. IN CHEMISTRY

For students planning to become professional chemists. Recommended to students planning to pursue graduate studies in chemistry. This degree carries certification by the Committee on Professional Training of the American Chemical Society.

Chemistry Requirements

C105, C106, C341, C342, C343, C344, C361, C362, C363, C310, C410, C430, C400, 6 credits in advanced chemistry (e.g., C301, C302, C335, C409, C443, C483—46 credits

Other Requirements

1. Mathematics MA163, MA164, MA261, MA262 — 18 credits
2. Physics: PHYS 152, PHYS 251, PHYS 342, PHYS 342L — 13 credits
3. At least 1 additional course in a laboratory science outside chemistry. May be chosen from e.g., Biology (BIOL 103, 104) or Geosciences, Physics.
4. Modern Foreign Language: German G101, G102, G231 — 13 credits

*All degrees carry the general requirements of the university granting the degree. These are described elsewhere in this bulletin.

MASTER OF SCIENCE IN CHEMISTRY

In cooperation with Indiana University, Bloomington, and Purdue University, Lafayette, the complete course and research work for the M.S. degree in chemistry with thesis or nonthesis option is offered at IUPUI. The nonthesis program is designed mainly for the part-time student who works in local industry or in chemically-related fields such as quality control, high school teaching, etc., and the thesis program is designed for the full-time student who is preparing for a career in the research-oriented fields of chemistry.

Admission Requirements

The prospective student should have a baccalaureate degree from an accredited institution, show promise of ability to engage in advanced work, and have made an adequate preparation (approximately 35 hours of coursework in under-graduate chemistry) to enter upon graduate study in chemistry. Anyone not meeting these requirements should take the Aptitude Test Section of the Graduate Record Examination.

Application for Admission

Regular graduate student application forms may be obtained from the Department of Chemistry, IUPUI. Usually eight weeks are required for final approval of these applications. Regular graduate students are eligible to become candidates for advanced degrees.

Temporary graduate student application forms may be obtained from the Admissions Office at the 38th Street Campus of IUPUI. The temporary graduate classification is primarily for those who wish to take courses for personal improvement. Usually not more than nine hours of credit earned under this classification may be applied toward an advanced degree.

Transfer Credit

The chemistry department will accept by transfer a maximum of six hours of graduate credit from approved institutions which are in excess of under-graduate degree requirements.

General Degree Requirements

The general requirements include admission to regular graduate status, completion of the English requirement, and satisfactory completion of an approved plan of study. A suitable research or library thesis must be submitted for the thesis option.

The English requirement for candidates whose native language is English is satisfied by having no undergraduate grades below B in composition or by scoring 600 or higher on the Verbal Aptitude Section of the Graduate Record Examination. Students who do not satisfy the English requirement by either of the above methods may take a written examination administered by the English Department to demonstrate their proficiency.

An informal plan of study should be drawn up by the student and the graduate advisor in advance of registration for the first semester of graduate work. The formal plan of study should be submitted as soon as possible and before the final semester. The English requirement must be satisfied before the plan of study may be filed. Only grades of A, B, and C are acceptable as satisfactorily completing an approved plan of study. All grades earned count toward the calculation of the grade point average.

Departmental Degree Requirements

Incoming students with an undergraduate grade point average of 2.80 or higher (A=4.00) will automatically be recommended for admission as regular graduate students. Those with an average below 2.80 will be admitted as temporary graduate students with the provision that a 2.50 average must be achieved in the first three courses (or nine credit hours) if they are to be admitted as regular graduate students.

Departmental placement examinations in analytical, inorganic, organic, and physical chemistry are given each fall to incoming regular graduate students to determine deficiencies which must be removed before the completion of the graduate program. The remedial courses are considered to be CHM 525 for analytical, CHM 542 for inorganic, undergraduate organic courses (no graduate credit) for organic, and CHM 573 and/or CHM 574 for physical.

The requirements for each degree are designed to provide both depth and diversity in knowledge. Of the 30-hour requirement for the nonthesis program (Purdue) or the course requirement for the thesis program (24 for Indiana and 20 for Purdue), 12 hours must be at the CHM 600-level and 9 hours must be in a declared major. Courses from three of the following areas must be taken: biochemistry, CHM 533 (C483 or B800); organic, CHM 561 (C443); analytical, CHM 621 (C510); inorganic, CHM 641 (C530); and physical, CHM 671 (C560), CHM 672 (C661), CHM 675 or CHM 679 (C563). Electives to meet the total number of credits may be taken in other departments, but prior approval of the advisory committee is required. A minimum grade point average of 2.50 must be maintained.

Financial Assistance

The chemistry department has available financial support in the form of tuition-refund assistantships and associate faculty positions on a very limited basis.

COURSES IN CHEMISTRY

C101 ELEMENTARY CHEMISTRY I (5 Cr., 3 without laboratory)
P: At least 1 semester high school algebra. Equiv. PU CHM 113. Fall, day and night; Spring, day and night; Summer, day.
Essential principles of chemistry. Lectures, laboratory. N.B. Most degree programs which include C101 require laboratory. Before registering for 3 credits, the student should be certain that this meets the requirements of his program.

C102 ELEMENTARY CHEMISTRY II (5 Cr)
P: C101. Continuation of C101. Equiv. PU CHM 251. Fall, night; Spring, day and night; Summer, day.
Introduction to organic and biochemistry; organic compounds and their reactions. Lectures, recitation, laboratory.

C105 PRINCIPLES OF CHEMISTRY I (5 Cr)
P: Two years of high school algebra, one year of high school chemistry. Equiv. PU CHM 117. Fall, day, night; Spring, day, night; Summer, day, night.
Basic concepts and nomenclature, atomic structure, nuclear chemistry, chemical bonding, stoichiometry, oxidation-reduction, the states of matter, solutions, colloids. Lectures, recitation, laboratory.

C106 PRINCIPLES OF CHEMISTRY II (5 Cr)
P: C105. Equiv. PU CHM 126. Fall, night; Spring, day, night; Summer, day.
Thermodynamics, electrochemistry, chemical equilibrium, kinetics, descriptive and environmental chemistry. Lectures, recitation, laboratory.

C111 CHEMICAL SCIENCE FOR ENGINEERS (4 Cr)
Equiv. PU CHM 101. Fall, day, night; Summer, day, night.
A non-laboratory course for engineers who do not expect to take more than one year of chemistry. Lectures, recitations.

C112 CHEMICAL SCIENCE FOR ENGINEERS (3 Cr)
P: C111. Equiv. PU CHM 102. Fall, day; Spring, day, night; Summer, day.
Continuation of C111. Lectures, recitation.

BIOC 207 BIOCHEMISTRY (4 Cr)
P: C102. Spring, day.
Introduction to Biochemistry presents the fundamental concepts of biochemistry to students who are more interested in the application of science than in the pursuit of science itself. Major emphasis is given to the chemical characteristics of biomolecules and to the interrelationships of the metabolic pathways common to all living organisms.

C209 SPECIAL PROBLEMS (1-2 Cr)
P: Two semesters of college chemistry and consent of instructor. Every semester, time arranged.
Individually supervised special problems of chemical interest, e.g., environmental problems, development of experiments, development of audiovisual materials, etc. May be repeated for credit, but maximum credit of 2 hours may be applied toward a chemistry degree.

255 ORGANIC CHEMISTRY (3 Cr)
P: C106. Equiv. PU CHM 255. Fall, day.
Aliphatic and aromatic hydrocarbons and their simple derivatives. Structure, bonding, syntheses and reactions.

255L ORGANIC CHEMISTRY LABORATORY (1 Cr)
P or C: 255. Equiv. PU CHM 255L. Fall, day.
Separation techniques. Preparation methods of organic compounds.

256 ORGANIC CHEMISTRY (3 Cr)
P: 255. Continuation of 255. Equiv. PU CHM 256. Spring, day.
Syntheses and reactions of polyfunctional compounds. Biological chemistry.

256L ORGANIC CHEMISTRY LABORATORY (1 Cr)
P or C: 256. P: 255L. Continuation of 255L. Equiv. PU CHM 256L. Spring, day.
Emphasizing methods for identifying organic compounds.

263L ORGANIC CHEMISTRY LABORATORY (1 Cr)
P or C: C341. Equiv. PU CHM 263L. Fall, day; Summer, day.
Elementary organic laboratory techniques. Syntheses and purification of organic compounds.

264L ORGANIC CHEMISTRY LABORATORY (1 Cr)
P or C: C342. P: 263L. Equiv. PU CHM 264L. Spring, day; Summer, day.
Preparation, isolation and identification of organic compounds; emphasis on modern research methods.

C301 CHEMISTRY SEMINAR I (1 Cr)
P: C341 and junior standing. Fall, night.
Topics in basic chemistry and interdisciplinary applications. Research reports and discussion by students, faculty and outside speakers. C301 and C302 may be elected three semesters for credit.

C302 CHEMISTRY SEMINAR II (1 Cr)
P: C341 and junior standing (C301 is not prerequisite). Spring, night.
Content same as C301.

C309 COOPERATIVE EDUCATION IN CHEMISTRY (1 Cr)
P: general and organic chemistry and consent of department chairman. Equiv. PU CHM 399. Every semester. Time arranged.
Industrial or similar experiences in chemically-oriented employment. Grade is determined on basis of employment visitations, a written student report, and a supervisor evaluation report. May be repeated for a maximum of 5 credits of which 3 may be used as satisfying an advanced chemistry elective.

C310 ANALYTICAL CHEMISTRY (4 Cr)
P: C342. Equiv. PU CHM 321. Fall, night.
Fundamental analytical processes including solution equilibrium, theory and applications of electrochemistry and spectrophotometry, chemical methods of separation and measurement.

C335 INORGANIC CHEMISTRY LABORATORY (1-3 Cr)
P: 1 year physical chemistry, P or C: C430. Equiv. PU CHM 342L. Fall, night.
Preparation of compounds of rarer elements and unusual compounds of common elements. Reactions of rarer elements.

C341 ORGANIC CHEMISTRY (3 Cr)
P: C106. Equiv. PU CHM 261. Fall, day, night; Spring, night; Summer, day.
Comprehensive study of aliphatic and aromatic compounds. Nomenclature, qualitative theory of valence and reactions. Commercial and laboratory syntheses and uses of monofunctional compounds.

C342 ORGANIC CHEMISTRY (3 Cr)
P: C341. Equiv. PU CHM 262. Spring, day, night; Summer, day.
Syntheses and reactions of polyfunctional compounds. Natural and industrial products. Physical and chemical methods of purification.

C343 ORGANIC CHEMISTRY LABORATORY (2 Cr)
P or C: C341. Equiv. PU CHM 265L. Fall, day, night; Spring, night; Summer, day.
Fundamental laboratory techniques of organic chemistry and general synthetic methods.

C344 ORGANIC CHEMISTRY LABORATORY (2 Cr)
P or C: C342. P: C343. Equiv. PU CHM 266L. Spring, day, night; Summer, day.
Preparation, isolation and identification of organic compounds; emphasis on modern research methods.

C360 ELEMENTARY PHYSICAL CHEMISTRY (3 Cr)

P: C106, Mathematics M119, Physics P201. Spring, night.

Chemical thermodynamics, chemical equilibria, solutions, phase equilibria, electrochemistry, and kinetics. For students not intending to specialize in physical sciences.

C361 PHYSICAL CHEMISTRY I (3 Cr)

P: C106, Mathematics M216, Physics P202 or P222. Equiv. PU CHM 373. Fall, night.

Order of taking C361 and C362 optional. Gases, kinetic-modular theory, chemical thermodynamics and kinetics, introduction to statistical thermodynamics.

C362 PHYSICAL CHEMISTRY II (3 Cr)

P: C106, Mathematics M311 and Physics P222. Equiv. PU CHM 374. Spring, night.

Order of taking C361 and C362 optional. Introduction to quantum chemistry; structure and spectra of atoms, molecules, and solids; solids, liquids, and phase equilibria.

C363 EXPERIMENTAL PHYSICAL CHEMISTRY (2 Cr)

P: One semester of physical chemistry. Equiv. PU CHM 374L, Spring, day.

Experimental work to illustrate principles of physical chemistry and to introduce research techniques.

C400 CHEMICAL DOCUMENTATION (1 Cr)

P: C341. Equiv. PU CHM 513. Spring, night.

Lectures and library problems on classical and computer techniques of searching and evaluating chemical literature—reference books, periodicals, patents, etc.

C409 CHEMICAL RESEARCH (1-5 Cr)

P: junior or senior standing and consent of instructor. Equiv. PU CHM 499. Every semester. Time arranged.

Chemical or literature research. Can be elected only after consultation with research advisor and approval of program. May be taken for a total of 10 credits.

C410 INSTRUMENTAL METHODS OF ANALYSIS (4 Cr)

P: 1 year of physical chemistry, C310. Equiv. PU CHM 424. Spring, night.

Theory and practice of modern analytical methods, including electroanalytical techniques, quantitative spectrophotometry, chromatography and radiochemical methods. Lectures, laboratory.

C430 INORGANIC CHEMISTRY (3 Cr)

P: 1 year of physical chemistry. Equiv. PU CHM 342. Fall, night.

An introduction to the principles of inorganic chemistry with emphasis on the chemistry of the nontransition elements. A brief introduction to coordination chemistry and ligand field theory.

C443 FUNDAMENTAL ORGANIC CHEMISTRY (3 Cr)

P: C342. Equiv. PU CHM 561. Fall, night.

Reactive intermediates and physical methods in organic mechanisms.

C483 BIOLOGICAL CHEMISTRY (3 Cr)

P or C: CHT 224 or C310, C342. Equiv. PU CHM 533. Spring, night.

Chemistry of biologically important molecules, including carbohydrates, lipids, proteins and nucleic acids. Special emphasis on chemistry of intermediary metabolism.

525 INSTRUMENTAL METHODS OF ANALYSIS (3 Cr)

P: C310. P or C: second semester physical chemistry. Not open to students with credit in CHM 524. Equiv. PU CHM 525. Spring, night.

Survey of optical and electrical methods of chemical analysis, including topics in instrumentation.

525L INSTRUMENTAL METHODS OF ANALYSIS LABORATORY (1 Cr)
P or C: 525. Equiv. PU CHM 525L. Spring, night.
Laboratory work in instrumental methods and instrumentation discussed in 525.

C530 ADVANCED INORGANIC CHEMISTRY (3 Cr)
P: C430 or 542. Equiv. PU CHM 641. Spring, night.
Bonding in inorganic chemistry, symmetry and group theory, transition metal chemistry, spectra and magnetism, mechanisms of inorganic reactions, lanthanides and actanides, organometallic compounds.

542 INORGANIC CHEMISTRY (3 Cr)
P: 1 year of physical chemistry. Equiv. PU CHM 542. Fall, night.
An introduction to the principles of inorganic chemistry with emphasis on the chemistry of the nontransition elements. A brief introduction to coordination chemistry and ligand field theory.

