

Bulletin of the Purdue University
School of Science at Indianapolis
1987-89

School of SCIENCE

Indiana University-Purdue University at Indianapolis

IUPUI

Degree Programs

School of Science

Biology

Bachelor of Arts (PU)

Bachelor of Science (PU)

Master of Science (PU)

Chemistry

Bachelor of Arts (PU)

Bachelor of Science (PU)

Bachelor of Science in Chemistry (PU)

Master of Science (PU)

Computer and Information Science

Bachelor of Science (PU)

Master of Science (PU)

Geology

Bachelor of Arts (IU)

Bachelor of Science (IU)

Master of Science (IU)

Mathematical Sciences

Bachelor of Science (PU)

Master of Science (PU)

Master of Arts in Teaching (PU)

Physics

Bachelor of Science (PU)

Master of Science (PU)

Psychology

Bachelor of Arts (PU)

Bachelor of Science (PU)

Master of Science (PU)

Rehabilitation Psychology

Doctor of Philosophy (PU)

Qualified students may be authorized to pursue the Ph.D. degree in a science discipline (except geology) at IUPUI in areas where a program equivalent to that at West Lafayette can be arranged. Please contact the department of interest at IUPUI for further details.

**Bulletin of the Purdue University
School of Science at Indianapolis
1987-89**

School of SCIENCE

1125 East 38th Street
P.O. Box 647
Indianapolis, IN 46223

While every effort is made to provide accurate and current information, Indiana University and the Purdue University School of Science reserve the right to change without notice statements in the bulletin series concerning rules, policies, fees, curricula, courses, or other matters.

IUPUI Calendar 1987-89

First Semester 1987-88

Classes Begin	M Aug. 24
Labor Day	M Sept. 7
	(Classes meet)
Thanksgiving Recess	M Nov. 23
Classes Resume	M Nov. 30
Classes End	S Dec. 13
Final Exams	M-S Dec. 14-20

Second Semester 1987-88

Classes Begin	M Jan. 11
Spring Recess	M Mar. 7
Classes Resume	M Mar. 14
Classes End	S May 1
Final Exams	M-S May 2-8
Commencement	S May 15

Summer I 1988

Classes Begin	W May 11
Memorial Day Recess	M May 30
Classes End	W June 22 ¹

Summer II 1988

Classes Begin	M June 27
Independence Day	
Recess	M July 4
Classes End	M Aug. 8

¹ Monday classes meet June 22

Contents

1	IUPUI Perspective	13	Academic Regulations
2	The School of Science	13	Grades
2	Honors	14	Courses Repeated
3	Student Welfare and Responsibility	14	Credit by Examination and Special Credit
4	Program Planning and Counseling Guidelines	15	Course Audits
4	Confidentiality of Student Records	15	Petition for Grade Change
4	Student Conduct	15	Class Standing
4	Career and Employment Services	15	Science Scholars and Dean's Honor List
4	Campus Housing	15	Candidates for Baccalaureate Degrees
5	Information for International Students	15	Double Major
5	Expenses and Financial Aid	15	Double Degree
5	Costs and Fees	16	Second Baccalaureate Degree
5	Refund Policy	16	Degrees Awarded with Distinction
6	Credit by Examination and Special Credit Fees	16	Academic Standing
6	Health Care and Insurance	16	Academic Probation
6	Financial Aid	16	Dismissal
6	Veterans' Benefits	16	Readmission
7	Admissions and Transfers	17	Special Facilities and Services
7	Beginning Students	17	Libraries
8	Advanced Academic Standing	17	Instructional Media Services
8	Adult Nondegree Students	17	Main Computing Services
8	Transient Students	17	Special Programs
8	Transfers	17	Secondary Teachers' Certificate
8	From IUPUI Schools, Indiana University Campuses, Purdue University Campuses	18	General Education
8	From Other Colleges and Universities	18	Professional Education
8	Transfer Credit	18	Predental and Premedical Programs
8	From IUPUI to other Indiana University and Purdue University Campuses	18	Honors Program
9	International Students	18	Geology
9	Graduate Students	19	Psychology
9	Regular Graduate Application	19	Cooperative Education Program
9	Temporary Graduate Application	19	Officer Training Programs (ROTC)
9	Graduation Requirements	21	Departmental Programs
9	Baccalaureate Degree	21	Department of Biology
9	General Requirements	27	Prepharmacy
10	Area Requirements	28	Preoptometry
10	Bachelor of Arts Degree	28	Preveterinary Medicine
11	Bachelor of Science Degree	33	Department of Chemistry
12	Graduate Programs	44	Department of Computer and Information Science
12	Purdue University	51	Department of Geology
13	Indiana University	60	Department of Mathematical Sciences
		73	Department of Physics
		77	Astronomy
		79	Department of Psychology
		92	Resident Faculty
		97	Degree Checklist
		97	Bachelor of Arts
		98	Bachelor of Science
		99	Index

Administrative Officers

Indiana University

JOHN W. RYAN, Ph.D., *President of the University*
HERMAN B WELLS, A.M., LL.D., *Chancellor of the University*
W. GEORGE PINNELL, D.B.A., *Executive Vice President of the University*
KENNETH R.R. GROS LOUIS, Ph.D., *Vice President, Bloomington*
GERALD L. BEPKO, L.L.M., *Vice President, Indianapolis*
JOHN D. MULHOLLAND, M.B.A., *Treasurer of the University*
LEO F. SOLT, Ph.D., *Dean of the Graduate School*

Purdue University

STEVEN C. BEERING, M.D., *President*
VARRO E. TYLER, Ph.D., *Executive Vice President for Academic Affairs*
FREDERICK R. FORD, Ph.D., *Executive Vice President and Treasurer*
ROBERT A. GREENKORN, Ph.D., *Vice President for Research*
ROBERT R. RINGEL, Ph.D., *Dean of the Graduate School*

Indiana University–Purdue University at Indianapolis

GERALD L. BEPKO, L.L.M., *Vice President, Indianapolis*
HOWARD G. SCHALLER, Ph.D., *Executive Dean and Dean of the Faculties*
PATRICIA A. BOAZ, Ph.D., *Associate Dean of the Faculties and Dean of Student Affairs*
CAROL NATHAN, A.M., *Associate Dean of Faculties*
WENDELL F. MCBURNEY, Ed.D., *Dean for Research and Sponsored Programs*
ROBERT E. MARTIN, M.P.A., *Director of Administrative Affairs*
JOHN C. KRIVACS, M.S., *Director of Admissions*
DAVID L. ROBBINS, M.B.A., *Director of Budgeting and Fiscal Affairs*
RICHARD E. SLOCUM, Ph.D., *Registrar*
LINCOLN LEWIS, Ed.D., *Campus Affirmative Action Officer*

IUPUI Perspective

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-1960s. 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 trustees of both Indiana and Purdue Universities merged their Indianapolis operations to form Indiana University-Purdue University at Indianapolis. Indiana University was selected to administer the campus and IUPUI is a core campus along with Bloomington in the statewide IU system.

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 on the main campus, just west of downtown Indianapolis. The School of Science and the School of Engineering and Technology utilize facilities on both the main and the 38th Street campuses.

Because IUPUI combines the arts and sciences and professions, including engineering and technology, it is the most comprehensive public institution of higher learning in the state. This broad spectrum of educational opportunities enables its students to prepare for a wide range of careers. All degrees earned are from Indiana University or Purdue University.

IUPUI has an urban orientation. Most of its students commute, and many of its programs are directly related to metropolitan concerns and aspirations. IUPUI has an enrollment of approximately 23,000 students, a faculty of 1,300, and a 5,000-member supporting staff. Professionals from business, industry, hospitals, and government agencies are often used as part-time lecturers in select disciplines, their practical experiences providing students with additional educational insights. School of Science students have the opportunity to participate in cooperative education programs with area industry.

IUPUI divisions include the country's second 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 work in the state, the country's oldest school of physical education, a law school with an urban emphasis, a nationally recognized school of art and Schools of Education, Business, Journalism, and Public and Environmental Affairs. 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 accredited by the North Central Association of Colleges and Secondary Schools. This assures the recognition of IUPUI credits, and enables graduates to study in virtually any school in the nation. Because of the organization of the School of Science, all degrees awarded are Purdue University degrees, except those given in geology which are Indiana University degrees.