573 PHYSICAL CHEMISTRY (3 Cr)
P: C106, Mathematics M216, Physics P202 or P222. Equiv. PU CHM 573. Spring, night.
Order of taking 573 and 574 optional. Gases, kinetic-molecular theory, chemical thermodynamics and kinetics, introduction to statistical thermodynamics.

574 PHYSICAL CHEMISTRY (3 Cr)
P: C106, Mathematics M311 and Physics P222. Equiv. PU CHM 574. Fall, night.
Order of taking 573 and 574 optional. Introduction to quantum chemistry; structure and spectra of atoms, molecules, and solids; solids, liquids, and phase equilibria.

599 SPECIAL ASSIGNMENTS (1-4 Cr)
P: consent of instructor. Equiv. PU CHM 599. Every semester, on demand. Time arranged.
Directed reading or special work not included in other courses.

621 ADVANCED ANALYTICAL CHEMISTRY (3 Cr)
P: C310, C410. Spring, even years, night.
A critical survey of recent chemical and instrumental methods of analysis.

626 ON LINE COMPUTER TECHNIQUES IN CHEMICAL INSTRUMENTATION (3 Cr)
P: 621. Spring, odd years, night.
Introduction to the basics of digital instrumentation and the incorporation of digital computers in the chemical laboratory.

636 BIOCHEMICAL MECHANISMS (3 Cr)
P: 1 year of physical chemistry and 651. Fall, night.
The chemical basis of enzymatic catalysis with particular emphasis on catalytic interactions important in aqueous media.

651 ADVANCED ORGANIC CHEMISTRY (3 Cr)
P: 561. Spring, night. Every third semester.
Organic reactions.

652 ADVANCED ORGANIC CHEMISTRY (3 Cr)
P: 651. Fall, night. Every third semester.
Organic syntheses.

668 THEORETICAL ORGANIC CHEMISTRY (3 Cr)
P: 651. Fall, night. Every third semester.
Emphasis on organic reaction mechanisms including effects of structure and medium.

671 ADVANCED PHYSICAL CHEMISTRY (3 Cr)
P: 1 year of physical chemistry. Fall, night.
Selected topics including atomic and molecular structure, spectroscopy.

672 QUANTUM CHEMISTRY (3 Cr)
P: 671. Spring, odd years, night.
Basic principles of classical and quantum mechanics; exact solutions for simple systems.

675 CHEMICAL KINETICS (3 Cr)
P: 671. Fall, odd years, night.
Experimental and theoretical considerations of chemical reaction rates and mechanisms.

679 CHEMICAL THERMODYNAMICS (3 Cr)
P: 671. Spring, even years, night.
Advanced thermodynamics of chemical and phase equilibria, of electrolyte and nonelectrolytic solutions, and of imperfect gases.

696 SPECIAL TOPICS IN CHEMISTRY (3 Cr)
On demand, night.
Lectures on selected topics of current interest.

Occasional courses of special interest are offered on the undergraduate and graduate level. For details see Special Programs, this bulletin.

DEPARTMENT OF GEOLOGY

PROFESSOR: Weihaupt; ASSOCIATE PROFESSOR: Mirsky (Chairman); ASSISTANT PROFESSOR: Brown.

Geology is the science of the earth—man's systematic attempt to understand the planet and the environment in which he dwells. Geology includes the location, extraction, and economic use of minerals, rocks, soils, water, coal, and petroleum. These natural resources compose the earth and make possible our modern technology and civilization. Geologists study the landforms produced by volcanoes, streams, wind, glaciers, and other surficial earth processes. Geologists investigate the internal earth processes of earthquakes, mountain building, continental drift, and sea-floor spreading. Geology includes the fossils which record the development of life on the earth and also includes the investigation of the billions of years of earth history. Geology has recently expanded to include the study of the moon and the earth-like planets.

The Department of Geology furnishes training for (1) those who desire to become professional geologists and seek careers in industry, in research laboratories, in federal or state or local government, or in university or college teaching; (2) those who wish to teach earth science or geology at the secondary school level; and (3) those who seek a general knowledge of geology, its relationship to other sciences, and its importance to the environment of mankind.

The following degree options are offered in geology. The choice of a particular degree option and proposed plan of study must be made in consultation with a departmental counselor.

BACHELOR OF ARTS DEGREE PROGRAM WITH MAJOR IN GEOLOGY

GENERAL GEOLOGY OPTION

General Course Requirements

Area I: English W117

Area II: Two semesters of foreign language.

There is no requirement beyond the first year of foreign language for either option. However, those planning to continue with graduate studies, especially toward the doctorate, normally are urged to take a modern foreign language beyond the first year level. Those planning to obtain only the A.B. degree, particularly in such specialties as Secondary Earth Science Teaching, Environmental Geology, or Applied Geology may find it more advantageous to substitute other electives for such additional modern foreign language. Each student should consult his departmental counselor to determine his foreign language needs.

Area III: Four courses in Arts and Humanities (e.g. English, Fine Arts, Folklore, History, Philosophy, Speech & Theatre)

Four courses in Social and Behavioral Sciences (e.g. Anthropology, Economics, Geography, Political Science, Psychology, Sociology, Urbanism)

Two Courses in Biological Sciences

Two Courses in Mathematics and Physical Sciences (fulfilled by Geology requirements)

Geology Requirements (Area IV)

30 credits of Geology (including G109, G110, G205, G221, G222, G323, G334, G404), 10 credits of chemistry, and sufficient credits from related subjects to complete the concentration group. This program can provide, in addition to a broad general education, an adequate background for professional employment and advanced study in geology.

Other Requirements

A. Electives to make a minimum of 122 credits. Students who are considering advanced study and desire a more rigorous program are urged to consider the following science electives: Chemistry C105-106, Physics PHYS 218-219 or PHYS 152 and 251, and Math M163-164.

B. Minimum cumulative grade-point average of 2.0.

C. Minimum of 30 credits in courses at 300-400 level.

D. No course in which the student receives a grade of D can be used to fulfill a geology requirement.

E. Normally only 10 credits from courses outside the Schools of Science and Liberal Arts can be applied towards the degree. Exceptions are made for courses in Military Science and certain courses in the Schools of Business, Education, and Engineering/Technology. Contact departmental counselors for further details.

EARTH SCIENCE SECONDARY TEACHING CERTIFICATION OPTION

General Course Requirements

A. **Humanities:** 16-18 credits

Area I: English W117

Area II: Two semesters of foreign language. See comments above for General Geology option concerning departmental language requirement.

Area III: Four courses in Arts and Humanities (e.g. English, Fine Arts, Folklore, Philosophy, Speech & Theatre)

B. **Social and Behavioral Sciences:** 14-16 credits

Area III: Four courses in Social and Behavioral Sciences (e.g. Anthropology, Economics, Geography, History, Political Science, Psychology, Sociology, Urbanism)

C. **Life and Physical Sciences:** 14-16 credits

Area III: Two courses in Biological Sciences

Area IV: Two courses in Mathematics and Physical Sciences

D. **Electives as needed to obtain a total of 50 credits of Humanities**

Earth Science Requirements (Area IV)

40 credits of Geology and related subjects (including G109, G110, G205, G221, G222, G323, G334, G404), 10 credits of Chemistry. The additional related subjects are listed below:

Certification Requirements

Astronomy, A100 or A105 — 3 credits
Physical Geography, G107 — 3 credits
Meteorology, G304 — 3 credits
Conservation, G316 or G416 or T480 — 3 credits
Regional Geography, G300 or G326 or G329 or G415 — 3 credits
Field Techniques or Cartography, G303 or G429 — 3 credits
Physical Anthropology, A303 — 3 credits

Professional Education Requirements

24 credits including F100, P280, M449, M462, M480, and S485. Every student who plans to obtain a teaching certificate must meet a minimum competence in a speech and hearing test and be formally admitted to the teacher education program. M449 must be taken one semester before student teaching. Also methods and student teaching must be taken on the same campus.

Other Requirements

a. Electives to make a minimum of 124 credits.
b. Minimum cumulative grade-point average of 2.0.
c. Minimum of 30 credits in 300-400 level courses.
d. No course in which the student receives a grade of D can be used to fulfill a geology requirement.
e. An average of C or better for education courses (with at least a C in M449).
f. Normally only 10 credits from courses outside the Schools of Science and Liberal Arts can be applied towards the degree. Exceptions are made for courses in Military Science and certain courses in the Schools of Business, Education, and Engineering/Technology. Contact departmental counselor for further details.

COURSES IN GEOLOGY

Courses with numbers in the 100's and 200's are lower division undergraduate courses. Courses with numbers in the 300's and 400's are upper division undergraduate courses which may, in some cases, be used for graduate credit. Courses in the 300's, prefixed by G or T, may be used for graduate credit *only* by M.A.T. students and graduate students in Education. The T prefix indicates that the course is especially designed for prospective teachers. Courses in the 400's may be taken for graduate credit by all graduate students.

NOTE: P—prerequisite; C—concurrent registration; R—recommended; Every—offered in both Fall and Spring Semesters and Summer Session; Fall—offered Fall Semester; Spring—offered Spring Semester; Summer—offered in one or both of the Summer Sessions; Day—offered as a daytime section; Night—offered as an evening section. For courses with no designated semester or section consult the *Schedule of Classes*. Equiv.—course is equivalent to the indicated course taught at Indiana University-Bloomington or the indicated course taught at Purdue University-West Lafayette.

G109 GEOLOGY: EVOLUTION OF THE EARTH (3 Cr)

P: None. Equiv. IU G104, IU G112, and PU GEOS 112. Every, day; Fall, night.

Basic principles of interpreting earth history: geologic time, stratigraphic analysis, reconstructing past environments. Physical development of the earth: geosynclines, mountainbuilding, continental drift, sea-floor spreading. Origin and development of life: evolution, the fossil record. Credit not given for both G109 and G100 or G105.

G110 GEOLOGY: THE EARTH'S ENVIRONMENT (3 Cr)

P: None. Equiv. IU G103, IU G111 and PU GEOS 111. Every, day; Spring, night.

Description, classification, and origin of minerals and rocks. Internal processes: earthquakes, rock deformation, origin of crustal structures. External processes: landslides, streams, glaciers, groundwater, man's geologic environment. Credit not given for both G110 and G100 or G105.

G205 REPORTING SKILLS IN GEOSCIENCE (2 Cr)

P: English W117, Geology G109 or G110. Fall, day.

Techniques of presenting written and oral reports from the geoscience approach. The written report: mechanics of format and illustrations, proper citation of geoscience literature, the Abstract, proof-reading and editing. The oral report: effective presentation and response to audience questions, simulating a professional science meeting.

G221 INTRODUCTORY MINERALOGY (3 Cr)

P: An introductory geology course or consent of instructor. Fall, day.

Crystallography: morphology, classes, twinning, habit. Mineral chemistry, physics, and genesis. Description, identification, association, occurrence, and use of common and important minerals. Credit not given for both G221 and G106 or T306.

G222 INTRODUCTORY PETROLOGY (3 Cr)

P: G221. Spring, day.

Igneous, sedimentary, and metamorphic rocks: composition, field occurrence, characteristics, classification, and origin, laboratory description and identification. Credit not given for both G222 and G106 or T306.

G300 ENVIRONMENTAL AND URBAN GEOLOGY (3 Cr)

P: G109 or G110 or Geography G107 or consent of instructor. Spring, day.

Significance of regional and local geologic features and geologic processes in land use planning; use of geologic data in areas of rapid urbanization to properly utilize mineral and water resources and to assess potential geologic hazards.

G303 GEOLOGY: MAPS AND AIR PHOTOS (3 Cr).

P: G109 or G110, or Geography G107 and consent of instructor. Fall, day.

Field use and interpretation of maps and aerial photographs. Planimetric, topographic, geologic, and soils maps; vertical and oblique air photos and photo mosaics. Introduction to remote sensing: infrared and radar imagery.

G316 MINERAL RESOURCES (3 Cr)

P: G110 and consent of instructor. Fall, day.

Formation of mineral deposits; survey of world's major mineral resources presented on a geological, historical, and economic basis. Credit not given for both G316 and G416.

G323 STRUCTURAL GEOLOGY (3 Cr)
P or C: G222. R: G303. Spring, day.
Nature and origin of primary and secondary structural features of the earth's crust; with emphasis on mechanics of deformation and origin. Laboratory consists of three-dimensional problems illustrating structural concepts. Field trips.

G334 PRINCIPLES OF SEDIMENTATION AND STRATIGRAPHY (3 Cr)
P: G222 or consent of instructor. Spring, day.
Interrelationship of sedimentation and stratigraphy: processes and factors influencing genesis of sedimentary strata; provenance, depositional environment, sedimentary facies, paleoecology; analytical techniques, application of principles to interpretation of stratigraphic record.

G401 OPTICAL MINERALOGY (3 Cr)
P: G222. Fall in Alternate Years, day.
Principles of optical crystallography applied to identification of minerals by immersion and thin-section methods. Solid solution series and chemical relations within the rock-forming minerals.

G402 PETROGRAPHY AND ADVANCED PETROLOGY (3 Cr)
P: G401. Spring in Alternate Years, day.
Identification, description, and classification of igneous, sedimentary, and metamorphic rocks using the petrographic microscope. Textures, structures, mineralogical, and chemical classification; petrogenesis including field relations, physical and chemical aspects of rock systems, with emphasis on phase relations. G410 (1 Cr) must be taken concurrently.

G404 GEOBIOLOGY (3 Cr)
P: G109 or consent of instructor. R: Zoology Z103. Fall, day.
Principles of paleontology. Application of biological principles and use of fossils in the study of earth history. G410 (1 Cr) must be taken concurrently for field project.

G410 UNDERGRADUATE RESEARCH IN GEOLOGY (1-6 Cr)
P: junior standing and consent of instructor. Every, day.
Field and laboratory research in selected problems in geology. May be repeated. Total of 6 credits may be applied toward the degree.

G413 INTRODUCTION TO EARTH PHYSICS (3 Cr)
P: consent of instructor. Fall, day.
Physics in the study of the earth, its origins, history, and internal constitution.

G415 PRINCIPLES OF GEOMORPHOLOGY (3 Cr)
P: G110 and consent of instructor. Fall, day.
Geomorphic processes, evolution, and classification of landforms. Laboratory: topographic, geologic, and soil maps; aerial photographs.

G416 ECONOMIC GEOLOGY (3 Cr)
P: G222. Fall, day.
Origin, geologic occurrence, distribution, use, and conservation of important geologic natural resources of the world. Metallic minerals; industrial minerals and rocks; coal, petroleum, natural gas, and other energy resources; water as a natural resource. Credit not given for both G416 and G316.

G420 REGIONAL GEOLOGY FIELD TRIP (1-2 Cr)
P: consent of instructor. Spring, day.
Seminar and field investigation of selected regions for study of mineralogic, lithologic, stratigraphic, structural, paleontologic, geomorphologic, or other geological relationships. Seminar held during the semester. Six to ten days in the field during or following the semester.

G429 FIELD GEOLOGY IN THE ROCKY MOUNTAINS (8 Cr)
P: G221, G222, G323, and G334. Summer.
Eight weeks including six weeks at Geologic Field Station in Montana. Geologic reconnaissance, measurement of stratigraphic sections, mapping on aerial

photographs, construction of structure sections. Regional geomorphology, stratigraphy, and structure through South Dakota, the Black Hills, Wyoming, Montana, Yellowstone Park, and Glacier Park. Students register through the Geology Department at Indiana University-Bloomington.

G451 PRINCIPLES OF HYDROGEOLOGY (3 Cr)

P: G109, G110 or consent of instructor. R: G334. Spring, day.

Water resources: occurrence, regulation, and management of water; hydrologic cycle, water movement, well hydraulics; water quality and pollution; surface and subsurface investigations; basin-wide development of water resources; legal aspects; relationship of hydrogeology to engineering geology.

G490 UNDERGRADUATE SEMINAR (2-3 Cr)

P: junior or senior standing and consent of instructor. Fall, day.

Readings and discussion of selected topics. May be repeated, provided different topics are studied, for a maximum of 6 credits.

T309 EARTH SCIENCE: GEOLOGIC ASPECTS I (3 Cr)

P: None. Fall, night.

Introductory course for advanced students. Basic principles of interpreting and reconstructing earth history; physical and biological evolution of the earth. May be used for graduate credit by students in education. Credit not given for both T309 and G109.

T310 EARTH SCIENCE: GEOLOGIC ASPECTS II (3 Cr)

P: None. Spring, night.

Introductory course for advanced students. Geologic principles, minerals and rocks, internal and external geologic processes. May be taken for graduate credit by students in education. Credit not given for both T310 and G110.

T480 SEMINAR IN EARTH SCIENCE (3 Cr)

P: consent of instructor. Spring, day.

Selected topics in earth sciences. May be repeated, provided different topics are studied, for a maximum of 6 credits.

DEPARTMENT OF MATHEMATICAL SCIENCES

PROFESSORS: Gemignani, Johnston; PROFESSORS EMERITUS: Suter, Sconce; ASSOCIATE PROFESSORS: Alton, Bittinger, Crown, Kleyle, Kuczkowski, Loh, Naghdi; ASSISTANT PROFESSORS: Bridges, Burkinshaw, John Gersting, Judith Gersting, Hunter, Kaminker, Laverell, Penna, Ridge, Samn; INSTRUCTOR: Suer; LECTURERS: Rigo, Shaver.

The Department of Mathematical Sciences includes the areas of Computer Science, Mathematics, Mathematics Education, and Statistics. The department offers the Bachelor of Science degree with major in Mathematics and provides electives leading to specialization in any one of five optional areas: pure mathematics, applied mathematics, computer science, statistics, and secondary school teaching. Since prospective teachers must comply with the requirements for certification imposed by the states in which they expect to teach, the option in secondary school teaching has general, major, and minor requirements slightly different from those of the other four options.

The department offers the Bachelor of Science degree in Computer Science.*

Graduate degrees offered are: Master of Arts in Teaching, Master of Science (Applied Computer Science), Master of Science (Option for Teachers), and Master of Science.

UNDERGRADUATE PROGRAMS

BACHELOR OF SCIENCE WITH MAJOR IN MATHEMATICS

Although a student may declare a mathematics major in his freshman year, he is not officially admitted to the department as a major in mathematics until completion of MA 351 or its equivalent. An average grade of 2.0 with no failing grades in mathematics courses through MA 351 is a minimum indication of success in this major.

General Requirements

The requirements for the Bachelor of Science degree with major in Mathematics in any optional area except secondary school teaching are:

1. Those general requirements of the University and the School of Science, treated earlier in this bulletin under "Graduation Requirements for Purdue University Degrees," except that
   a. Mathematics courses below MA 163 do not count toward the degree.
   b. Courses in other schools that are primarily mathematical may not be used to fulfill the 18-hour humanities and social science requirement of the School of Science. If in doubt about a particular course, the student should consult his advisor.

2. Those relating to the minor.
3. Those relating to the major.

*Authorization is currently being sought to offer this degree at IUPUI. Students may already register for this degree at Purdue, Lafayette.

Minor Requirements

In order that a student should acquire some depth of study in a subject outside his major area, he is required to have a minor in the natural sciences, the social sciences, the behavioral sciences, or the humanities. For this minor he needs 18 hours including at least three courses beyond the introductory level. While a minor is usually in one department it may be from two or more, if the student's advisor approves. Courses may be used for the double purpose of fulfilling general requirements and the minor requirements of the Department of Mathematical Sciences. Physics is a good choice of minor for students in this department.

Major Requirements

1. The calculus sequence MA 163, 164, 261.
2. One year of algebra, MA 351 and 453.
3. One year of analysis chosen from MA 361, 362, 441, 442, CS 414 (Note that MA 361 is a prerequisite for CS 414.)
4. Nine additional hours in mathematics, computer science, or statistics with no more than one statistical methods course.
5. A graduation index of at least 2.0 in those used to fulfill the minimum requirements listed under 2, 3, and 4 above.

These requirements are minimal, and it is expected that most students will take programs stronger than the minimum.

The student whose primary interest is in applied mathematics, computer science, pure mathematics, statistics, or secondary school teaching should see his advisor for suggestions concerning his plan of study.

Secondary School Teaching Option

General Requirements

The general requirements for this option differ from the other options in that only one course (5 Cr) is required in a modern foreign language.

Minor Requirements

The student in this option is encouraged, but not required, to have a minor.

Major Requirements

1. The calculus sequence MA 163, 164, 251.
2. One year of Algebra MA 351, 453.

3. One year of analysis consisting of either MA 300 or MA 441 and one of MA 361, 362, 442.
4. One course in geometry MA 563 or 561.
5. One course in statistics STAT 311, 516, or 519.
6. One mathematics elective above the 300 level.
7. Five additional credits in mathematics, computer science, statistics, or physics.

According to Indiana state law, a student should have fifty semester hours in general education courses as part of the requirement for a teaching license.

BACHELOR OF SCIENCE IN COMPUTER SCIENCE

The requirements for the Bachelor of Science degree in Computer Science are:

1. Those general requirements of the University and the School of Science, treated earlier in this bulletin under "Graduation Requirements for Purdue University Degrees," except that mathematics courses below MA 163 and computer science courses below CS 220 do not count toward the degree.
2. Those relating to the major.

Major Requirements

1. The calculus sequence MA 163, 164, 251.
2. One year of algebra MA 351 and either CS 482 or MA 453.
3. One year of analysis MA 361 and CS 414.
4. CS 220, 300, 402, 461, 484.
5. STAT 511 or 516.
6. At least three additional computer science courses at the 400 level or above of which at least one is a 500 level course.

GRADUATE PROGRAMS

MASTER OF ARTS IN TEACHING

This program is open only to students who are (or are preparing to be) secondary school teachers and whose mathematics background is not sufficient to permit candidacy for the M.S. (Option for Teachers) degree. It is a flexible program designed to provide certificated secondary school teachers with an additional year of training.

This non-thesis program requires a minimum of 33 credits. Not more than six hours of courses with a grade of C may be counted. Required courses are MA 547, 548, 550, 551, 561, 563. In addition the student selects one, three-hour course in mathematics, computer science or statistics and twelve hours of electives which must be approved by his advisory committee.

MASTER OF SCIENCE (OPTION FOR TEACHERS)

Secondary school mathematics teachers who wish to have a stronger program in mathematics will meet the requirements for the M.S. (Option for Teachers). This program requires 33 hours of course work. Required courses are MA 540, 525, 553, 554, 571, 519, and MA 561 or MA 563. Twelve hours of electives are to be selected by the student and his advisory committee.

MASTER OF SCIENCE

This master of science is a strong terminal masters degree with emphasis in pure mathematics. The program normally requires 30 hours of course work. Required courses are MA 525, 544, 545, 553, 554, 571, and one course in the Mathematical Sciences for which some of these are prerequisite. Nine hours of electives are to be selected by the student and his advisory committee.

MASTER OF SCIENCE (APPLIED COMPUTER SCIENCE)

This program is authorized for the Indianapolis Campus by the Department of Computer Science of Purdue University, and it leads to a Purdue University Degree. Attainment of the MS (ACS) represents a high level of competence in the field.

Students entering this program should have an undergraduate degree and a background in computer programming and mathematics with an overall B average or better. All applicants should have completed the following courses (or equivalents) which if taken as deficiency courses carry no credit: CS 220, CS 300, MA 163, MA 164, and MA 261.

Under this program candidates must complete at least 30 credit hours with at least a B average and normally no more than two courses with grade C will be acceptable in a plan of study. Normally no more than 9 credits can be transferred from another institution. Candidates may choose either of two major options, Numerical Analysis or Programming & Systems, with required core courses as follows:

1. Numerical Analysis—CS 514, 520, and either 614 or 615. Students in the Numerical Analysis option should also have completed MA 262 (or 361), MA 511* (or 351), and CS 512* (or 414).
2. Programming & Systems—CS 502, 503, and 660. Students in the Programming & Systems option should also have completed CS 402*, 461*, MA 511* (or 351), and should take CS 501 as an elective.

Normally a plan of study should include at least one course from each of the following four categories: numerical analysis above CS 512*, programming & systems above CS 500, logic and automata theory, mathematics above MA 511*.

The 30 credit hours may be completed with electives chosen from graduate level courses (see note *) in the fields of computer science, mathematics, and engineering.

*Within reason and with approval of the candidate's advisory committee, courses marked * and certain others such as CS 402, CS 461, MA 510, STAT 511 will be accepted for half credit (i.e. 1½ credit for a nominally 3 credit course).

COURSES IN MATHEMATICAL SCIENCES

Information pertaining to time of offering is intended only as a guide for the student. Schedules are sometimes very tentative. For this reason very little summer session information has been included.

COMPUTER SCIENCES

UNDERGRADUATE LEVEL
Lower-Division Courses

CS 201 INTRODUCTION TO COMPUTERS FOR THE HUMANITIES (3 Cr)
P: None.
An introduction to computers for undergraduates in humanities, social sciences, and education. Symbolic representation of information; algorithms; symbolic models; errors in models. Programming in BASIC language; survey of non-numeric languages. Historical and current research involving computers in the humanities. Information storage and retrieval, privacy, and security; computerized services; depersonalization; legal problems.

CS 208 THE COMPUTER IN BUSINESS (2 Cr)
P: MA 111 or equivalent. Fall, Spring, day, night.
Introduction to digital computers and illustrations of their use in business: stored program concept, types of programming languages, computer experience using the FORTRAN language to solve business oriented problems.

CS 220 INTRODUCTION TO ALGORITHMIC PROCESSES (3 Cr)
P or C: One semester of mathematics beyond MA 151. Not open to students with credit in CS 208. Fall, Spring, day, night.
Introduction to the intuitive notion of an algorithm; representation of algorithms in narrative form as flow charts and as computer programs; general structure of computers; computer experience using a procedure-oriented language in programming algorithms such as those used in elementary numerical calculations, sorting, simulation of a random process and symbol manipulation; definition and use of functions, subroutines and iterative procedures; survey of a variety of significant uses of computers.

Upper-Division Courses

CS 300 ELEMENTS OF COMPUTERS AND PROGRAMMING (3 Cr)
P: CS 220. Spring, day, night.
Components of digital computer. Number and character representation codes. Error detection and correction coding schemes. Absolute and assembly language programming, pseudo operations, macros and buffering. Communication between operating system and user program.

CS 385 INTRODUCTION TO LOGIC
See MA 385.

CS 402 INTRODUCTION TO COMPUTER SYSTEMS (3 Cr)
P: CS 300. Fall, night.
Two pass assembler. Relocatable loader. Computer arithmetic. Components of central processing unit and program execution. Types of computer memories. Interfacing of input-output equipment, sequential access devices, direct access devices. Examination of the architecture of some specific computers. Sorting.

CS 414 INTRODUCTION TO NUMERICAL ANALYSIS (3 Cr)

P: MA 262 or MA 361, CS 220 or equivalent. Fall, night.

Error analysis, solution of nonlinear equations, direct and iterative methods for solving linear systems, approximation of functions, numerical differentiation and integration, numerical solution of ordinary differential equations.

CS 461 ALGORITHMIC LANGUAGES (3 Cr)

P: CS 300 or equivalent. Spring, night.

Syntax and semantics of ALGOL, COBOL and PL/1. Students are expected to write, debug, and run programs in the languages discussed.

CS 482 DISCRETE COMPUTATIONAL STRUCTURES (3 Cr)

P: MA 351. Fall, night.

Finite algebraic structures and their applications to the theory of computers. Sets, binary relations, partial orderings, Boolean algebras, directed graphs, finite state machines, minimization, gating networks, semigroups, monoids, groups.

CS 484 MODELS FOR ALGORITHMIC PROCESSES (3 Cr)

P: CS 482 or MA 453. Spring, night.

Finite automata, McCulloch-Pitts neural networks, regular expressions, algebraic decomposition of finite automata, Turing machines, universal Turing machine, unsolvability problems, recursive functions, Church's thesis.

CS 490 TOPICS IN COMPUTER SCIENCES FOR UNDERGRADUATES (1-5 Cr)

By arrangement.

Supervised reading and reports in various fields. Open to students only with the consent of the department.

CS F490 USER ORIENTED SYSTEMS SOFTWARE ARCHITECTURE AND ADVANCED FORTRAN

P: CS 220 or equivalent.

User oriented discussion of file manipulation, utility packages, loader directives, plotting (CALCOMP), interactive computing (INTERCOM, FORTRAN, BASIC), multiple step job streams. Study of FORTRAN from the point of view of advanced topics as storage, management, information passage, character manipulation and input-output idiosyncracies.

DUAL LEVEL
Undergraduate-Graduate

CS 501 DATA AND STORAGE STRUCTURES (3 Cr)

P: CS 402. R: 461. Fall, night.

Methods of organizing and linking together information stored in computer memory and on disks. Representation of discrete events, datafiles, polynomials, etc., lists and trees. Storage allocation and reclamation in computer memory. Applications to compiler and operating system design, information storage, symbol manipulation, and simulation problems. Programming in list and string processing languages.

CS 502 OPERATING AND PROGRAMMING SYSTEMS (3 Cr)

P: CS 402. R: CS 501. Spring, night.

Basic principles of operating systems. Control of translation, loading, and execution. Reloading loaders and overlay generation. Symbolic coding systems. Lexical and syntactic analysis. Design and operation of assemblers and macroprocessors. Introduction to compiler design. Interpretive systems.

CS 503 DESIGN OF OPERATING SYSTEMS (3 Cr)

P: CS 502.