The School of Science

The School of Science offers many undergraduate and graduate programs that will prepare students for a variety of careers now open to scientists. Scientists are encouraged by society to pursue new avenues of research, either as individuals, or as part of research teams employing many scientists. Needed to design computers and computer programs, locate and analyze natural resources, and help find ways to protect our environment, scientists can apply research findings to industrial and human problems. They are wanted as administrators for governmental organizations using other scientists, and as salespersons and managers by companies with science-based products.

Undergraduate training in one or several of the sciences is considered excellent background for graduate study in medicine (including veterinary medicine), dentistry, business administration, law, and areas of the social sciences where quantitative methods are important. The School of Science also is very much interested in helping young people whose goal is not a career 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 biology, chemistry, computer science, geology, mathematics, physics, and psychology. A Master of Arts in Teaching is offered in mathematics. Master of Science degrees are offered in biology, chemistry, computer science, geology, physics, psychology, and mathematics. A Ph.D. program in rehabilitation psychology is also offered. All degrees awarded are Purdue University degrees, except those given in geology, which are Indiana University degrees. Qualified students may be authorized to pursue a Purdue Ph.D. degree at IUPUI in areas where a program equivalent to that at West Lafayette can be arranged.

Honors

The faculty cooperates in nominating students for various annual awards offered by the School of Science departments, or organizations interested in science education.

Department of Biology

Academic Achievement Award for the graduating senior who has achieved excellence in biology and all other courses

Scholarly Research Award for the student who has shown the greatest accomplishment in independent laboratory research

Department of Chemistry

Academic Achievement Award for the graduating senior with highest achievement in a Bachelor of Arts degree program

Loren T. Jones Award for the graduating senior with the highest academic achievement in a Bachelor of Science degree program

Chemical Rubber Company Award for the outstanding freshman student in general chemistry

Outstanding Undergraduate Analytical Chemistry Award sponsored by the American Chemical Society

Loren T. Jones Scholarship for summer support of an outstanding chemistry major

Frank J. Welcher Award for the graduating senior with greatest professional promise

Department of Computer and Information Science

Outstanding Student Award for a major in computer and information science

Outstanding Graduate Student Award for a regular graduate student in computer and information science

Department of Geology

Academic Achievement Award for the graduating senior with high academic achievement

Leadership and Service Award for the graduating senior with outstanding leadership and service to the department

Indiana Geology and Gem Society Scholarship for a sophomore or junior geology major with a minimum grade average of 3.00 and in financial need

Department of Mathematical Sciences

Anna K. Suter Award for the outstanding mathematics major

Anna K. Suter Scholarship for undergraduate mathematics majors. This scholarship covers tuition and books for one year. It is renewable based on academic performance. An additional, substantial cash award is also made when funds are available.

Outstanding Student Award for an outstanding junior or senior (or both) based on achievements in advanced mathematics

Department of Physics

Academic Achievement Award for the physics major with the best academic record

Golden A. Flake Award for the best student in the elementary physics course sequence for science majors

Department of Psychology

Robert C. Neel Award for the graduating senior with highest academic achievement

Robert I. Long Award for the most outstanding graduating senior

Student Research Award for the graduating senior who has demonstrated the most skill as a research scientist

Karen C. Carmen Award for disabled undergraduate or graduate with highest academic achievement

Graduate Psychology Awards for the most outstanding graduate student in Applied Social, Industrial/Organization, and Rehabilitation Programs

In addition, science honor students compete successfully for Outstanding Freshman Scholarships and Outstanding Upper Class Scholarships awarded by IUPUI. Freshmen with a high level of achievement are eligible for election to the IUPUI Chapters of Alpha Lambda Delta and Phi Eta Sigma Honoraries. Psychology majors may be elected to Psi Chi Honorary for students of that discipline. Undergraduate majors whose research advisers commend their accomplishment may compete for Student Research Symposium Awards offered jointly by the School of Science and Sigma Xi, the Scientific Research Society.

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 curricula and courses, majors and minors, and campus residence. Advisers, directors, and deans will aid students in meeting these requirements, but students are responsible for fulfilling them. At the end of the course of study, the faculty and the Board of Trustees vote upon the conferring of degrees. If requirements have not been satisfied, degrees will be withheld pending adequate fulfillment. For this reason, it is important for students to acquaint themselves with all regulations and remain currently informed throughout their University career.

This bulletin lists the requirements and regulations in effect for students who are accepted to the School of Science in January 1987. Students who enter after this date may be subject to different requirements; students who entered prior to January 1987 may elect to follow the graduation requirements which were in effect at the time of their admission to their degree program or the graduation requirements which became effective thereafter. However, the requirements chosen must be from only one bulletin.

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. Students should be thoroughly familiar with all academic requirements which must be met before a degree is granted.
2. Students should seek appointments with faculty advisers in their major departments on or before the dates established by the University calendar for academic counseling. In such conferences students should, as a minimum objective, make certain that they review their degree requirements and that they have 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 the student; 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 the degree program, he or she is urged to obtain this clarification from a faculty adviser or from the Office of the Assistant Dean for Academic Affairs, the School of Science, Krannert Science Building, Room 155.

Confidentiality of Student Records

Indiana University, in compliance with the General Education Provisions Act, Section 438, titled Family Educational Rights and Privacy Act, provides that all student records are confidential and available only to the student and to the student's parents, if the student is under 21 and dependent as defined by IRS standards. The student may review his or her record upon request and may ask for deletions or corrections of the record in a hearing process described in detail in the booklet, *Student Rights and Responsibilities*. References, recommendations, and other similar documents may carry a voluntary waiver relinquishing the student's right to review this specific material. The student may also release the record to others by signing a written release available in the offices which maintain records. Further details regarding the provisions of the Privacy Act and a list of offices where student records are kept may be found in the booklet, *Student Rights and Responsibilities*, available in the Office of the Dean for Student Affairs, Administration Building, Room 108A.

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 affairs has the assignment of implementing central administration action if necessary. More information can be obtained in the booklet, *Student Rights and Responsibilities*.

Career and Employment Services

The Office of Career and Employment Services provides services for students and alumni/ae in evaluating career interests and opportunities and assistance to graduating students in job-search strategies, resume preparation, interviewing techniques, and on-campus recruiting interviews.

The office maintains a career resource library containing company literature, occupational and career information, employment trends, and specific full-time employment opportunities at both the graduate and undergraduate level.

Recruiting companies interview graduating students on campus during the fall and spring semesters. Students may take advantage of this opportunity by registering with the office located in the Business/SPEA Building, Room 2010.

In addition to the Office of Career and Employment Services, information about specific career fields is also available in the Office of the Assistant Dean for Academic Affairs and in departmental chairpersons' offices.

Campus Housing

Admission to the University does not guarantee campus housing accommodations at IUPUI. Students must file separate applications for housing in order to reserve spaces, and should

apply as soon as they decide to attend school at this campus. Assignments are made based on the date of receipt of the application and the \$15 application fee. Persons may apply for housing even though they are not yet admitted to the University.

Dormitory spaces for men and women total 375 beds. Accommodations include Ball Residence and Warthin Dormitory Suites. Graduate Townhouses and Warthin Apartments provide an additional 120 one- and two-bedroom living units on campus. Requests by students for specific dormitory roommates will be honored whenever possible, if the applications are received at approximately the same time and if both applicants make written requests on the application form to room together.

Academic-year campus housing assignments and billing information are usually mailed in July and early August. For additional information, please contact the Campus Housing Office, located in Ball Residence, 1226 W. Michigan St., Indianapolis, IN 46202, Phone (317) 274-7200.

Information for International Students

International students coming to study at IUPUI use the international application. In addition to academic qualifications, they must show proficiency in English and proof of financial support before the travel documents are issued. The International Student Services Office is responsible for all travel documents and immigration concerns, orientation, adjustment to American living, and activities. Upon their arrival, all international students and exchange visitors must report to the International Student Services Office, Union Building, Room 574.