Topics in the area of operating systems and computer architecture, multiprogramming and multiprocessor systems, dynamic storage allocation and virtual memory systems, time-sharing systems, interaction between hardware and software.

CS 512 NUMERICAL METHODS FOR ENGINEERS AND SCIENTISTS (3 Cr)

P: MA 262 or MA 361, CS 220 or equivalent. Not open to students with credit in CS 414. Fall, night.

Error analysis, solution of nonlinear equations, direct and iterative methods for solving linear systems, eigenvalues, approximation of functions, interpolation, numerical differentiation and integration, numerical solution of ordinary differential equations, numerical instability.

CS 514 NUMERICAL ANALYSIS (3 Cr)

P: CS 414 or CS 512 or equivalent. Spring, night.

Difference equations, spline theory, analysis of interative methods for solving nonlinear equations, quotient-difference algorithm for solution of polynomial equations, numerical solution of ordinary differential equations, analysis of algorithms for stability and round-off error.

CS 515 NUMERICAL ANALYSIS OF LINEAR SYSTEMS (3 Cr)

P: MA 351 or 511, CS 220 or equivalent.

Computational aspects of linear algebra; linear equations and matrices, direct and iterative methods; eigenvalues and eigenvectors of matrices; error analysis.

CS 520 MATHEMATICAL PROGRAMMING (3 Cr)

P: MA 351 or MA 511.

Systems of linear equations, Gauss-Jordan reduction and echelon form, systems of linear inequalities, convex sets, linear programming, simplex method, duality, parametric programming, integer programming, networks.

CS 542 DESIGN OF DATA PROCESSING SYSTEMS (3 Cr)

P: CS 402 or consent of the instructor. Spring, night.

Structuring of data processing systems and computer organization as it affects those systems. File organization, file maintenance routines; sorting, retrieval algorithms. Evaluation and analysis of batch processing, real time, and time share systems and the related problems of feasibility and implementation. The total systems concept in the design of integrated information systems.

CS 543 SIMULATION AND INFORMATION PROCESSING (3 Cr)

P: MA M119, CS 208 or 220, STAT 311 or 511, or consent of the instructor. R: CS F490. Fall, night.

Simulation and modeling. Monte Carlo techniques; use of special simulation languages to simulate actual systems; generation of random numbers and stochastic variates; verification of simulation models; design of simulation experiments.

CS 572 HEURISTIC PROBLEM-SOLVING (3 Cr)

P: CS 461. Recommended P: CS 501.

Design and development of heuristic problem-solving systems. The emphasis is on the development of general data representations, heuristics, and problem solving strategies which can be applied to a wide class of problems. The task areas explored include game playing, theorem proving, pattern recognition, semantic information processing, cognitive psychology, design synthesis, robotology, and integrated artificial intelligence systems.

CS 582 AUTOMATA, FORMAL LANGUAGES, AND COMPUTABILITY I (3 Cr)

P: CS 484 or MA 453. By arrangement.

Basic notions of algebra and its application in computer science. Behavior of finite automata, algebraic operations on automata, minimization of automata, analysis and synthesis theorems. Regular expressions, regular sets, and their relationship to automata. Grammar for formal languages, derivation trees. Regular systems; context-free languages, deterministic languages, concept of ambiguity. Pushdown automata, operations on languages. LR (k) grammars.

CS 584 AUTOMATA, FORMAL LANGUAGES, AND COMPUTABILITY II (3 Cr)

P: CS 582. By arrangement.

Post systems (type O grammars) and context sensitive grammars; Turing machines and linear bounded automata; Shepherdson Sturgis programs; universal programs. The Church-Turing Thesis. Applications to decision problems; testing for

ambiguity, identity, containment, etc. for languages defined by various grammars. A general theory of strong programming languages: the recursion theorem, Roger's theorem on translations, Rice's theorem on input-output relations. The general theory of computational complexity with emphasis on simple optimization problems too general to be algorithmically solvable: Blum speed-up theorem, Blum's theorems on the size of programs and optimization techniques; gap theorem. Time and storage bounds for recognition devices: crossing sequences, lower bounds on tape complexity, tape and time hierarchies; time and space requirements for recognizing context free languages.

CS 585 MATHEMATICAL LOGIC I
(See MA 585)

CS 586 MATHEMATICAL LOGIC II
(See MA 586)

CS 590 TOPICS IN COMPUTER SCIENCES (1-5 Cr)
By arrangement.
Directed study for students who wish to undertake individual reading and study on approved topics.

CS T590 COMPUTER SCIENCE FOR TEACHERS (3 Cr)
Summer.

GRADUATE LEVEL

CS 614 NUMERICAL SOLUTION OF ORDINARY DIFFERENTIAL EQUATIONS (3 Cr)
P: CS 514 or consent of the instructor. Fall, night. By arrangement.
Numerical solution of initial-value problems by Runge-Kutta methods, general one-step methods, and multistep methods. Analysis of discretization error and rounding error. Stability of multistep methods. Numerical solution of boundary-and eigen-value problems by initial-value techniques and finite difference methods.

CS 615 NUMERICAL SOLUTION OF PARTIAL DIFFERENTIAL EQUATIONS (3 Cr)
P: CS 514, MA 523. By arrangement.
The numerical solution of hyperbolic, parabolic, and elliptic equations by finite difference methods; iterative methods (Gauss-Seidel, overrelaxation, alternating direction) for solving elliptic equations; discretization and round-off errors; explicit and implicit methods for parabolic and hyperbolic systems; the method of characteristics; the concept of stability for initial value problems.

CS 660 DESIGN OF TRANSLATING SYSTEMS (3 Cr)
P: CS 502.
Systems design of higher level programming languages and their processors. Symbol tables, lexical scan, syntax scan, object code generation and optimization. Boot-strapping techniques, higher level translators, self compilers, and decompilers. Heuristic generators.

MATHEMATICS

SPECIAL SERVICE COURSES

MA 001 HIGH SCHOOL ALGEBRA (0 Cr one unit for admission)
Fall, Spring, night.
Covers the material in the first year of high school algebra. Numbers and algebra, integers, rational numbers, equations, polynomials, graphs, systems of equations, inequalities, radicals.

MA 002 PLANE GEOMETRY (0 Cr)
P: MA 001 or one year of high school algebra. Fall, Spring, night.
Covers the material in a year of high school geometry. Sets and real numbers, coordinate systems, loci, lines, circles, angles, triangles, constructions, area and perimeter, surface area and volume.

UNDERGRADUATE LEVEL

Lower-Division Courses

MA 111 ALGEBRA (3 Cr)
P: MA 001 or one year of high school algebra. Fall, Spring, day, night.
Real numbers, linear equations and inequalities, systems of equations, polynomials, exponents logarithmic functions. Covers material in the second year of high school algebra.

MA 112 TRIGONOMETRY (3 Cr)
P: MA 111 or 3 semesters of high school algebra. Fall, Spring. Not open to students with credit in MA 151 or 153.
Real numbers, factoring, functions, exponents, trigonometric functions, tables, identities, complex numbers.

MA M118 FINITE MATHEMATICS I (3 Cr)
P: MA 111 or equivalent. Equiv. PU MA 213. Fall, Spring, day, night.
Set theory, vectors, matrices, permutations, combinations, simple probability, conditional probability, Markov chains, linear programming, graphical and simplex methods, duality theorem.

MA M119 BRIEF SURVEY OF CALCULUS I (3 Cr)
P: MA 111 or two years of high school algebra. Fall, Spring, day, night.
Sets, limits, derivatives and applications, integrals and applications, functions of several variables.

MA 130 MATHEMATICS FOR ELEMENTARY TEACHERS I (3 Cr)
P: MA 001 or one year of high school algebra, MA 002 or one year of high school geometry. Equiv. IU MA T101. The sequence MA 130, 131, 132 fulfills the mathematics requirements for elementary education majors. Fall, Spring, day, night.
Numeration systems, mathematical reasoning, natural numbers, whole numbers, properties, algorithms, sets, sentences, logic.

MA 131 MATHEMATICS FOR ELEMENTARY TEACHERS II (3 Cr)
P: MA 130. Equiv. IU MA T102. Fall, Spring, day, night.
Number systems: numbers of arithmetic, integers, rationals, reals, mathematical systems, decimal and fractional notations; probability, simple and compound events, algebra review.

MA 132 MATHEMATICS FOR ELEMENTARY TEACHERS III (3 Cr)
P: MA 131. Equiv. IU MA T103. Fall, Spring, day, night.
Metric and nonmetric properties of geometric figures, measurement; introduction to the foundations of euclidean geometry; coordinate geometry.

MA 147 ALGEBRA AND TRIGONOMETRY FOR TECHNOLOGY I (3 Cr)
P: 3 semesters of high school algebra. Fall, Spring, day, night.
MA 147-148 is a two semester version of MA 150.

MA 148 ALGEBRA AND TRIGONOMETRY FOR TECHNOLOGY II (3 Cr)
P: 4 semesters of high school algebra. Fall, Spring, day, night.
MA 147-148 is a two semester version of MA 150.

MA 150 MATHEMATICS FOR TECHNOLOGY (5 Cr)
P: 3 semesters of high school algebra. Fall, Spring, day, night.
MA 147-148 is a two semester version of MA 150. Fundamental laws of algebra, functions and graphs, trigonometric functions, linear equations, factoring, exponents, vectors, complex numbers, logarithms, ratio, proportion, variation.

MA 151 ALGEBRA AND TRIGONOMETRY (5 Cr)

P: MA 111 or three semesters of high school algebra. Equiv. IU MA M015. Fall, Spring, day, night.

MA 153, 154 is a two semester version of MA 151. Sets, real numbers, factoring, functions, linear equations, inequalities, exponents, logarithms, permutations, combinations, probability, binomial theorem, trigonometric functions, right triangles, identities, complex numbers, law of tangents.

MA 153 ALGEBRA AND TRIGONOMETRY I (3 Cr)

P: MA 111 or three semesters of high school algebra. Fall, Spring, day, night.

MA 153, 154 is a two semester version of MA 151.

MA 154 ALGEBRA AND TRIGONOMETRY II (3 Cr)

P: MA 153 or five semesters of high school algebra. Equiv. IU MA M017. Fall, Spring, day, night.

MA 153, 154 is a two semester version of MA 151.

MA 163 INTEGRATED CALCULUS AND ANALYTIC GEOMETRY I (5 Cr)

P: 2 years of high school algebra, one semester of trigonometry, one year of geometry. Equiv. IU MA M215. Fall, Spring, day, night.

The Cartesian plane, functions, limits, differentiation and applications, mean value theorem, definite integral and applications.

MA 164 INTEGRATED CALCULUS AND ANALYTIC GEOMETRY II (5 Cr)

P: MA 163, Equiv. IU MA M216. Fall, Spring, day, night.

Transcendental functions, methods of integration, conics, polar coordinates, parametric equations, vectors, improper integrals.

MA 214 FINITE MATHEMATICS II (3 Cr)

P: MA M118.

Vectors, matrices, systems of linear equations, linear programming, game theory.

MA 221 CALCULUS FOR TECHNOLOGY I (3 Cr)

P: MA 150 or equivalent. Fall, Spring, day, night.

Analytic geometry, the derivative and applications, the integral and applications.

MA 222 CALCULUS FOR TECHNOLOGY II (3 Cr)

P: MA 221. Fall, Spring, day, night.

Differentiation of transcendental functions, methods of integration, power series, Fourier series, differential equations.

MA 261 MULTIVARIATE CALCULUS (4 Cr)

P: MA 164. Equiv. IU MA M311. Fall, Spring, day, night.

Partial differentiation, multiple integration, vector functions and vector analysis, infinite series.

MA 262 LINEAR ALGEBRA AND DIFFERENTIAL EQUATIONS (4 Cr)

P: MA 261. Fall, Spring, day, night.

Vector spaces, bases, orthogonality, determinants, differential equations, first order equations, applications, second order equations.

Upper-Division Courses

MA 300 FOUNDATION OF THE NUMBER SYSTEMS (3 Cr)

P: MA 163. Equiv. IU MA M391. Spring, night.

Logic, sets, functions, relations, groups, natural numbers, rational numbers, real numbers. The notion of proof is emphasized. Suggested for prospective high school teachers.

MA 351 ELEMENTARY LINEAR ALGEBRA (3 Cr)

P: MA 261. Fall, day, night.

Vector spaces, bases, linear transformations, scalar products, triangulation, spectral theorem.

MA 361 ADVANCED CALCULUS AND DIFFERENTIAL EQUATIONS (3 Cr)
P: MA 261. Spring, night.
Uniform convergence, Fourier series, linear differential equations, existence and uniqueness of solutions of first order equations.

MA 362 TOPICS IN ADVANCED CALCULUS (3 Cr)
P: MA 261.
Multivariate calculus, partial differentiation, implicit function theorems, line and surface integrals, vector fields, theorems of Gauss, Green, Stokes.

MA 385 INTRODUCTION TO LOGIC
P: MA 261.
Propositional calculus and predicate calculus with applications to mathematical proofs, valid arguments, switching theory, and formal languages.

MA 441 FOUNDATIONS OF ANALYSIS (3 Cr)
P: MA 261. Fall, night.
Topology of Cartesian spaces, sequences, continuity, differentiation, Riemann-Stieltjes integral.

MA 442 MULTIVARIATE ANALYSIS (3 Cr)
P: MA 351 and 441.
Euclidean spaces, Differentiation, vector valued functions, measure and integration, exterior algebra, differential calculus, integration on manifolds.

MA 453 ALGEBRA I (3 Cr)
P: MA 351 or consent of the instructor. Spring, night.
Fundamental properties of groups, rings, and fields with emphasis on structure, morphisms, quotients, fundamental homomorphism theorems.

MA 454 ALGEBRA II (3 Cr)
P: MA 453.
Rings of polynomials, extension fields, automorphisms of fields, finite fields, Galois theory.

MA 471 INTRODUCTION TO TOPOLOGY (3 Cr)
P: MA 261.
Topological spaces, metric spaces, sequences, completeness, connectedness, compactness. Emphasis on the topological properties of the real line.

MA 490 TOPICS IN MATHEMATICS FOR UNDERGRADUATES (1-5 Cr)
By arrangement.
Supervised reading and reports in various fields. Open only to students with the consent of the department.

MA S490 SENIOR SEMINAR (3 Cr)

MA E490 MATHEMATICS FOR ELEMENTARY TEACHERS (1 Cr)
Fall, day.
This course is for undergraduate students who need one credit in mathematics to meet the State of Indiana certification requirements. Offered for the last time in Fall 1974.

DUAL LEVEL COURSES

Undergraduate—Graduate

MA 510 ADVANCED CALCULUS (3 Cr)
P: MA 262. Fall, night.
Functions of several variables, partial derivatives, differentials, chain rules, extrema, gradient fields, divergence, curl, Laplacians, multiple integration, line integrals, Green's theorem, surface integrals, divergence theorem, Stoke's theorem, change of variable.