Nondiscrimination policy

Indiana University-Purdue University at Indianapolis provides its services without regard to sex, age, race, religion, ethnic origin, veteran status, or handicap. An Affirmative Action Office on each campus monitors the University's policies and assists individuals who have questions or problems related to discrimination.

Expenses and Financial Aid Admissions and Transfers

Costs and Fees

The cost of attending IUPUI generally is related to the number of credit hours taken by the student. The fee structure for general academic areas of IUPUI as of Fall 1986 is as follows:

	In-State	Out-of-State
Undergraduate	\$53.75/credit hour	\$143.00/credit hour
Graduate	\$73.75/credit hour	\$201.75/credit hour

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

Fees are subject to change without notice by action of the Board of Trustees of Indiana University. Inquiries about fees should be directed to the Office of the Bursar, Cavanaugh Hall, Room 147.

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 \$1800 for fees, books, and class supplies. Other expenses such as transportation, food, and entertainment vary according to individual needs.

Refund Policy

Refunds during the fall and spring semesters and summer sessions are based upon the date of withdrawal as stated below:

For courses scheduled 9-16
weeks in length:

1st week	100% refund
2nd week	75% refund
3rd week	50% refund
4th week	25% refund
5th week	No Refund

For courses scheduled 5-8
weeks in length:

1st week	100% refund
2nd week	50% refund
3rd week	No Refund

To be eligible for a refund, students must submit a schedule adjustment form to the

Registrar's Office for the course they wish to drop. Refund amounts are determined by the official date on which the withdrawal form is received by the IUPUI Registrar's Office, Cavanaugh Hall, Room 133.

Credit by Examination and Special Credit Fees

If the credit is awarded as the result of an examination and;

1. is during the first or second consecutive semester of matriculation there is no charge.
2. applicant is a first semester transfer student, there is a \$10 per credit hour charge.
3. applicant is neither of the above, the standard credit-hour resident or nonresident rate will be assessed.

Credit by Credentials and/or Experience

Special credit awarded as a result of credentials or experience will be assessed at the rate of \$10 per credit hour not to exceed \$50 per course.

Health Care and Insurance

The Student Employee Health Service (SEHS) is located in Coleman Hall. All full-time IUPUI students are eligible for the program of outpatient health care provided by SEHS. There is no charge for the services of physicians, nurses, or speciality consultants. In addition, the SEHS clinic has available about 70 specialty clinics to which students may be referred. The University has also arranged for an optional health insurance plan to supplement the services provided by the SEHS Clinic. All students are eligible for this program through a private insurance carrier. Part-time students may be treated in the Student Employee Health Service on a fee-for-service basis. Information is available at registration and at SEHS. Telephone: (317) 274-8214.

Financial Aid

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 college 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 scholarships, grants, loans, and participation in the work-study program.

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

Office of Scholarships and Financial Aids
Cavanaugh Hall 103
425 Agnes Street
Indianapolis, Indiana 46202
Telephone (317) 274-4162

Veterans' Benefits

Students eligible for education benefits from the Veterans Administration enroll according to the following benefits scale:

Benefits	Undergraduate		Graduate	
	Fall/Spring	Summer (6 weeks)	Fall/Spring	Summer (6 weeks)
Full time	12 hrs. or more	4 hrs. or more	9 hrs. or more	4 hrs. or more
$\frac{3}{4}$ time	9-11 hrs.	3 hrs.	7-8 hrs.	3 hrs.
$\frac{1}{2}$ time	6-8 hrs.	2 hrs.	5-6 hrs.	2 hrs.
Tuition	less than	less than	less than	less than
only	6 hrs.	2 hrs.	5 hrs.	2 hrs.

For further information including VA paid tutorial assistance and work/study opportunities, consult the Office of Veterans Affairs at the Registrar's Office in Cavanaugh Hall, phone (317) 274-1501.

Admissions and Transfers

All students entering the School of Science must have been officially admitted to the University by the Office of Admissions, 425 Agnes St., Room 129, Indianapolis, Indiana 46202. Further information and application forms may be obtained at this address. All applications for admission must be accompanied with a \$20 nonrefundable fee. Checks should be made payable to IUPUI.

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

Beginning Students

When entering directly from high school, the application for admission should be filed at the end of the junior year.

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 the student meets or exceeds the minimum subject requirements is indicated below. For admission to the School of Science, the student's record should include:

Subjects	Semesters
English	6
History or social studies	2
Algebra ¹	3
Geometry ¹	2
Trigonometry or fourth semester Algebra ¹	2
Laboratory Science ¹	2

Students 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 the high school offers more than the above mathematics courses, students may benefit from taking analytic geometry (precalculus mathematics). It is advised that one semester of chemistry be included in 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. Departmental counselors will be glad to help with preplanning for admission.

3. All applicants are required to take the SAT (College Board Scholastic Aptitude Test) or the ACT (American College Testing Program). It is recommended that these tests be taken in the spring of the junior year in high school.
4. Indiana Residents
 - a. Residents of Indiana must rank in the upper half of their high school graduating class or have a combined verbal-math SAT of 950. In either case, neither SAT score may be below 400.
 - b. Residents of Indiana must rank in the upper half of their high school graduating class or have an ACT composite score of 23. In either case, neither the verbal ACT score nor the math ACT score may be below 18.
A marginal applicant may be granted admission, admitted on probation, or have admission denied.
5. Out-of-State Residents
Out-of-state applicants must rank in the top third of their high school graduating class. They must also rank in the top third of the IUPUI distribution on the SAT or ACT.
6. Information provided by the high school counselor.

Students should declare a major when applying for admission so that a departmental adviser can be assigned. Premedical and pre dental students should declare a chemistry or biology major at the time of admission.

¹ Students in the B.A. and B.S. programs in psychology and the B.A. program in geology are required to have four semesters of mathematics, two of which will be in algebra, for admission to the School of Science.

Advanced Academic Standing

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

SPAN (Special Pre-College Age Non-Degree Programs)

The SPAN program allows middle and high school students ranking in the top 10 percent of nationally standardized tests (SAT, IOWA, PSAT, etc.) and senior year high school students ranking in the top 20 percent of their class to earn college credit prior to their graduation from high school. This permits them to be challenged in courses not available in their own schools and to develop better study and research skills while simultaneously continuing their normal junior or senior high school education. To determine qualification, consult the high school counselor and the Honors Program at IUPUI.

Adult Nondegree Students

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

Transient Students

It is the responsibility of the individual as a transient student to determine whether credits earned at IUPUI may be applied toward the degree being sought from one's own university.

Transfers

From IUPUI Schools, Indiana University campuses, Purdue University campuses

Students desiring to transfer should have a minimum grade-point average of 2.0 on a 4.0 scale and be in good disciplinary standing. Upon processing of appropriate materials as indicated below, acceptance to the School of Science requires the signature of the chairperson of the department approving the request to pursue a degree program and the signature of the assistant dean for academic affairs of the School of Science.

1. An IUPUI student files a record change form that may be obtained from the office of the assistant dean of academic affairs of the School of Science or the student's current school.
2. A student at another Indiana University campus files an inter-campus transfer form which may be obtained from the office of the dean of the campus in which the student is enrolled.
3. A Purdue campus student must make an official application through the IUPUI Office of Admissions.

From other colleges and universities

If the student has earned transfer credit for 12 semester hours and a cumulative grade-point average of 2.0 on a 4.0 scale (3.0 for nonresidents of Indiana) in other institutions, he or she may be admitted to the School of Science. Admittance to the School is contingent upon acceptance into a departmental program. Submit with the application for admission:

1. A copy of the high school record showing satisfactory completion of entrance requirements.
2. An official transcript of work completed in each institution previously attended.
3. Evidence of good academic and disciplinary standing at the institution 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 Admissions 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 IUPUI.

From IUPUI to other Indiana University and Purdue University campuses

Students transferring from IUPUI to other Indiana University and Purdue University campuses should consult the appropriate departments at those campuses about equivalence of courses.

International Students

Applicants from foreign countries will be considered for admission without taking the American Entrance Examination on the basis of credentials showing marks earned and certifying the completion of secondary school. Official translations must accompany academic records and other credentials not written in English. Financial aids for undergraduate international students are not available.