MA 511 LINEAR ANALYSIS (3 Cr)
P or C: MA 510. Spring, night.
Matrices, rank and inverse of a matrix, linear programming, simplex method, eigenvectors, unitary and similarity transformations on matrices.

MA 519 INTRODUCTION TO PROBABILITY (3 Cr)
P: MA 362 or 510. Fall, night.
Algebra of sets, sample spaces, combinatorial problems, conditional probability, independence, random variables, distribution functions, characteristic functions, special distributions, limit theorems.

MA 520 BOUNDARY VALUE PROBLEMS OF DIFFERENTIAL EQUATIONS (3 Cr)
P: MA 261, 361. Recommended P or C: MA 362 or 510.
Sturm-Liouville theory; singular boundary conditions, orthogonal expansions, separation of variables in partial differential equations; spherical harmonics.

MA 523 INTRODUCTION TO PARTIAL DIFFERENTIAL EQUATIONS (3 Cr)
P: MA 261 and 361. Recommended P or C: MA 362 or 510.
Method of characteristics for quasilinear first-order equations; complete integral; Cauchy-Kowalewsky theory; classification of second-order equations in two variables; canonical forms; difference methods for hyperbolic and parabolic equations; Poisson integral method for elliptic equations.

MA 525 INTRODUCTION TO COMPLEX ANALYSIS (3 Cr)
P: MA 510.
Complex numbers and complex-valued functions: differentiation of complex functions; power series, uniform convergence; integration, contour integrals; elementary conformal mapping.

MA 529 OPERATIONAL CALCULUS (3 Cr)
P: MA 525.
Laplace and Fourier transforms; Heaviside-Mikusinski calculus; generalized functions; asymptotic evaluation of Fourier integrals.

MA 532 ELEMENTS OF STOCHASTIC PROCESSES (3 Cr)
P: MA 519, 525.
A basic course in stochastic processes including normal processes, covariance processes, Poisson processes, renewal processes, and Markov processes.

MA 540 ANALYSIS I (3 Cr)
P: MA 361.
Continuity, differentiation, functions of bounded variation, Riemann-Stieltjes integral.

MA 541 ANALYSIS II (3 Cr)
P: MA 540.
Multiple integrals, line integrals, infinite series, sequences of functions, Fourier series and integrals.

MA 544 PRINCIPLES OF ANALYSIS I (3 Cr)
P: A B in MA 441 or consent of the instructor.
Functions of a real variable, topology of the real line, continuity, derivatives, convergence, uniform convergence, Stone-Weierstrass theorem.

MA 545 PRINCIPLES OF ANALYSIS II (3 Cr)
P: MA 544.
Inverse mapping theorem, implicit function theorem, Lebesque measure, integrable functions, signed measures, completeness, duality, differentiation, Fubini's theorem, change of variables in multiple integrals.

MA 546 INTRODUCTION TO FUNCTIONAL ANALYSIS (3 Cr)
P: MA 545. By arrangement.
Banach spaces, Hahn-Banach theorem, uniform boundedness principle, closed graph theorem, open mapping theorem, Hilbert spaces.

MA 547 ANALYSIS FOR TEACHERS I (3 Cr)
P: MA 261. Fall, night.
Set theory, logic, relations, functions, Cauchy's inequality, metric spaces, neighborhoods, Cauchy sequences.

MA 548 ANALYSIS FOR TEACHERS II (3 Cr)
P: MA 547. Spring, night.
Functions on a metric space, continuity, uniform continuity, derivative, chain rule, Riemann integral, fundamental theorem of calculus, double integrals.

MA 550 ALGEBRA FOR TEACHERS I (3 Cr)
P: MA 351.
Definitions and elementary properties of groups, rings, integral domains, fields. Intended for secondary school teachers.

MA 551 ALGEBRA FOR TEACHERS II (3 Cr)
P: MA 550.
Polynomial rings, fields, vector spaces, matrices.

MA 553 INTRODUCTION TO ABSTRACT ALGEBRA (3 Cr)
P: MA 453. Fall, night.
Basic properties of groups, rings, integral domains, fields, polynomials, solvable groups, finitely generated abelian groups. Algebraic and transcendental field extensions. Separable extensions. Normal extensions. Galois theory.

MA 554 LINEAR ALGEBRA (3 Cr)
P: MA 453. Spring, night.
Vector spaces, matrices and linear transformations, eigenvalues, similarity, duality, bilinear forms, quadratic forms, inner products, orthogonal bases, adjoint, applications.

MA 556 INTRODUCTION TO THE THEORY OF NUMBERS (3 Cr)
P: MA 261. Summer.
Divisibility, congruences, quadratic residues, Diophantine equations, the sequence of primes.

MA 561 PROJECTIVE GEOMETRY (3 Cr)
P: MA 261.
Projective invariants, Desargues' theorem, cross-ratio, axiomatic foundation, duality, consistency, independence, coordinates, conics.

MA 563 ADVANCED GEOMETRY (3 Cr)
Spring, night.
Analysis of axiomatic systems, finite geometries, critique of Euclid, axiomatic development, incidence, existence, betweenness, congruence, non-euclidean geometry. Parallel postulate, Hilbert's geometry, hyperbolic geometry, models.

MA 571 ELEMENTARY TOPOLOGY (3 Cr)
P: MA 441.
Topological spaces, metric spaces, continuity, compactness, connectedness, separation axioms, nets, function spaces.

MA 581 INTRODUCTION TO LOGIC FOR TEACHERS (3 Cr)
P: MA 351.
Logical connectives, rules of sentential inference, quantifiers, bound and free variables, rules of inference, interpretations and validity, theorems in group theory, introduction to set theory.

MA 583 HISTORY OF ELEMENTARY MATHEMATICS (3 Cr)
P: MA 261. Summer.
A survey and treatment of the content of major developments of mathematics through the 18th century, with selected topics from more recent mathematics, including non-euclidean geometry and the axiomatic method.

MA 585 MATHEMATICAL LOGIC I (3 Cr)
P: MA 351. By arrangement.

Axiomatic treatment of propositional calculus and first order predicate calculus; Goedel's completeness theorem, Skolem-Loewenheim theorem, model theory of first order axiom systems; axiomatic elementary number theory.

MA 586 MATHEMATICAL LOGIC II (3 Cr)
P: MA 585.
Tarski theorem on undefinability of truth, Goedel theory of incompleteness of elementary number theory; Church theorem of undecidability of elementary predicate calculus; advanced topics.

MA 587 GENERAL SET THEORY (3 Cr)
P: MA 351.
Informal axiomatization of set theory, cardinal numbers, countable sets, cardinal arithmetic, order types, well ordered sets and ordinal numbers, axiom of choice and equivalences, paradoxes of intuitive set theory, Zermelo-Fraenkel axioms.

MA 598 TOPICS IN MATHEMATICS (1-5 Cr)
By arrangement.
Directed study and reports for students who wish to undertake individual reading and study on approved topics.

MA A598 TOPICS IN ARITHMETIC FOR ELEMENTARY SCHOOL TEACHERS (3 Cr)
Spring, night.
Set theory, systems of numeration, operations on whole numbers, mathematical sentences, integers, rational numbers, real numbers.

MA B598 TOPICS IN MATHEMATICS FOR ELEMENTARY SCHOOL TEACHERS (3 Cr)
Fall, night.
Rational numbers, real numbers, measurement, geometry.

MA M598 MATHEMATICAL MODELING (3 Cr)
P: MA 262, MA 351, MA 511, MA 551, or MA 554. Spring, night.
Linear programming; game theory, mathematical modeling of problems in economics, politics, psychology, sociology.

STATISTICS

UNDERGRADUATE LEVEL

Upper-Division Courses

STAT 301 ELEMENTARY STATISTICAL METHODS I (3 Cr)
P: College algebra. Not open to students in the Division of Mathematical Science and Schools of Engineering. Fall, Spring, day, night.
A basic introductory statistics course with applications shown to various fields and emphasis placed on assumptions, applicability, and interpretations of various statistical techniques. Subject matter includes frequency distribution, descriptive statistics, elementary probability, normal distribution, applications, sampling distribution, estimation, hypothesis testing, and linear regression.

STAT 302 ELEMENTARY STATISTICAL METHODS II (3 Cr)
P: STAT 301 or equivalent. Continuation of STAT 301. Fall, night.
Multiple regression and analysis of variance, with emphasis on statistical inference and applications to various fields.

STAT 311 INTRODUCTORY PROBABILITY (3 Cr)
P: MA 261 or equivalent. Spring, night.
Formulation of probability problems, discrete and continuous random variables, expectation, standard distributions, applications to statistical problems and problems in the physical sciences.

STAT 490 TOPICS IN STATISTICS FOR UNDERGRADUATES (1-5 Cr)
Fall, to be arranged.
Supervised reading and reports in various fields.

DUAL LEVEL

Undergraduate-Graduate

STAT 511 STATISTICAL METHODS I (3 Cr)
P: MA 163. Fall, night.
Descriptive statistics; elementary probability; normal, binomial, Poisson, hypergeometric distributions; sampling distributions; testing hypotheses, and estimation; one-way analysis of variance; chi-square test.

STAT 512 STATISTICAL METHODS II (3 Cr)
P: STAT 511.
Linear and multiple regression; non-linear regression; analysis of variance; random, fixed, mixed models, nested factorial, expected mean squares, pooling, modifications under relaxed assumptions, multiple comparisons, variance of estimates; analysis of covariance.

STAT 513 APPLICATIONS OF STATISTICS IN INDUSTRY (3 Cr)
P: STAT 511. Spring, night.
Control charts and acceptance sampling, continuous sampling plans, sequential analysis, statistics of combinations, and some non-parametric methods.

STAT 514 DESIGN OF EXPERIMENTS (3 Cr)
P: STAT 512.
Fundamentals, completely randomized design, randomized complete blocks; Latin square; multiclassification; factorial; incomplete blocks and fractional replications; confounding; lattice design; general mixed factorials; split plot; analysis of variance to regression models; optimum design.

STAT 516 BASIC PROBABILITY AND APPLICATIONS (3 Cr)
P: MA 164 or equivalent. MA 261 desirable.
A first course in probability intended to serve as a foundation for statistics and other applications. Intuitive background; sample spaces and random variables; joint, conditional, and marginal distributions; special distributions of statistical importance; moments and moment generating functions; statement and application of limit theorems; Markov chains.

STAT 517 STATISTICAL INFERENCE (3 Cr)
P: STAT 516 or equivalent.
Sampling Distribution, Estimation including unbiased, maximum likelihood, and moment estimation, testing hypotheses for standard distributions and contingency tables; confidence intervals and regions; introduction to nonparametric inference and tests of goodness of fit; introduction to multivariate analysis.

STAT 519 INTRODUCTION TO PROBABILITY
See MA 519.

STAT 528 FOUNDATIONS AND METHODS OF STATISTICS I (3 Cr)
P: MA 519.
Distribution of the mean and variance in normal samples, sampling distribution derived from the normal distribution, chi-square, t, and F. Distribution of statistics based on ordered samples. Asymptotic sampling distributions. Introduction to multivariate normal distribution and linear models. Maximum likelihood, least squares, linear estimation, other methods of point estimation, and discussion of their properties, Cramer-Rao inequality and Rao-Blackwell theorem. Tests of statistical hypotheses, simple and composite hypotheses, likelihood ratio tests, power of tests.

STAT 532 ELEMENTS OF STOCHASTIC PROCESSES
See MA 532.

DEPARTMENT OF PHYSICS

PROFESSORS: Flake, Meiere (Chairman); ASSOCIATE PROFESSORS: Vasavada, Yen; ASSISTANT PROFESSORS: Kleinhans, Morrison, Novak, Paik, Seubert, Thatcher.

The Department of Physics offers the following program leading to the degree of Bachelor of Science.

FRESHMAN YEAR
- MA 163 (Calculus)
- CHM C105 (Chemistry)
- ENGL W117 (English)
- Elective

- MA 164 (Calculus)
- CHM C106 (Chemistry)
- PHYS 152 (Mechanics)
- Elective

SOPHOMORE YEAR
- MA 261 (Calculus)
- PHYS 251 (Heat, Electricity and Optics)
- ENGL W118 (English)
- Language

- MA 262 (Linear Algebra and Differential Equations)
- PHYS 342 (Modern Physics)
- PHYS 342L (Laboratory)
- Elective
- Language

JUNIOR YEAR
- PHYS 310 (Intermediate Mechanics)
- PHYS 322 (Oscillations and Waves)
- PHYS 350 (Laboratory I)
- Electives*

- PHYS 330 (Electricity and Magnetism)
- PHYS 351 (Laboratory II)
- Electives*

SENIOR YEAR
- PHYS 550 (Quantum Mechanics)
- PHYS 515 (Thermodynamics)
- Electives*

- PHYS 545 (Solid State) and/or
- PHYS 556 (Nuclear Physics)
- PHYS 590 (Research)
- Electives*

*Electives may be chosen to satisfy requirements for certification as a high school teacher.

COURSES IN PHYSICS

100 PHYSICS IN THE MODERN WORLD (5 Cr)
P: Introductory high school mathematics. Fall, Spring, Summer, day, night.
Ideas, language, methods, and impact of physics today.

200 OUR PHYSICAL ENVIRONMENT (3 Cr)
P: None. Fall, Spring.
A non-mathematical introduction to physical concepts and methods by means of examples from daily life and current technological applications.

218 GENERAL PHYSICS (4 Cr)
P: MA 150 or equivalent. Equiv. IU P201. Fall, Spring, Summer, day, night.
Mechanics, conservation laws, gravitation; simple harmonic motion and waves; kinetic theory, heat and thermodynamics for students not specializing in physics.

219 GENERAL PHYSICS (4 Cr)
P: PHYS 218. Equiv. IU P202. Fall, Spring, Summer, day, night.
Electricity, light and modern physics for students not specializing in physics.

152 MECHANICS (4 Cr)

P or C: MA 164. Equiv. IU P221. Fall, Spring, Summer, day, night.

Statics, uniform and accelerated motion; Newton's Laws; circular motion; energy, momentum, and conservation principles; dynamics of rotation; gravitation and planetary motion; properties of matter; simple harmonic and wave motion.

251 HEAT, ELECTRICITY, AND OPTICS (5 Cr)

P: PHYS 152. Equiv. IU P222. Fall, Spring, day, night.

Heat, kinetic theory, elementary thermodynamics, heat transfer. Electrostatics, current electricity, electromagnetism, magnetic properties of matter. Geometrical and physical optics.

310 INTERMEDIATE MECHANICS (4 Cr)

P: MA 261 and two terms of general physics. Fall.

For students familiar with calculus. Elements of vector algebra; statics of particles and rigid bodies; theory of couples; principle of virtual work; kinematics; dynamics of particles and rigid bodies; work, power, and energy; elements of hydromechanics and elasticity.

322 OSCILLATIONS AND WAVES (3 Cr)

P: PHYS 251. Fall.

Modes of vibration of a system; emission and absorption of waves; properties of sound, electromagnetic and particle waves including phenomena of refraction, reflection, dispersion, diffraction, interference, polarization, and double refraction; lasers and holography.

330 INTERMEDIATE ELECTRICITY AND MAGNETISM (3 Cr)

P: PHYS 251; P or C: MA 262. Spring.

Electrostatics; electric currents; magnetostatics; electromagnetic induction; Maxwell's equations; electromagnetic waves.

342 MODERN PHYSICS (3 Cr)

P: PHYS 251. Equiv. IU P301. Fall, Spring.

A survey of basic concepts and phenomena in atomic, nuclear, and solid state physics.

342L MODERN PHYSICS LABORATORY (1 Cr)

Laboratory experiments to accompany PHYS 342.

350 INTERMEDIATE LABORATORY I (2 Cr)

P or C: PHYS 322.

Lectures on geometrical optics; instructor demonstrations and student experiments involving mechanical and electromagnetic wave and oscillation phenomena.

351 INTERMEDIATE LABORATORY II (2 Cr)

P or C: PHYS 330. Spring.

Lectures on AC circuit theory; instructor demonstrations and student experiments involving particle diffraction, wave polarization, double refraction, AC circuits, and meters.

470 READING IN SPECIAL TOPICS (1-3 Cr)

501 PHYSICAL SCIENCE (3 Cr)

P: A course in college physics. Fall, Spring.

Survey of the physical sciences with emphasis on methods of presentation appropriate to the elementary school. Graduate credit is extended only for elementary school teacher programs.

515 THERMODYNAMICS (3 Cr)

P: PHYS 310 and 330 and a course in differential equations or advanced calculus. Fall.

Fundamental concepts of heat; theory and practice of heat measurements; first and second laws of thermodynamics, with applications; kinetic theory.

545 SOLID STATE PHYSICS (3 Cr)

P: Any undergraduate course in modern physics. Spring.

Crystal structure; lattice vibrations; free electron theory of solids; band theory of solids; semiconductors; superconductivity; magnetism; magnetic resonance.

550 INTRODUCTION TO QUANTUM MECHANICS (3 Cr)

P: Should be preceded by PHYS 342 and at least one other junior-level course in each of mathematics and physics or equivalent. Fall.

Brief historical survey; waves in classical physics; wavepackets; uncertainty principle; operators and wave functions; Schrodinger equation and application to one-dimensional problems; the hydrogen atom; electron spin; multi-electron atoms; periodic table: molecules; Periodic potentials; Bloch wave functions.

556 INTRODUCTORY NUCLEAR PHYSICS (3 Cr)

P: PHYS 550 or equivalent. Spring.

Theory of relativity; brief survey of systematics of nuclei and elementary particles; structure of stable nuclei, radioactivity; interaction of nuclear radiation with matter; nuclear reactions; particle accelerators; nuclear instruments; fission; nuclear reactors.

570 MATHEMATICAL PHYSICS (3 Cr)

P: Courses in electromagnetism, mechanics, and optics or consent of instructor.

Vectors and vector operators; analytic functions and calculus of residues; differential equations and the special functions of mathematical physics; partial differential equations; calculus of variations.

590 READING AND RESEARCH (1-3 Cr)

ASTRONOMY

The Department of Physics has counseling and administrative responsibility for the courses in Astronomy offered at IUPUI.

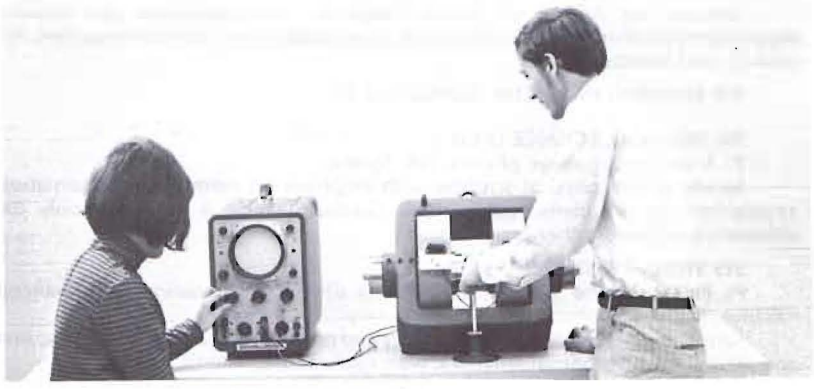
A 100 THE SOLAR SYSTEM (3 Cr)

Celestial sphere and constellations, measurement of time, astronomical instruments, earth as a planet, moon, eclipses, planets and their satellites, comets, meteors, theories of origin of solar system.

A 105 STELLAR ASTRONOMY (3 Cr)

Spring.

The sun as a star, physical properties of stars, principles of spectroscopy as applied to astronomy, double stars, variable stars, star clusters, gaseous nebulae, stellar motions and distributions, Milky Way system, external galaxies, expanding universe, cosmic time scale.



DEPARTMENT OF PSYCHOLOGY

PROFESSORS: Hanford, Long, Morris, Neel (Chairman). ASSOCIATE PROFESSORS: Fleener, Fortier. ASSISTANT PROFESSORS: Einsiedel, Evenbeck, Goldberg, Lauer, Reck, Ware. LECTURERS: Delys, Kelfer.

The Psychology Department of IUPUI grants two undergraduate degrees: Bachelor of Arts from Indiana University and the Bachelor of Science from Purdue University. The student may choose either according to his interest. The degree and institution desired should be determined in consultation with a Psychology Department counselor.

Requirements for the Major

Minimum Recommended Requirements for Major: 6 hours Introductory Psychology (2 semesters), 9 hours Methodology courses (courses above 100 level ending in odd numbers), 9 hours Content courses (courses above 100 level ending in even numbers, except courses ending with number 2). Total of 24 hours minimum.

Those planning graduate work in psychology should definitely include B305. Those planning graduate work in clinical psychology should also include B360, B380, and B307. Those planning careers in personnel work should also take B424, B307, and B370.

MASTER OF SCIENCE IN PSYCHOLOGY

The Psychology Department of IUPUI through Purdue University grants a Master of Science with a specialty in personnel and industrial psychology. An undergraduate major in psychology is not required for admission to this program. However, the bachelor's degree from an accredited institution with a grade-point average of near B or above and combined aptitude test scores on the Graduate Record Examination of approximately 1100 are required. The entire program can be completed at Indianapolis and all courses are offered in the evening so that a student may also be regularly employed while enrolled in this program. Two options are available to the student: the thesis option of 18 hours of core courses, nine hours of electives, plus thesis; the non-thesis option of 18 hours of core courses and 18 hours of approved electives. Please see or write a Psychology Department counselor if interested in this program.

COURSES IN PSYCHOLOGY

B104 PSYCHOLOGY AS A SOCIAL SCIENCE (3 Cr)
Equiv. to IU P102 and PU 120. Every semester.
Introduction to scientific method, individual differences, personality, developmental, abnormal, social, and industrial psychology.

B105 PSYCHOLOGY AS A BIOLOGICAL SCIENCE (3 Cr)
Equiv. to IU P101 and PU 120. Every semester.
Research Methods and Content areas of learning, sensation-perception, psycho-physiology, motivation, emotions, and statistics.

B211 INTRODUCTORY LABORATORY IN PSYCHOLOGY (3 Cr)
P: PSY B105. Equiv. to IU P111, P211 and PU 200. Every semester.
Introductory laboratory in psychology experimental methods, statistical treatment of data, in several areas of psychology; introduction to experimental report writing.

B270 INTRODUCTION TO INDUSTRIAL PSYCHOLOGY (3 Cr)
P: 3 hours of psychology. Equiv. to IU P233. Fall.
Applications of psychological principles and research methods to personnel and industrial problems including selection, performance evaluation, motivation, morale, supervision, and union-management relations.

B305 STATISTICS (3 Cr)
P: PSY B105. Equiv. to IU P354, K300, K310 and PU 301. Fall and Spring.
Introduction to basic statistical concepts; descriptive statistics and inferential statistics.

B307 TESTS AND MEASUREMENT (3 Cr)
P: 3 hours of psychology. Equiv. to IU P336 and PU 302. Fall.
An introduction to psychological measurement, including psychophysics, scaling techniques, psychological testing, and individual differences.

B320 PSYSIOLOGICAL PSYCHOLOGY (3 Cr)
P: PSY B105. Equiv. to IU P326 and PU 329. Fall.
Review of necessary background in neurophysiology and neuroanatomy followed by the relationship of physiology to sensory processes, motivation, and learning. Emphasis on research with animals.

B324 PSYCHOPHYSIOLOGY OF THE SENSES (3 Cr)
P: PSY B105 or equivalent. Equiv. to IU P329 and PU 328. Fall.
This course will consider vision, audition, taste, smell, touch, temperature sensitivity and the vestibular and kinesthetic senses and their relation to behavior.

B334 PERCEPTION (3 Cr)
P: PSY B105 and consent of Psychology Department. Equiv. to IU P329 and PU 310. Spring.
Consideration of the concepts and research in perception. Relation of sense organ systems to human behavior. Some attention to social and cultural factors.

B344 LEARNING (3 Cr)
P: 3 hours of psychology. Equiv. to IU P325 and PU 311. Every semester.
History, theory, and research involving human and animal learning and cognitive processes.

B356 MOTIVATION (3 Cr)
P: 3 hours of psychology. Equiv. to IU P326 and PU 311. Every semester.
Study of motivational processes in human and animal behavior; how needs and incentives influence behavior, and how motives change and develop.

B360 CHILD AND ADOLESCENCE (3 Cr)
P: 3 hours of psychology. Equiv. to IU P316 and PU 235. Every semester.
Development of behavior in infancy, childhood and adolescence including sensory and motor development and processes such as learning, motivation, and socialization.

B362 PRACTICUM IN CHILD PSYCHOLOGY (3 Cr)
P or C: PSY B360.
Experience in working with children in field settings. May be repeated once.

B370 SOCIAL (3 Cr)
3 hours of pyschology. Equiv. to IU P420 and PU 340. Every semester.
Study of the individual in social situations including socialization, social perception, social motivation, attitudes, social roles, and small group behavior.

B374 GROUP DYNAMICS, THEORY AND RESEARCH (3 Cr)
P: PSY B370. Spring.

An intensive survey of research and theory on the behavior of small groups and the research methods by which groups are studied.

B380 ABNORMAL (3 Cr)
P: 3 hours of psychology. Equiv. to IU P324 and PU 350. Every semester.
Various forms of mental disorders with emphasis on cause, development, treatment, prevention, and interpretation.

Spring.

B382 PRACTICUM IN ABNORMAL (3 Cr)
P or C: PSY B380.
Experience in working with individuals who manifest abnormal behavior, includes research, demonstrations, and observations. May be repeated once.

B423 LABORATORY IN PHYSIOLOGICAL PSYCHOLOGY (3 Cr)
P: PSY B211 and PSY B320. Equiv. to IU P426.
Experiments and demonstrations in physiological psychology.

B424 THEORIES OF PERSONALITY (3 Cr)
P: 9 hours of psychology. Equiv. to IU P319 and PU 423. Fall, Spring.
Methods and results of the scientific study of personality including the development, structure, and functioning of the normal personality.

B425 LABORATORY IN PERSONALITY (3 Cr)
P: PSY B211 and PSY B424. Equiv. to PU 424.
Demonstrations and experiments in personality research.

B431 LABORATORY IN SENSATION AND PERCEPTION (3 Cr)
P: PSY B211 and consent of instructor. Equiv. to IU P424 and PU 312.
Experiments and demonstrations in sensation and perception with an emphasis on their physiological basis.

B445 LABORATORY IN LEARNING (3 Cr)
P: PSY B211 and PSY B344. Equiv. to IU P436 and PU 312. Fall.
Experiments and demonstrations involving learning and cognitive processes.

B450 HISTORY AND SYSTEMS (3 Cr)
P: 12 hours in psychology. Equiv. to IU P458 and PU 480. Spring.
Historical bases of modern empirical, applied, and theoretical psychology; influence of systems on development of modern psychology.

B457 LABORATORY IN MOTIVATION (3 Cr)
P: PSY B211 and PSY B356. Equiv. to IU P436 and PU 312. Fall.
Experiments and demonstrations in motivation.

B461 LABORATORY IN DEVELOPMENTAL PSYCHOLOGY (3 Cr)
P: PSY B211 and PSY B360. Equiv. to IU P429. Fall, Spring.
Principal research methods in developmental psychology and their application to selected problems.

B462 CLASSROOM BEHAVIOR MANAGEMENT (3 Cr)
P: consent of instructor. Equiv. to IU P468. Fall, Spring.
Conducted as a seminar and a practicum for teachers and psychology major in the principles and methodology of classroom behavior management.

B464 PSYCHOLOGY OF LANGUAGE (3 Cr)
P: 9 hours of psychology, or permission of instructor. Spring.
Survey of important topics in the psychology of language. Included are historical treatments, generative grammar, development of language, experimental psycholinguistics, and semantics.

B466 SEMINAR IN CHILD PSYCHOLOGY (3 Cr)
P: B360 or equivalent and one of the following as P or C: PSY B362, B382 (with major focus upon children), B461, B462, or permission of instructor.
Integration of practical experience with relevant psychological literature.

B471 LABORATORY IN SOCIAL (3 Cr)
P: PSY B211 and P or C: PSY B370. Equiv. to IU P421 and PU 346. Fall, Spring.
Observational, correlational, and experimental studies in social psychology.

B472 PRACTICUM IN GROUP DYNAMICS (3 Cr)
P: 6 hours of psychology and consent of instructor. Equiv. to IU P321 and PU 348. Fall, Spring.
Application in the field of group dynamics through experience as a participant in group sensitivity training.

B492 READINGS AND RESEARCH IN PSYCHOLOGY (1-3 Cr)
P: consent of instructor. Equiv. to IU P495 and PU498. Every semester.
Independent readings and research on psychological problems.

B499 HONORS RESEARCH (credit arranged)
P: consent of departmental honors committee. Equiv. to IU P499 and PU 499. Every semester.
Independent readings and research resulting in a research paper.

GRADUATE COURSES

(500 level courses open to Seniors also)

500 STATISTICAL METHODS APPLIED TO PSYCHOLOGY, EDUCATION, AND SOCIOLOGY (3 Cr) Fall and Spring.
Descriptive statistics and an introduction to sampling statistics. Applied to psychological, sociological, and educational data.

505 MENTAL MEASUREMENT (3 Cr)
P: 6 hours of psychology, including PSY 500 or equivalent.
Introduction to the general area of mental measurement. Theory and content of measuring devices in the fields of intelligence, interests, personality, and special aptitudes.