Graduate Students

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

Application should normally be made at least three months before the beginning of the session in which the student wishes to enroll. However, late applications will also be accepted. The applicant will be advised of action on his or her application by the Dean of the Purdue University Graduate School, or, for a geology applicant, the Dean of the Indiana University Graduate School.

Qualified students may be authorized to pursue a Purdue Ph.D. degree at IUPUI in areas where a program equivalent to that at West Lafayette can be arranged. For further detail, contact the department in which study is desired.

Financial support in the form of teaching and research assistantships is available through the departments of the School of Science.

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.

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 the chosen major department at the time of application for admission as a temporary graduate student. The major department will advise applicants 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 Education/Social Work Building, Room 4106. *Not more than 9 hours of credit earned under this classification may be used in a plan of study without approval of the major department.*

Graduation Requirements

Baccalaureate Degree

General Requirements

1. A minimum of 124 hours—(122 for geology). Acceptance must be obtained from the Office of the Assistant Dean for Academic Affairs to use as credit toward graduation any course that was completed ten or more years previously.
2. A minimum grade-point average of 2.0.
3. A minimum of 24 hours must be taken in a major subject (see departmental requirements) with a minimum average of 2.0. No grade below C- is acceptable in the major subject.
4. A minimum of 9 hours in the major subject must be completed at IUPUI (see departmental requirements).
5. Residence at IUPUI for at least two semesters and completion, while at IUPUI, of at least 32 semester hours of work in courses at the 300 level or higher.
6. With the approval of the assistant dean for academic affairs, students who have had at least four semesters of resident study may complete up to 15 hours of the senior year in another approved college or university.
7. Courses taken on the pass/fail option can be applied only as general electives and not toward degree area requirements of the school or department.

8. Not more than 60 hours earned in accredited junior colleges can be applied toward a degree.
9. Students may enroll in Independent Study (correspondence) courses for general electives up to a maximum of 12 credit hours with permission of the assistant dean for academic affairs. Also, by permission of the department, credit may be earned through special credit examination. Credits earned by special credit examination may be used toward the total hours required and to satisfy area requirements for a degree.
10. The following courses do not count for any credit toward any degree program in the School of Science: AGR 101; BIOL N100, N120, N200; CHEM C100; all COAS courses; EDUC U205, X150, X151, X152, ENG W001, MATH 001, 002, 110, 111, 112, 123, 130, 131, 132.
11. Courses taken outside of the Schools of Science and Liberal Arts must receive departmental approval. No more than 6 hours of the clinical, athletic, or performing arts types will be approved. See the departmental counselor for details.
12. In general, credit is not allowed for both of two overlapping courses. See the departmental counselor for details.
13. An application for a degree must be filed in the Office of the Recorder, School of Science, Krannert Building, Room 155, at least one semester prior to the anticipated graduation. Degrees are conferred in May, August, and December; Commencement is held only in May. Candidates for degrees in August may participate in May Commencement.

Area Requirements

The Faculty of the School of Science has adopted the following degree requirements for the Bachelor of Arts and Bachelor of Science degrees. Students may follow the School of Science and departmental requirements which are in effect when they enter the School of Science, or they may choose new requirements which become effective after that date. However, the requirements must be chosen from only one bulletin. School of Science requirements are the minimal requirements in various areas and individual departments *may require more* as stated in their degree descriptions. Students should consult with departmental counselors in planning their courses of study.

Students should note the following:

1. Check departmental descriptions for courses which are considered overlaps. Some courses may not be used to fulfill distributional requirements. Students should consult with their advisers on these points.
2. Cross-listed courses may count only once in fulfilling requirements.
3. English W131 and other composition courses may not be used to complete the Area III requirements.
4. It is recommended that a student who intends to pursue graduate studies should plan to take the Graduate Record Examination at the beginning of the senior year.

Bachelor of Arts Degree

Area I

English Composition and Communicative Skills Two courses in English composition of at least 3 credits each and one course in speech skills of at least 3 credits are required. The English composition requirement is partially satisfied by completing English W131. A second course, in technical or research writing, may be used to complete the composition requirement. Consult departmental guidelines. A grade of C or better must be obtained in both composition courses.

Area II

Foreign Language No courses are required by the School of Science. Consult departmental requirements.

Area III

IIIA. Arts and Humanities Four courses totaling at least 12 credits are required. There must be at least two courses in one discipline in either IIIA or IIIB. History is cross-listed and may be used in IIIA or IIIB, but not both.

American Studies

English

Fine Arts

Folklore

French

History

German

Journalism

Music

Philosophy

Religious Studies

Spanish

Theatre

Performing arts and studio courses are not accepted as fulfilling arts and humanities requirements. Writing courses are not accepted as English or journalism courses.

IIIB. Social and Behavioral Sciences Four courses outside the major department totaling at least 12 credits are required. There must be at least two courses in one discipline in either IIIA or IIIB. History is cross-listed and may be used in IIIA or IIIB, but not both.

Anthropology	Linguistics
Economics	Political Science
Geography	Psychology
History	Sociology

IIIC. Physical and Biological Sciences At least four science courses totaling a minimum of 12 credits outside the major department are required. At least one of the courses must be a laboratory course. Not acceptable are BIOL N100, N120, N200, all agriculture courses; and CHEM C100. If GEOL G130 is selected, a minimum of three 1-credit sections must be taken for fulfillment of this requirement. Check major department for additional restrictions.

Biology	Geology
Chemistry	Physics (including Astronomy)

IIID. Mathematical Sciences One course of at least 3 credits in computer science (CSCI) is required. Check for additional departmental requirements.

Computer Science	Mathematics
Statistics	

Area IV

Major Department Consult the listing of the major subject as well as courses required by the major department in the other areas.

Bachelor of Science Degree

Area I

English Composition and Communicative Skills Two courses in English composition of at least 3 credits each and one course in speech skills of at least 3 credits are required. The English composition requirement is partially satisfied by completing English W131. A second course, in technical or research writing, may be used to complete the composition requirement. Consult departmental guidelines. A grade of C or better must be obtained in both composition courses.

Area II

Foreign Language No courses are required by the School of Science. Consult departmental requirements.

Area III

IIIA. Arts and Humanities Two courses totaling at least 6 credits are required. There must be two courses in one discipline in either IIIA or IIIB. History is cross-listed and may be used in IIIA or IIIB, but not both.

American Studies	Journalism
English	Music
Fine Arts	Philosophy
Folklore	Religious Studies
French	Spanish
History	Theatre
German	

Performing arts and studio courses are not accepted as fulfilling arts and humanities requirements. Writing courses are not accepted as English or journalism courses.

IIIB. Social and Behavioral Sciences Two courses outside the major department totaling at least 6 credits are required. There must be two courses in one discipline in either IIIA or IIIB. History is cross-listed and may be used in IIIA or IIIB, but not both.

Anthropology	Linguistics
Economics	Political Science
Geography	Psychology
History	Sociology

IIIC. Physical and Biological Sciences At least four science courses totaling a minimum of 12 credits outside the major department are required. At least one of the courses must be a laboratory course. Not acceptable are BIOL N100, N120, N200, all agriculture courses, and CHEM C100. If GEOL G130 is selected, a minimum of three 1-credit sections must be taken for fulfillment of this requirement. Check major department for additional restrictions.

Biology	Geology
Chemistry	Physics

IIID. Mathematical Sciences At least two courses beyond algebra and trigonometry, totaling a minimum of 6 credits, are required. In addition, one course of at least 3 credits in computer science (CSCI) is required. Check for additional departmental requirements.

Computer Science
Statistics

Mathematics

Courses in applied statistics are not acceptable.

Area IV

Major Department Consult the listing of the major department for courses required within the major subject as well as other courses required by the major department in other areas.

Graduate Programs

Master of Science degrees are offered in computer science, biology, chemistry, geology, physics, psychology, and mathematics. A Ph.D. program in rehabilitation psychology is also offered. All degrees awarded are Purdue University degrees, except that given in geology, which is an Indiana University degree. Qualified students may be authorized to pursue a Purdue Ph.D. degree at IUPUI in areas where a program equivalent to that at West Lafayette can be arranged.