570 INDUSTRIAL PSYCHOLOGY (3 Cr) Fall and Spring.
Survey of the applications of psychological principles and of research methodology to the various human problems in industry, such as: personnel selection and appraisal; the organizational and social context of human work; the job and work situation; human errors and accidents; and psychological aspects of consumer behavior.

572 ORGANIZATIONAL PSYCHOLOGY (3 Cr)
A survey of basic behavioral science research and thinking as these contribute to the understanding of individual, dyadic, group, intergroup and other large organization behavioral phenomena. The topics covered include motivation, perception, attitudes and morale, communication, leadership, conflict, problem solving, behavior change, and organizational effectiveness.

574 PSYCHOLOGY OF INDUSTRIAL TRAINING (3 Cr)
P: 3 hours of psychology.
Utilization of psychological measurement techniques in assessing training needs and evaluating training effectiveness and the application of learning research and theory to industrial training.

577 HUMAN FACTORS IN ENGINEERING (3 Cr)
Survey of human factors in engineering with particular reference to human functions in man-machine systems, and consideration of human abilities and limitations in relation to design of equipment and work environments.

578 OCCUPATIONAL ANALYSIS (3 Cr)
P: PSY 570.
Survey of systematic study of human work, including techniques of analysis of jobs and occupations for personnel and related purposes. Survey of occupational research and related topics. Practice in job analysis.

579 HUMAN FACTORS LABORATORY (3 Cr)
P: PSY 577.
Laboratory experience in carrying out and writing up experiments in aspects of human performance that are relevant to human factors engineering, including sensory and psychomotor processes, information processing, and decision analysis. In addition, each student will have the opportunity to develop and carry out an experiment of his own choosing.

585 PSYCHOLOGICAL FOUNDATIONS OF CONSUMER BEHAVIOR (3 Cr)
P: 3 hours of psychology.
A survey of the concepts and methods of psychology as they apply to the study of consumer behavior.

590 INDIVIDUAL RESEARCH PROBLEMS (1-3 Cr)
P: 12 hours of psychology and the consent of the instructor. Every semester.
Opportunity for students to study particular problems in any field of psychology or initiate themselves into research techniques under the guidance of a member of the staff.

***600 STATISTICAL INFERENCE** (3 Cr)
P: PSY 500 or equivalent.
Emphasis is given to principles underlying both parametric and nonparametric inference.

***601 CORRELATION AND EXPERIMENTAL DESIGN** (3 Cr)
P: PSY 600.
Continuation of PSY 600 with emphasis upon the design and analysis of experiments.

610 ADVANCED TECHNOLOGY OF TESTS AND MEASUREMENTS (3 Cr)
P: PSY 600 and PSY 505 or equivalent.
Theory and technique relating to the construction and utilization of measuring devices such as intelligence, special aptitude, interest, achievement, and personality tests.

630 PSYCHOLOGY OF LEARNING (3 Cr)
P: consent of instructor.
Basic concepts and experimental findings in acquisition, extinction, discrimination, transfer, retention, and problem solving.

646 PSYCHOLOGICAL BASES OF GROUP STRUCTURE AND SOCIAL PROCESSES (3 Cr)
P: consent of instructor.
Examination of the structure and processes of social groups of various sizes including consideration of leadership, problem-solving behavior, communication, cohesion, norms, roles, and the psychological foundations of social systems and social conflict.

***680 ANALYSIS OF PUBLISHED RESEARCH IN INDUSTRIAL PSYCHOLOGY** (3 Cr)
P: PSY 570 or equivalent.
A survey of the various areas of industrial psychology (personnel, social-industrial, human factors, and consumer) with particular reference to current research as reflected in current journals and texts. Course provides opportunity for critical evaluation of research investigiations, familiarity with sources of material, and experience in the preparation of manuscripts.

***681 SEMINAR IN INDUSTRIAL PSYCHOLOGY** (3 Cr)
P: PSY 680 and consent of instructor
Intensive analysis of application of various research and statiscal methods to human problems in industry.

***683 SEMINAR IN INDUSTRIAL-SOCIAL PSYCHOLOGY** (3 Cr)
P: PSY 570, PSY 572, or equivalent.
Study of research and theory emphasizing social perception, attitudes,

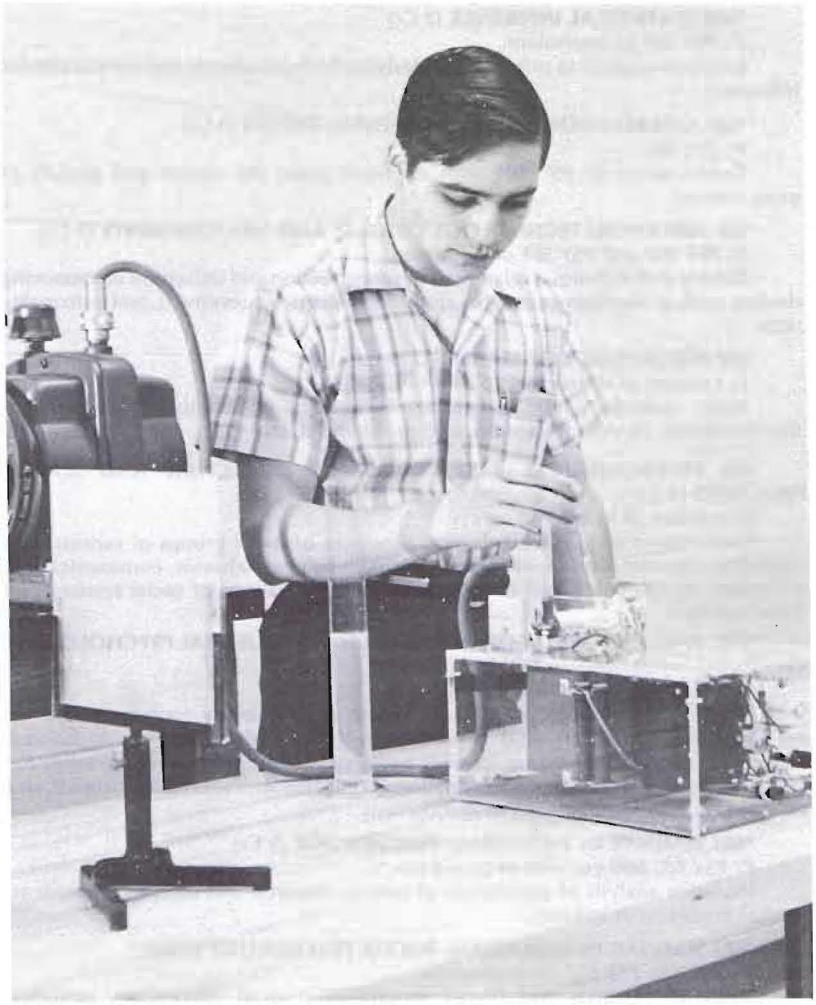
supervisory behavior, employee participation, motivation, and organizational structure.

685 SEMINAR IN CONSUMER AND OPINION RESEARCH (3 Cr)
P: PSY 585.
Exploration of new topics, critical examination of current literature and selectively distributed research reports and analysis of original studies in consumer attitudes, and opinion research. May be repeated for credit.

687 SEMINAR IN HUMAN FACTORS (3 Cr)
P: PSY 577 or equivalent.
Analysis of current literature and research in the field of human factors in engineering with particular reference to the consideration of the human functions in man-machine systems.

698 RESEARCH M.S. THESIS

***Core courses for the M.S. degree.**



RELATED DEPARTMENTAL PROGRAMS AND COURSES

AGRICULTURE

(Including Forestry)

Students at IUPUI are offered the opportunity to complete the first two years' requirements for most of Purdue's Bachelor of Science in Agriculture degrees. Students must then transfer to complete requirements for graduation in either Agriculture or Forestry at the Lafayette campus.

The first two years of training are based upon a solid foundation of mathematics, chemistry, biology, physics, economics, and English. Much of this foundation is laid during the freshman year when the program of study is basically the same for all agriculture students. An effort is made during the freshman year to familiarize the students with the opportunities throughout Agriculture and Forestry. Electives are permitted to enable the student to explore the various options in which he may choose to concentrate his efforts during the remaining years.

At the sophomore level, students are asked to select an option within agriculture or forestry so that they might develop a sequence of courses leading to a more clearly defined career objective. Each option has substantial opportunities for electives which permit additional specialization in main areas of interest or permit a broad choice in liberal arts or general education.

Students should contact the Agricultural Program counselor in the Biology Department soon after admission to IUPUI to formulate a tentative sequence of courses for the first year or two.

101 AGRICULTURAL LECTURES
To acquaint new students in agriculture with the important problems and opportunities in the various fields of agriculture.

AGRICULTURAL ECONOMICS

100 INTRODUCTORY AGRICULTURAL BUSINESS AND ECONOMICS
The role and characteristics of farm and off-farm agricultural business in our economy; introductory economic and business principles involved in successful organization, operation, and management.

330 MANAGEMENT METHODS FOR AGRICULTURAL BUSINESS
Management of the nonfarm firm, with emphasis on businesses selling to farmers and handling their products; topics deal primarily with tools for management decisions and the decision-making process. Major areas of study include: principles of decision making, legal forms of business organization, basics of financial analysis, inventory and quality control, short and long range planning, and other tools for management decision.

AGRONOMY

105 CROP PRODUCTION
Fundamental Principles of crop production and distribution. An introduction to basic soil relations, current field crop production practices, agricultural meteorology, turfgrass management, and plant breeding.

255 SOIL SCIENCE

Differences in soils; soils genesis; physical, chemical and biological properties of soils; relation of soils to problems of land use and pollution; soil management relative to tillage, erosion, drainage, moisture supply, temperature, aeration, fertility and plant nutrition. Introduction to fertilizer chemistry and use. (Prerequisite—1 year college chemistry.)

ANIMAL SCIENCE

101 ANIMAL AGRICULTURE

Importance of livestock in the field of agriculture, and the place of meats and other animal products in the human diet.

221 INTRODUCTORY ANIMAL NUTRITION

Prerequisite: CHM C101 or equiv.

Classification and function of nutrients, deficiency symptoms, digestive processes, characterization of feedstuffs, and formulation of diets for domestic animals.

BIOCHEMISTRY

207 BIOCHEMISTRY

Prerequisite: CHM C102 or equivalent.

Introduction to the chemistry, function, and metabolism of compounds found in the living organism.

FORESTRY AND CONSERVATION

103 INTRODUCTION TO NATURAL RESOURCE CONSERVATION

A broad treatment of the scientific basis for forestry and associated natural resources. For students majoring in forestry and conservation and those interested in a natural resources course as an elective.

582 CONSERVATION OF NATURAL RESOURCES

Prerequisite: at least junior standing.

Classroom and laboratory instruction in natural resource conservation. Designed for teachers of vocational agriculture, biological sciences, general sciences, home economics, and social studies.

HORTICULTURE

101 FUNDAMENTALS OF HORTICULTURE

Study of the biology and technology of horticultural plants and products. Laboratories include: field trips to horticultural farms and industries, experiments to demonstrate both the theoretical and practical aspects of horticultural plant growth and development, and exercises in landscape design.

AGRICULTURE—M.S.

(Extension Education)

These programs are administered by an interdisciplinary committee on the Lafayette campus. The committee is chaired by D. C. Pfendler (Associate Dean, School of Agriculture).

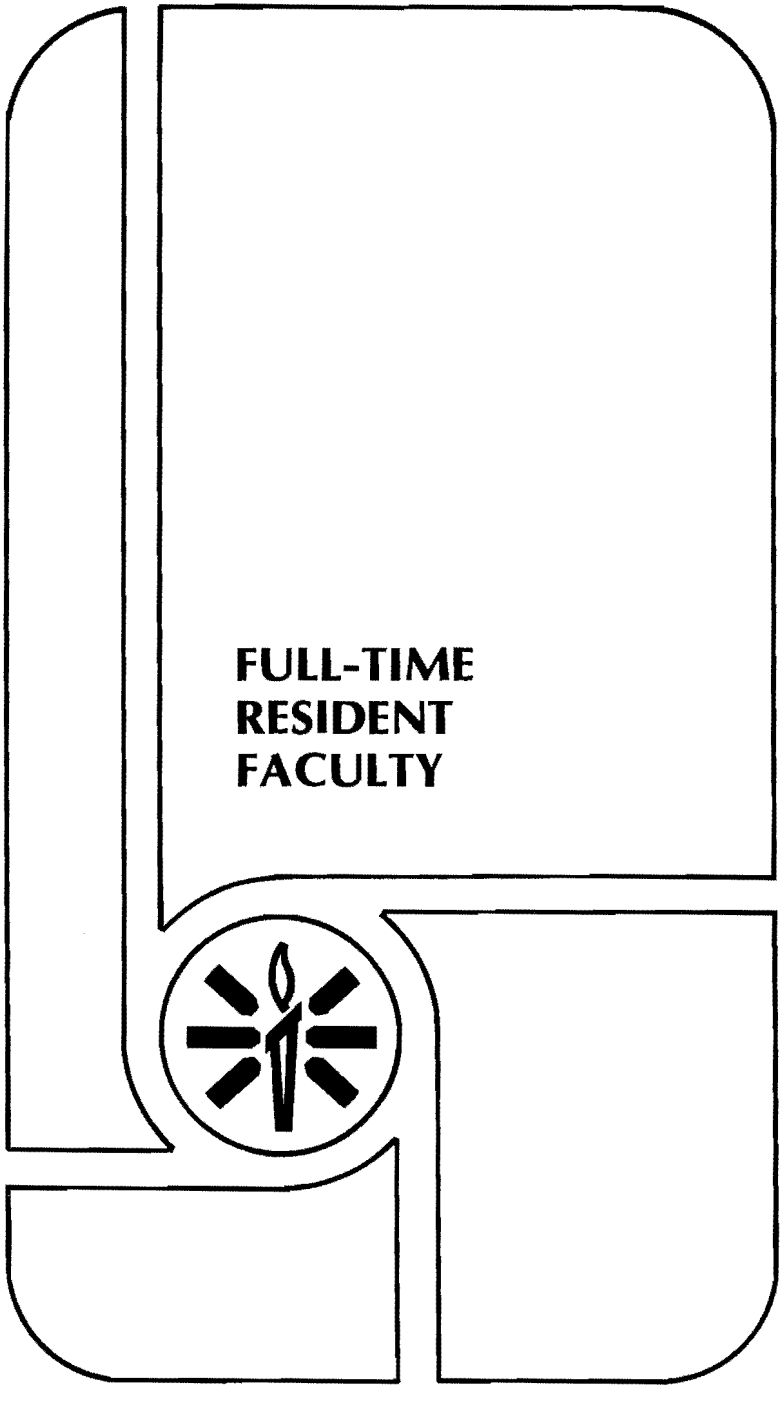
Admission to graduate programs with a primary area in extension education leading to the degree of Master of Science will be approved and the program coordinated at the West Lafayette campus. These programs are developed on an individual basis for persons engaged in or anticipating participation in development of human, community, or natural resources, such as extension agents, members of extension or community policy boards, personnel of social and welfare agencies, and those engaged in continuing adult education.