Purdue University Graduate Degrees

General Requirements

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

Candidate 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 (GRE) or 36 or higher on the verbal portion of the Admission Test for Graduate Students in Business, or (3) if they can certify exemption from undergraduate composition on the basis of both a Scholastic Aptitude Verbal test score of at least 650 and a rank in the upper 10 percent of the high school class. If the English requirement is satisfied in one of the above ways and the information is included as part of the information submitted with the graduate application, English clearance will be given automatically. If the student takes the GRE 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 must 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 that 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 the individual graduate adviser. 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 30 to 36 semester hours of credit.

6. Oral and written examinations—The Graduate School has no general requirement for oral and written examinations for the master's 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 master's degree. The committee must certify to the Graduate School either that the student has passed the required examinations of the department in which the major graduate study has been taken or that the committee is satisfied with the accomplishment of the student as based on a committee conference.
7. A student who has previously earned a bachelor's degree may enroll in graduate courses without making formal application as a degree-seeking student. Application as a temporary graduate student is, however, required and may be accomplished through the IUPUI Office of Graduate Programs in the Education/Social Work Building, Room 4106. A maximum of 9 hours of courses completed as a temporary student may be used in completing the requirements of a degree upon acceptance as a degree-seeking student and upon departmental approval.

Indiana University Graduate Degrees

Consult Department of Geology section for information.

Academic Regulations

Grades

The School of Science uses a grading system that may include plus and minus grades as well as straight grades for all undergraduate and graduate courses:

A+	(4.0)
A	(4.0)
A-	(3.7)
B+	(3.3)
B	(3.0)
B-	(2.7)
C+	(2.3)
C	(2.0)
C-	(1.7)
D+	(1.3)
D	(1.0)
D-	(0.7)
F	(0.0) (No credit) Failed the work in a course or failed to complete an official withdrawal
R	(Deferred Grade)
S	Satisfactory
P	Passed (See pass-fail option)
F	Failing (See pass-fail option) (No credit)

Each instructor has the prerogative of using the plus-minus or the conventional grading system for his or her courses.

P or F Pass/Fail During the four years of his or her undergraduate program, any undergraduate student in good standing (not on probation) may enroll in up to a maximum 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 August 15 to August 15. 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 cannot be changed subsequently to a grade of A, B, C, or D.

Computation of GPA To compute the grade-point average (GPA), the number of grade points received (4.0 for an A, 3.0 for a B, etc.) is multiplied by the number of credits assigned for each course. The sum of grade points received for all courses is then divided by the total number of course credits. Grades of P and S are not included in the computation; a grade of F is included.

W or Withdrawal Students may officially withdraw from classes without penalty during the first one-half of a semester or session if they secure the approval of their adviser; a grade of

"W" is recorded on the final grade report. Students may withdraw from classes during the third quarter of a semester or session if they secure the approval of their adviser and the instructor of the course; a grade of "W" is assigned by the instructor of the affected course. The grade so assigned is recorded on the final report. Students may withdraw from classes during the last quarter of a semester or session if they secure the approval of their adviser, the instructor of the course, and the dean of their school; a grade of "W" is assigned by the instructor of the affected course. The grade so assigned is recorded on the final grade report. *Students will be allowed to withdraw from class during the last quarter of the semester only under extenuating circumstances. A written justification from a doctor, clergyman, adviser, etc., must be presented.*

Students who alter their schedule, whether by personal incentive or by departmental directive, must follow withdrawal procedures. Students who do not follow these procedures risk jeopardizing their record by incurring a failing grade in a course not properly dropped, or may risk not receiving credit for work done in a course which has not been properly added.

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 student has completed three-fourths of the semester with course work 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 the work.

Removal of Incomplete The removal of a grade of Incomplete is the responsibility of the student. A grade of Incomplete must be removed within one year from the time that is given. An Incomplete grade which has not been removed by the end of one year will be converted by the Registrar's Office to the grade of F. The dean may authorize adjustment of the one year period in exceptional circumstances.

Removal of F or FX Option The FX option is available only to undergraduate students and may be exercised for no more than three courses, totaling no more than 10 credits. By applying the FX Option, a student who retakes a course previously failed shall have only the second grade in that course counted in the determination of the official transcript cumulative grade-point average. The grade of FX is used to replace the original grade of F on the transcript and is not counted in computing the grade-point average. A student may exercise the FX Option no more than once for a given course. The student's transcript shall record all enrollments in the course and all grades earned for each enrollment, with an FX understood as reflecting an original grade of F.

In retaking the course, the student must receive a grade of A, B, C, D, S, or P to remove the original F grade. The designation W/Withdrawal will not remove the original F unless the student is withdrawn from the original enrollment. Under this policy, a student may replace a grade through re-enrollment only in a course in which a grade of F was received. A grade of D, C, or B cannot be improved by this policy. *Students who wish to take advantage of this option must secure the approval of the assistant dean for academic affairs (in KB 155) and fill out the FX form at the beginning of the semester in which the course is repeated.*

Courses Repeated

The School of Science computes a school grade-point average which is the basis for recommending the awarding of a degree. The computation of this grade-point average, including repeated courses, is done during the senior year at IUPUI, and is made using the rule that only the most recent grade in repeated courses counts in computing the school grade-point average for the purpose of graduation. The official grade-point average, which is based upon all grades earned, appears on all transcripts.

Credit by Examination and Special Credit

Students may receive course credit by examination or credit for credentials and/or experience. Departments within the School of Science authorize and determine such credits and administer the exams in their areas. The student must obtain a special credit form from the consenting department, obtain the necessary signatures, and pay the examination or special credit fee to the Office of the Bursar (see Expenses and Financial Aid). Credit earned by examination will be assigned an A (highest passing grade) or S (passing grade). Credit earned by credentials and/or experience will be assigned an S.

Course Audits

While auditing of courses is permitted under University policy, audited courses may not be retaken at a later date for academic credit. Written permission from the instructor to audit a class must be obtained before the student attempts to register.

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 approval of the department chairperson and the assistant dean for academic affairs of the School of Science.
2. Student petition: A student may request a change of grade by filing a petition with the assistant dean for academic affairs, and should include:
 - a. A statement of attempted, but unsuccessful, interview with the faculty member and the chairperson 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; pass/fail option; and FX option are available in the departmental offices, Office of Assistant Dean for Academic Affairs or the Registrar's Office.

Class Standing

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

Freshman	0 to 25	Junior	56 to 85
Sophomore	26 to 55	Senior	86 or more

Science Scholars and Dean's Honor Lists

The School of Science recognizes exceptional academic performance prior to graduation from the University by periodically publishing the Science Scholars List and the Dean's Honor List. The Science Scholars List is a list of names of full-time or part-time students who have completed at least 26 hours of coursework at IUPUI and who have a semester and cumulative GPA of at least 3.75. The Dean's Honor List contains the names of the students who have achieved a GPA of 3.5 or higher during a semester in which they carry 12 or more credit hours. Part-time students who are juniors or seniors and who have a cumulative and semester GPA of 3.5 or higher also will be included on the Dean's Honor List. Courses assigned a deferred grade (R) will count toward the 12 hour minimum required of full-time students. Courses taken on a pass/fail basis will not count toward the 12 hour minimum. Students who received an Incomplete (I) will not be placed on the Science Scholars List or the Dean's List. No Science Scholars or Dean's List is published for the summer sessions.

Candidates For Baccalaureate Degrees

Students are considered to be candidates in good standing for a baccalaureate degree awarded by the School of Science when they have been admitted as regular students by the Office of Admissions, their last semester's grade-point average is not less than a C (2.0), and their cumulative grade-point average is not below this same level.

Double Major

A double major is awarded to students who simultaneously complete the requirements for two Purdue bachelor of science programs or two Purdue bachelor of arts programs in the School of Science. Students who plan to double major must have their programs approved by both major departments and the assistant dean for academic affairs. A form to petition for a double major can be obtained from the office of the assistant dean for academic affairs.

Double Degree

A student may be awarded two degrees by simultaneously completing baccalaureate degree programs from two different schools at IUPUI, or by simultaneously completing two baccalaureate major programs from the School of Science, one leading to a Purdue Bachelor of Arts degree and the other leading to a Purdue Bachelor of Science degree, or one leading to a Purdue degree and the other leading to an Indiana University degree. A student who plans to pursue a double degree must receive approval from the two major departments and the academic deans of the schools awarding the degrees. A form to petition for a double degree

can be obtained from the office of the assistant dean for academic affairs of the School of Science.