The curriculum is under the general supervision of an interdisciplinary committee and is broadly selective from a wide range of courses offered in the areas of agriculture, home economics, industrial management, social sciences, education, and civil engineering. After initial counselling by members of the interdisciplinary committee, members of the advisory and examining committees for students in the program will be selected from departments within which the student selects his courses.

For further information concerning the program, contact Professor Pfendler in Lafayette (749-2402).

ASTRONOMY

The Department of Physics has counselling and administrative responsibility for the courses in Astronomy offered at IUPUI. Course listings are included with the course listings of the Department of Physics.


FULL-TIME
RESIDENT
FACULTY

RESIDENT FACULTY

ALTON, ELAINE V., Associate Professor of Mathematics-Education (1964); A.B., 1946, New York State; M.Ed., 1951, St. Lawrence; M.A., 1958, Michigan; Ph.D., 1965, Michigan State University.

BITTINGER, MARVIN, Associate Professor of Mathematics-Education, (1968); B.S., 1963, Manchester College; M.S., 1965, Ohio State University; Ph.D., 1968, Purdue University.

BOAZ, PATRICIA A., Associate Professor of Chemistry (1967); B.S., 1944, Vassar; Ph.D., 1951, State University of Iowa.

BOSCHMANN, ERWIN, Associate Professor of Chemistry (1968); B.A., 1963, Bethel College (Kansas); M.S., 1965, Ph.D., 1968, University of Colorado.

BRIDGES, HARRY B., Assistant Professor of Mathematics (1966); B.S.Ed., 1931, South East Missouri State; M.S., 1935, Illinois; B.S.E.E., 1939, Missouri School of Mines.

BROWN, JIM McCASLIN, Assistant Professor of Geology (1969); B.S., 1960, M.S., 1963, University of Alaska; Ph.D., 1968, University of Wisconsin.

BURKINSHAW, OWEN, Assistant Professor of Mathematics (1972); B.S., 1966, M.S., 1968, Ohio University-Athens; Ph.D., 1972, Purdue University.

CADY, WAYNE ALLEN, Assistant Professor of Chemistry (1972); B.S., 1966, Calvin College, Michigan; Ph.D., 1972, University of Illinois.

COURTIS, WILLIAM, Assistant Professor of Biology (1971); B.S., 1960, M.S., 1964, University of Miami, Coral Gables; Ph.D., 1972, Southern Illinois University.

CROWN, J. CONRAD, Associate Professor of Mathematical Sciences (1969); B.S., 1943, Polytechnic Institute of Brooklyn; M.S., 1962, Ph.D., 1965, University of Connecticut.

CUTSHALL, THEODORE W., Associate Professor of Chemistry (1961); B.S.Ch.E., 1949, Purdue University; M.S., 1959, Ph.D., 1964, Northwestern University.

DELYS, PAMELA JEAN, Lecturer in Psychology (1973); B.S., 1969, M.S., 1971, Purdue University.

EINSIEDEL, ALBERT A., Assistant Professor of Psychology (1973); A.B., 1966, University of Philippines,; M.A., 1970 California State University; Ph.D., 1973, Indiana University.

EVENBECK, SCOTT EDWARD, Assistant Professor of Psychology (1972); A.B., 1968, Indiana University; M.A., 1971, Ph.D., 1972, University of North Carolina.

FICKLIN, FRED L., Assistant Dean (1973); B.S., 1963, Greenville College; M.S., 1966, Butler University; Ed.D., 1973, Indiana University.

FIFE, WILMER K., Chairman and Professor of Chemistry (1971); B.S., 1955, Case Institute of Technology; Ph.D., 1960, Ohio State University.

FLAKE, GOLDEN A., Professor of Physics (1947); B.Ed., 1933, Eastern Illinois; M.S., 1946, Northwestern.

FLEENER, DON E., Associate Professor of Psychology (1966); B.S. (Ed.), 1949, Indiana Central College; Ph.D., 1967, Indiana University.

FORTIER, ROBERT H., Associate Professor of Psychology (1966); B.S., 1947, Ph.D., 1952, Western Reserve.

FRICKE, GORDON H., Assistant Professor of Chemistry (1972); B.A., 1964, Goshen College; M.A., 1966, State University of New York at Binghampton, N.Y.; Ph.D., 1970, Clarkson College of Technology.

GEBAUER, PETER A., Assistant Professor of Chemistry (1970); B.S., 1965, Harvey Mudd College; Ph.D., 1970, University of Illinois.

GEMIGNANI, MICHAEL C., Chairman, Department of Mathematical Sciences, Professor of Mathematics (1972); B.A., 1962, University of Rochester; M.S., 1964, Ph.D., 1965, University of Notre Dame.

GERSTING, JOHN M., JR., Assistant Professor of Engineering Science and Computer Science (1970); B.S., 1962, Purdue University; M.S., 1964, Ph.D., 1970, Arizona State University.

GERSTING, JUDITH L., Assistant Professor of Mathematics (1970); B.S., 1962, Stetson University; M.A., 1964, Ph.D., 1969, Arizona State University.

GOLDBERG, CARLOS I., Assistant Professor of Psychology, (1969); B.A., 1961, Brooklyn College; M.A., 1964, Ph.D., 1969, The City University of New York.

HANFORD, PETER VANCE, Professor of Psychology and Psychiatry (1960); B.S., 1952, M.S., 1953, Ph.D., 1958, Pennsylvania State University.

HUNTER, LAWRENCE W., Assistant Professor of Mathematics and Computer Sciences (1973); B.S., 1965, Stanford; Ph.D., 1971, University of Wisconsin, Madison.

JOHNSTON, ERNEST R., Professor of Mathematics (1955); B.Ed., 1938, M.S., 1939, Illinois State; Ph.D., 1954, University of Minnesota.

JUILLERAT, FLORENCE, Instructor in Biology (1966); B.S., 1962, M.S., 1967, Purdue University.

JUILLERAT, MONTE E., Professor of Agricultural Economics (1967); B.S.A., 1956, M.S., 1958, Ph.D., 1959, Purdue University.

KAMINKER, JEROME ALVIN, Assistant Professor of Mathematics (1973); B.A., 1963, University of California, Berkeley; M.A., 1965, Ph.D., University of California at Los Angeles.

KECK, ROBERT WILLIAM, Assistant Professor of Biology (1972); B.A., 1962, M.S., 1964, University of Iowa; Ph.D., 1968, Ohio State University.

KELFER, DEBORAH ANN, Lecturer in Psychology (1973); B.A., 1969, Simmons College; M.A., 1971, University of Illinois, Chicago.

KIRK, RONALD, Assistant Professor of Biology (1968); A.S., 1955, Vincennes University; B.S., 1958, M.S., 1959, Ph.D., 1966, Purdue University.

KLEINHANS, FREDERICK W., Assistant Professor of Physics (1972); B.S., 1965, University of Michigan; Ph.D., 1971, Ohio State University.

KLEYLE, ROBERT M., Associate Professor of Mathematics and Statistics (1973); B.A., 1960, Duquesne University, Pittsburgh; M.S., 1962, University of Pittsburgh; Ph.D., 1968, Harvard.

KUCZKOWSKI, JOSEPH E., Associate Professor of Mathematics (1966); B.S., 1961, Canisius; M.S., 1963, Ph.D., 1968, Purdue University.

LAUER, JOAN B., Assistant Professor of Psychology (1973); A.B., 1964, Ph.D. 1973, Indiana University.

LAVERELL, W. DAVID, Assistant Professor of Mathematics (1970); B.S., 1963, Ursinus College; M.S., 1965, Ph.D., 1969, Lehigh University.

LEES, NORMAN DOUGLAS, Assistant Professor of Biology (1973); A.B., 1967, Providence College, Providence, R.I., Ph.D., 1973, Northwestern.

LOH, PETER C., Associate Professor of Mathematics (1968); B.S., 1963, Purdue University; Ph.D., 1968, Stanford University.

LONG, ROBERT IRVIN, Professor of Psychology (1956); A.B., 1950, Indiana University; M.S., 1955, Ph.D., 1956, Tulane University.

MEIERE, FORREST T., Chairman and Professor of Physics (1969); B.S., 1959, Carnegie-Mellon University; (2 B.S. degrees: 1 in Physics, 1 in Math); Ph.D., 1964, Massachusetts Institute of Technology.

METZ, CLYDE R., Associate Professor of Chemistry (1966); B.S., 1962, Rose Polytechnic Institute; Ph.D., 1966, Indiana University.

MIRSKY, ARTHUR, Chairman and Associate Professor of Geology (1967); B.A., 1950, University of California, Los Angeles; M.S., 1955, University of Arizona; Ph.D., 1960, Ohio State University.

MORRIS, BARNETT B., Professor of Psychology (1965); B.A., 1948, Brooklyn College; M.A., 1951, Nebraska; Ph.D., 1959, University of Oklahoma.

MORRISON, L. KENT, Assistant Professor of Physics (1970); B.S., 1962, Highlands University; M.S., 1964, University of Washington; Ph.D., 1967, University of Seattle.

NAGHDI, AMIR K., Associate Professor of Aeronautics, Astronautics and Engineering Sciences and Mathematics (1966); B.S., 1951, Teheran; M.S.M.E., 1958, Illinois; Ph.D., 1964, Purdue University.

NEEL, ROBERT G., Chairman and Professor of Psychology (1964); B.A., 1948, M.A.,1949, Denver; Ph.D., 1962, Michigan.

NEVILL, WILLIAM A., Dean of the School of Science, Professor of Chemistry (1967); B.S., 1951, Butler; Ph.D., 1954, California Institute of Technology.

NOVAK, GREGOR M., Assistant Professor of Physics (1964); M.S., 1963, University of Chicago.

PAIK, HAN WON, Assistant Professor of Physics (1962); B.S., 1956, M.S., 1958, Yonsei University, Seoul, Korea; M.S., 1962, Northwestern University; Ph.D., 1970, Indiana University.

PENNA, MICHAEL A., Assistant Professor of Mathematics (1973); B.A., 1967, Union College, Schenectady, N.Y.; A.M., 1968, University of Illinois, Urbana.

PFLANZER, RICHARD GARY, Assistant Professor of Anatomy and Physiology (1969); A.B.,1964, Ph.D., 1969, Indiana University.

RABIDEAU, PETER W., Associate Professor of Chemistry (1970); B.S., Loyola University, 1964; M.S., Case Institute of Technology, 1967; Ph.D., Case Western Reserve University, 1969.

RAICHART, DENNIS WAYNE, Assistant Professor of Chemistry (1972); B.A., 1968, Wabash College; Ph.D., 1972, Stanford University.

RECK, MARTIN, Assistant Professor of Psychology (1970); B.A., 1963, Brooklyn College; M.S., 1965, Ph.D., 1967, Purdue University.

RIDGE, WILLIAM C., Assistant Professor of Mathematics (1970); B.A., 1959, M.A., 1963, Ph.D., 1969, Indiana University.

RIGO, THOMAS, Lecturer in Mathematics (1970); B.S., 1961, Canisius College; M.S., 1963, Purdue University.

SAMN, SHERWOOD, Assistant Professor of Mathematics (1968); B.A., 1963, Ph.D., 1968, University of California, Berkeley.

SAMUELS, ROBERT, Chairman and Professor of Biology (1967); B.A., 1938, M.A., 1940, Pennsylvania; Ph.D., 1952, University of California.

SANBORN, RICHARD C., Professor of Biology (1957); A.B., 1943, M.A., 1948, Ph.D., 1950, Harvard.

SEUBERT, JAMES W., Assistant Professor of Physics (1968); A.B., 1958, Washington University; M.S., 1964, Ph.D., 1968, Indiana University.

SHAVER, LINDA D., Lecturer in Mathematics (1966); B.A., 1962, M.A., 1964, Syracuse University.

SUER, LORAZE B., Instructor in Mathematics (1961); A.B., 1937, University of Evansville; A.M., 1945, Indiana University.

THATCHER, FREDERICK C., Assistant Professor of Physics (1970); B.S., 1961, University of Chicago; M.S., 1964, DePaul University; Ph.D., 1969, University of California, Riverside.

VASAVADA, K. V., Associate Professor of Physics (1970); B.S., 1958, University of Baroda, India; M.S., 1960, University of Delphi, India; Ph.D., 1964, University of Maryland.

WARE, JOSEPH ROGER, Assistant Professor of Psychology (1972); B.S., 1957, M.A., 1961, University of Louisville; Ph.D., 1972, University of Kentucky.

WEIHAUPT, JOHN G., Assistant Dean for Academic Affairs and Professor of Geology (1973); B.S., 1952, M.S., 1953 and 1970, Ph.D., 1973, University of Wisconsin.

WELCHER, FRANK J., Professor of Chemistry, (1949); A.B., 1929, M.A., 1930, PhD., 1932, Indiana University.

WILSON, CLAUDE E., Assistant Professor of Chemistry (1971); B.A., 1960, Harpur College, State University of New York; M.A., 1961, Ph.D., 1966, Columbia University, New York.

WYMA, RICHARD J., Associate Professor of Chemistry (1969); A.B., 1958, Hope; M.S., 1960, Ph.D., 1964, Michigan.

YEN, WEN LIANG, Associate Professor of Physics (1968); B.A., 1960, National Taiwan; M.S., 1962, National Tsing Hua; Ph.D., 1968, Purdue University.

PROGRAM WORK SHEET—I.U. UNDERGRADUATE DEGREES

Academic Record of Completion of Degree Requirements

(Enter course title, grade received, and hours of credit in columns under each area.)

AREA I
English Composition

AREA II
Foreign Language
Placement/Special Credit

AREA III
A. Arts and Humanities
(4 courses)

B. Social and Behavioral Sciences (4 courses)

C. Biological Sciences
(2 courses)

D. Mathematics and Physical Sciences (2 courses)

AREA IV
A. Concentration

Hours Outside Science
(Limit of 10 hours)

Electives Inside Science

300-400 Hours (30 required)

Total hours completed toward graduation (122 required)

PROGRAM WORK SHEET—PURDUE UNDERGRADUATE DEGREES

MAJOR

Course	Credit	Semester

MINOR (Dept. Option)

ELECTIVES

ENGLISH COMPOSITION (4 cr.)

	Credit	Semester

MODERN LANGUAGE
(4th semester proficiency required)

LABORATORY SCIENCE (4 courses)

MATHEMATICS (11 hrs. minimum)

HUMANITIES, SOCIAL STUDIES, AND BEHAVIORAL SCIENCES (18 hrs., 2 areas 6 hrs. ea., seq)

2 areas _____ Sequence _____

TOTAL CREDIT HOURS

(124 required for graduation)