Second Baccalaureate 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 assistant dean for academic affairs 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 meet the requirements of the School of Science and of the department in which the student is a candidate. In particular, item 5 (referring to residency and level of course work) under general requirements for a baccalaureate degree should be noted.

Degrees Awarded With Distinction

IUPUI recognizes outstanding performance in course work of any student by awarding bachelor's degrees with distinction. Purdue degrees are awarded with Distinction and Highest Distinction. IU degrees are awarded with Distinction, High Distinction, and Highest Distinction. To be eligible a student must have taken a minimum of 60 credit hours at IUPUI.

GPA	PU	IU
3.5500-3.7499	Distinction	Distinction
3.7500-3.8499		High Distinction
3.8500-4.0000	Highest Distinction	Highest Distinction

Academic Standing

Academic Probation

Full-time students are on academic probation when either their semester grade point or cumulative grade-point average is below C (2.0). Part-time students are on academic probation when their grade-point average for two consecutive semesters or cumulative grade-point average is below C (2.0).

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

Dismissal

Students are dismissed from the University when, in the opinion of the assistant dean for academic affairs of the School of Science, they have ceased to make progress toward their degree.

Full-time students are subject to dismissal when they have failed to attain a C (2.0) average in any two consecutive semesters and when the cumulative grade-point average is below C (2.0).

Part-time students are subject to dismissal when their grade-point average for three consecutive semesters or cumulative grade-point average is below C (2.0).

Each student who is dismissed will be so advised by letter from the Office of the Dean for Academic Affairs.

Readmission

A student dismissed for the first time may immediately petition the Office of the Dean for Academic Affairs 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 July 1 for the fall semester, November 15 for the spring semester, and April 1 for the summer sessions.

Students who are readmitted will be so informed by letter from the assistant dean for academic affairs. They are informed of conditions and restrictions upon which readmission depends.

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 although lending policies vary. These are located at the Dental School, Herron School of Art, University Library, Law School, Medical School, and 38th Street campus. The School of Physical Education 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 University Library and the 38th Street campus 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.

Instructional Media Services

Audio-visual learning centers are located in the Krannert Building at the 38th Street Campus, and in Cavanaugh Hall. The centers provide a variety of audio-visual materials, equipment, and services for student and faculty use. Study carrels equipped with cassette tape recorders and slide projectors provide convenient facilities for individual study of recorded course and reference material. Equipment available for classroom and laboratory use includes audio and video tape recorders, closed-circuit TV, and various projectors (overhead, movie, and slide).

Main Computing Services

Computing Services provides computer assistance to the faculty, staff, and students of IUPUI and the other campuses of Indiana University. Computing Services is located on the main campus and houses two DECsystems 20/60s, an IBM 4381, and an IBM 4341. Both timesharing and batch processing are available on the mainframes. In addition, there is extensive microcomputer support available through Computer Services. A terminal cluster is available at the 38th Street Data Center, and clusters are located at various sites on the Michigan Street Campus. The responsibilities of Computing Services are the support of academic computing and research. Technical assistance is available for programming problems, statistical analysis, acquisition and use of computer software and hardware. Programs can be designed and written for faculty and other researchers by Computing Services personnel. Consulting is available at all Computing Services locations to assist students, faculty, and other researchers with programming problems. For more information, contact the Director of Computing Services, Engineering/Technology Building, Room 1023, (317) 274-0707.

Special Programs

Secondary Teachers' Certificate

A student earning a baccalaureate degree in the School of Science may also receive a standard secondary teacher's certificate. With careful planning, the requirements for both programs can be completed in four years. The Secondary School Teacher Certificate, Standard, qualifies the holder to teach in the subject-matter fields for which it is endorsed in any public secondary school in Indiana. The standard certificate 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 completion of program requirements and may be renewed.

Every student who plans to obtain a teaching certificate must be admitted formally to the teacher education program by the end of his or her sophomore year. Admission to teacher education is dependent on successful completion of the Admission to Teacher Education Competency Test and course prerequisites listed in the School of Education *Bulletin*. Application forms and competency test information are available from the student's department adviser or from the School of Education, 902 West New York St., Indianapolis, IN 46223.

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 adviser 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+ (2.3) or above in all University work taken. The student must earn an average grade of C+ (2.3) in all education courses (with at least a C in the methods courses), and a C+ (2.3) in all the course work of his or her teaching major and of the teaching minor if one exists.

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

General Education

Forty (40) credits as follows:

Humanities: minimum of 18 credits (for example English, fine arts, folklore, foreign language, music, philosophy, speech and theatre)

Social and Behavioral Sciences: minimum of 9 credits (for example anthropology, economics, geography, history, political science, psychology, sociology)

Life and Physical Sciences: minimum of 9 credits (subject matter area meets this requirement; some departments specify lab sciences)

Electives as needed for a total of 40 credits

Professional Education

EDUC H340—Education and American Culture (3 Cr)

EDUC P253—Educational Psychology for Secondary Teachers (3 Cr)

EDUC M300—Introduction to Teaching in a Culturally Pluralistic Society (3 Cr)

EDUC M313—Teaching in the Secondary School (3 Cr) (prerequisite for all other methods courses)

EDUC M462—Methods of Teaching High School Reading (3 Cr)

EDUC M440-478—Special Methods in major academic area (4 Cr)

EDUC M480—Student Teaching in Secondary School (9 Cr)

Consult an adviser for any variations or additional requirements.

Predental and Premedical 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 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 nonscience degrees, who are electing courses in the School of Science to prepare for professional school, are also invited to use this counseling service.

Honors Program

The IUPUI Honors Program is open to students in both the Purdue and Indiana University degree programs. Students with a 3.3 overall grade-point average after their first full semester of work or entering freshmen with a combined SAT score of 1200 or those who graduated in the top 10 percent of their high school class are invited to participate in the Honors Program. Students with less than a 3.3 GPA may be permitted to take honors courses. They should, however, discuss the matter with their adviser and the honors counselor before doing so.

To obtain an honors degree in all departments in the School of Science, except geology and psychology, a student must have a cumulative grade-point average of 3.3 and a minimum of 24 credit hours, with a 3.5 GPA in honors work. Six (6) hours of honors credit must be outside one's major field. Students majoring in geology or psychology should follow the requirements below since both departments have their own departmental requirements.

Geology

For the Bachelor of Science degree, the student must complete 24 credit hours of honors work, 18 in geology and 6 hours in other approved honors work. For the Bachelor of Arts degree, the requirements are 15 credit hours in Geology and 9 credit hours outside Geology in other approved honors work. The following upper division geology courses are approved for H-Option contracts: G323, Structural Geology; G334, Principles of Sedimentation and

Stratigraphy; G403, Optical Mineralogy and Petrology; G404, Geobiology (3 credits) plus G410, Field Project (1 credit); G406, Introduction to Geochemistry; G413, Introduction to Earth Physics; G415, Principles of Geomorphology; G416, Economic Geology; G430, Principles of Hydrology; G499, Honors Research in Geology. The student must complete 3 credits in G499, Honors Research in Geology, to satisfy the requirements for the honors component. The overall GPA must be 3.3 with a 4.0 in all honors work.

Psychology

To graduate with honors in psychology students must earn at least 24 hours of honors credit, 6 in psychology and 6 that may be outside psychology. The remaining 12 credits can be in either division. At least 3 hours must be earned in B499, Honors Research in Psychology, which requires an honors thesis. Only grades of "A" or "B" will count for honors credit. To graduate with honors, the student must have an over-all GPA of 3.3, with at least 3.5 in honors courses and at least a 3.5 in psychology courses.

In general, students may take no more than 6 hours of honors work a semester. Students may earn honors credit by taking special honors courses (H300, H399, H400); by taking specially designated sections of multi-section courses; by taking special overseas or internship work or by contracting for honors credit using an H-Option contract in conjunction with regular classes. H-Options are the most popular and frequent way that students earn honors credit. An H-Option requires that a student work out with the instructor of a course a specific contract for a paper, field project, oral presentation, etc., during the first four weeks of the semester. By the end of that period, the H-Option form with all the necessary signatures must be submitted to the Honors Office.

Students completing honors work or an honors degree will, upon request, receive an honors course record, listing all honors work, to be included with official University grade transcripts.

For additional information, contact the Honors Office (ES2126, 274-2660).

Cooperative Education Program

The School of Science Cooperative Education Program gives science students the opportunity of supervised professional employment with course work while studying for degrees. The program is currently available in only select situations.

If a student chooses to participate in cooperative education, it may extend the time required to earn a degree, but the benefits received are important. Based on past experiences of students in co-op programs, one can expect that (1) earnings will be enough to pay for remaining years of employment/studies, and (2) valuable professional experience will be gained in a scientific field—giving students a feeling for a career, making course work more relevant, and increasing one's value as a future employee.

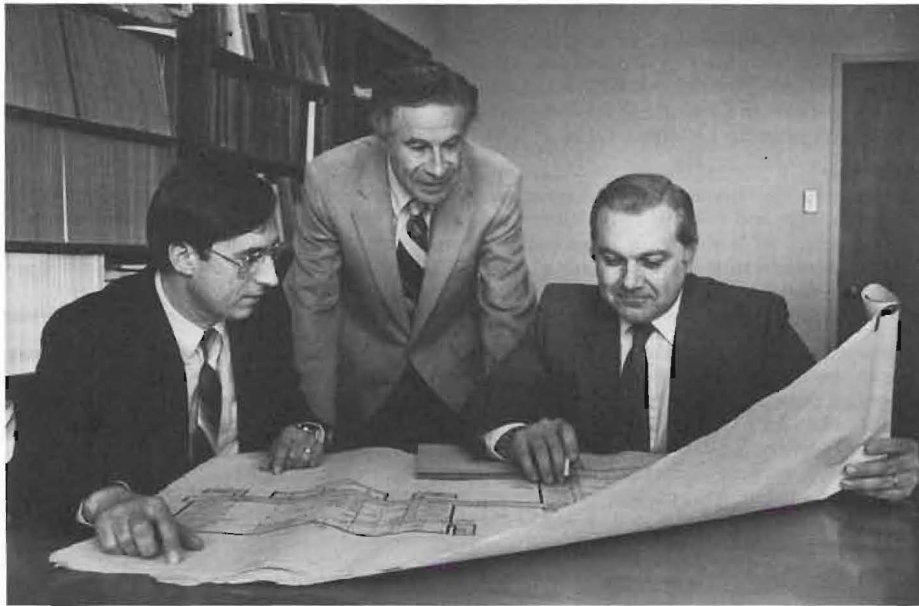
A cooperative education employer is one who has been approved by the School of Science and has agreed to offer a meaningful work experience related to a student's scientific interests. Normally, a student will work for the same employer throughout his or her program and be given increasing responsibility.

To be accepted into the co-op program, a student must apply to the School of Science cooperative education coordinator. If one is interested in co-op, he or she should contact the cooperative education coordinator as early as possible, to facilitate job placement and to assure eligibility.

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

Officer Training Programs (ROTC)

Both Army and Air Force ROTC are available to IUPUI students. Completion of either program leads to a commission as a 2nd Lieutenant. Programs are available to both men and women. Courses are pursued in conjunction with academic curriculum and receive academic credit as electives. Placement credit is available to veterans and students with high school ROTC backgrounds. For information, contact a professor of military science (Army ROTC) (317) 274-2691 or a professor of aerospace studies (Air Force ROTC) (812) 335-4191.



Joseph E. Kuczkowski, Assistant Dean, Marshall C. Yovits, Dean, and Robert W. Keck, Associate Dean

The School of Science proudly salutes its faculty who
have distinguished themselves in the areas of

TEACHING RESEARCH SERVICE

Department of Biology

Professors Bayer, Ockerse, Sanborn (Emeritus), Schauf (Chairperson)

Associate Professors Bard, Juillerat, Keck, Lees (Director, Graduate Program), McCracken, Pflanzner, Russo, Stillwell, Wilson

Assistant Professors Chernoff, Jarrett, Kirk, Witzmann (Columbus Campus)

Adjunct Professors Butler, Ingolia, Petersen

Lecturers Wiese, Zevin

Departmental Counselors *Preprofessional*: Chernoff, Ockerse; *Prepharmacy and preoptometry*: Lees; *Biology programs*: all faculty.

The Department of Biology offers instructional programs leading to the Bachelor of Arts and Bachelor of Science degrees. These programs are designed to prepare students for a variety of careers in the biological sciences and allow sufficient flexibility to accommodate the needs and interests of students. Postgraduate activities frequently selected by our biology majors include graduate schools, medical and dental schools, other health care professions, agricultural schools, industrial positions in research and technology, and secondary teaching. The selection of a particular degree program in biology should be made in consultation with a departmental counselor.

The Department of Biology offers graduate study leading to the Master of Science (M.S.) degree. The M.S. degree program may be completed with a thesis option or with a nonthesis option in Interdisciplinary Biology. Among the nonthesis options is the M.S. in Teaching of Biology degree which is designed primarily for secondary school teachers. Within the thesis option is the M.S. in Biotechnology which is designed to provide classroom and research experience in a variety of applied disciplines.

Qualified students may be authorized to pursue the Ph.D. degree in biology at IUPUI in areas where a program equivalent to that at West Lafayette can be arranged. Please contact the Department of Biology at IUPUI for further details.

The Department of Biology regards research as an important component of its programs at both the undergraduate and graduate levels. Students may work in such specific areas as microbial genetics, membrane biochemistry and biophysics, immunology, parasitology, neuroanatomy, morphogenesis and ultrastructure of plants, recombinant DNA, mosquito ecology, protein chemistry, and plant and animal tissue culture.

Undergraduate Programs in Biology

Bachelor of Arts Degree Requirements

Area I See School of Science requirements. The second semester of English composition may be satisfied with ENG W132, ENG W231 or TCM 220.

Area II There is no foreign language requirement; however, knowledge of a foreign language is strongly recommended for the student planning to attend graduate school.

Area IIIA and IIIB See School of Science requirements.

Area IIIC Physical and Biological Sciences:

Physics Two semesters of basic physics (Physics 201-202, 218-219, or 152-251).

Chemistry Through two semesters of organic chemistry lecture and one semester of laboratory (C341, C342, C343); plus prerequisite basic sequence or background to enter sequence above. Basic chemistry sequence to be worked out with departmental counselor based on SAT scores and/or background of the student. The second laboratory in organic chemistry (C344) is strongly recommended for students in most programs—consult departmental counselor.

Area IIID

Mathematics MATH 150. The starting point to be worked out with departmental advisor based on the math placement test and/or background of the student. The computer requirement may be satisfied with CSCI 206, CSCI 207 or CSCI 220.

Area IV Biology Requirements**Required Core Sequence:**

- K101-K103 (Concepts of Biology I and II)
- K322 (Genetics lecture)
- K341 (Ecology lecture)

Upper Level Courses

- A. At least one lecture course from each of the first three areas listed below.
- B. Three laboratory courses beyond K101-K103 selected from Areas I-IV. A maximum of two credit hours of Independent Research (K493) may be applied to the Biology credit hour requirement. K493 will count as one laboratory course.
- C. Electives—sufficient lecture or laboratory coursework to total 30 credit hours. These credits may be selected from any of the three Areas or the Biotechnology Electives.

Areas/Electives**I. Molecular Area****Undergraduate Level**

K483 Biological Chemistry

Undergraduate and Graduate Level

530 Introductory Virology

559 Endocrinology

561 Immunology

570 Biological Membranes

II. Cellular Area**Undergraduate Level**

K356 Microbiology

K357 Microbiology Laboratory

Undergraduate and Graduate Level

501 Cell Physiology

532 Topics in Bacteriology

551 Plant Physiology

552 Laboratory in Plant Physiology

566 Developmental Biology

567 Laboratory in Developmental Biology

571 Developmental Neurobiology

III. Organismal Area**Undergraduate Level**

K331 Embryology

K332 Plant Growth and Development

K443 Medical Parasitology and Entomology

Undergraduate and Graduate Level

556 General and Comparative Physiology

557 Mammalian Systemic Physiology

572 Comparative Animal Physiology

IV. Biotechnology Electives**Undergraduate Level**

K313 Laboratory in Immunology

K317 Laboratory Techniques in Biology

K477 Techniques of Transmission Electron Microscopy

K493 Independent Research

Additional Laboratory Courses for the B.A.

K323 Genetics Laboratory

K342 Ecology Laboratory

The Department of Biology will accept 20 credit hours toward graduation outside the Schools of Science and Liberal Arts. A maximum of 15 hours of biology earned at other institutions is applicable to the B.A. degree.

Bachelor of Science Degree Requirements

Area I See School of Science requirements. For teacher certification, the requirement is met by the School of Science requirement. The second semester of English composition may be satisfied with ENG W132, ENG 231, or TCM 220.

Area II There is no foreign language requirement; however, knowledge of a foreign language is strongly recommended for the student planning to attend graduate school.

Area IIIA and IIIB See School of Science requirements.

Area IIIC Physical and Biological Sciences

Physics Two semesters of basic physics (Physics 218-219 or 152-251).

Chemistry Through two semesters of organic chemistry with laboratory (C341, C342, C343, C344) plus prerequisite basic sequence or background to enter sequence above. Basic chemistry sequence to be worked out with departmental counselor based on SAT scores and/or background of the student. (A course in analytical chemistry or biochemistry is also strongly recommended—determination to be made in consultation with department counselor.)

Area IIID

Mathematics Through two semesters of calculus (MATH 221-222 or MATH 163-164). Starting point to be worked out with departmental adviser based on the math placement test and/or background of the student. The computer requirement may be satisfied with CSCI 206, CSCI 207, or CSCI 220.

Area IV Biology Requirements

Required Core Sequence:

- K101-K103 (Concepts of Biology I and II)
- K322, K323 (Genetics with Laboratory)
- K341, K342 (Ecology with Laboratory)
- K493 (Independent Research; 2 Cr. Min., 3 Cr. Max.)
- K494 (Senior Research Thesis)

Upper Level Courses

- A. At least one course from each of the first three Areas listed below.
- B. Two laboratory courses beyond the core sequence laboratories selected from Areas I to IV.
- C. Senior Research Thesis (K494). This will consist of the completion of K493 activities and the preparation of a written report on the results of the research project. The title and nature of the K493-K494 sequence is to be determined in consultation with the department research sponsor.
- D. Electives—sufficient lecture and laboratory coursework to total 40 credit hours. These credits may be selected from any of the three Areas or the Biotechnology Electives.

Areas/Electives

- I. Molecular Area
 - Undergraduate Level
 - K483 Biological Chemistry
 - Undergraduate and Graduate Level
 - 530 Introductory Virology
 - 559 Endocrinology
 - 561 Immunology
 - 570 Biological Membranes
- II. Cellular Area
 - Undergraduate Level
 - K356 Microbiology
 - K357 Microbiology Laboratory
 - Undergraduate and Graduate Level
 - 501 Cell Physiology
 - 532 Topics in Bacteriology
 - 551 Plant Physiology
 - 552 Laboratory in Plant Physiology
 - 566 Developmental Biology
 - 567 Laboratory in Developmental Biology
 - 571 Developmental Neurobiology

III. Organismal Area

Undergraduate Level

K331 Embryology

K332 Plant Growth and Development

K443 Medical Parasitology and Entomology

Undergraduate and Graduate Level

556 General and Comparative Physiology

557 Mammalian Systemic Physiology

572 Comparative Animal Physiology

IV. Biotechnology Electives

Undergraduate Level

K313 Laboratory in Immunology

K317 Laboratory Techniques in Biology

K477 Techniques of Transmission Electron Microscopy

K493 Independent Research

The Department of Biology will accept 20 credit hours towards graduation outside the Schools of Science and Liberal Arts. A maximum of 20 hours of biology earned at other institutions is applicable to the B.S. degree

Biology Plans of Study

Undergraduate

There is no single semester-by-semester plan of study for any of the degree options, because of the flexibility encouraged within the program for each option. However, one possible sequence of courses for each option is given below; variations from these examples of plans of study should be made in consultation with a departmental counselor.

Bachelor of Arts Sample Program

Freshman

1	BIOL K101 (5) Concepts of Biology I-Plants	CHEM C105 (5) Principles of Chemistry I	MATH 147 (3)	ENG W131 (3) English Composition I
2	BIOL K103 (5) Concepts of Biology II-Animals	CHEM C106 (5) Principles of Chemistry II	MATH 148 (3)	Second English Composition (3)

Sophomore

3	Biology (3-5) Core or Area Elective Lecture, Biology Lab	CHEM C341 (3) Organic Chemistry I	CHEM C343 (2) Organic Chem. Laboratory I	PHYS 201 (5), PHYS 218 (4), or PHYS 152 (4) Physics	Elective (3) Arts and Humanities
4	Biology (3) Core or Area Elective Lecture	CHEM C342 (3) Organic Chemistry II	Elective (3) Behavioral and Social Sciences	PHYS 202 (5), PHYS 219 (4), or PHYS 251 (5) Physics	Comm C110 (3) Speech

Junior

5	Biology (3-5) Core or Area Elective Lecture, Biology Lab	Elective (3) Behavioral and Social Sciences	Elective (3) Arts and Humanities	Computer Elective (3)	Elective (3)
6	Biology (3-5) Core or Area Elective Lecture, Biology Lab	Elective (3) Arts and Humanities	Elective (3) Behavioral and Social Sciences	Elective (3)	Elective (3)

Senior

7	Biology (3) Core or Area Elective Lecture	Elective (3) Behavioral and Social Sciences	Elective (3)	Elective (3)	Elective (3)
8	Biology (1-5) Elective	Elective (3) Arts and Humanities	Elective (3)	Elective (3)	Elective (3)

Bachelor of Science with Secondary Teaching Certification Sample Program

Freshman				
1	BIOL K101 (5) Concepts of Biology I-Plants	CHEM C105 (5) Principles of Chemistry I	MATH 221 (3) or MATH 163 (5) Calculus	ENG W131 (3) English Composition
2	BIOL K103 (5) Concepts of Biology II-Animals	CHEM C106 (5) Principles of Chemistry II	MATH 222 (3) or MATH 164 (5) Calculus	Second English Composition (3)
Sophomore				
3	Biology (3-5) Core or Area Elective Lecture, Biology Lab	CHEM C341 (3) Organic Chemistry I	CHEM C343 (2) Organic Chem. Laboratory I	EDUC H340 (3) Education and Am. Culture
4	Biology (3-5) Core or Area Elective Lecture, Biology Lab	CHEM C342 (3) Organic Chemistry II	CHEM C344 (2) Organic Chem. Laboratory II	Elective (3) Humanities or Foreign Language
				EDUC M300 (3) Intro. to Teaching in P. Society
Junior				
5	Biology (3-5) Core or Area Elective Lecture, Biology Lab	Elective (3)	Elective (3) Behavioral and Social Sciences	PHYS 218 (4) or PHYS 152 (4) Physics
6	Biology (3) Core or Area Elective Lecture	EDUC P253 (5) Ed. Psych. for Secondary Teachers	Elective (3) Behavioral and Social Sciences	PHYS 219 (4) or PHYS 251 (5) Physics
				Biology K493 (1-2) Independent Research
				Biology K493 (1-2) Independent Research
Senior				
7	Biology (3-5) Core or Area Elective Lecture, Biology Lab	Biology K494 (1) Senior Thesis	EDUC M449 (3) Methods of Teaching	Elective (3)
8	Biology (1-5) Elective	EDUC M480 (9) Student Teaching	EDUC M462 (3) Methods of Teaching	Computer Elective (3)

Bachelor of Science Sample Program

Freshman				
1	BIOL K101 (5) Concepts of Biology I-Plants	CHEM C105 (5) Principles of Chemistry I	MATH 221 (3) or MATH 163 (5) Calculus	ENG W131 (3) English Composition
2	BIOL K103 (5) Concepts of Biology II-Animals	CHEM C106 (5) Principles of Chemistry II	MATH 222 (3) OR MATH 164 (5) Calculus	Second English Composition (3)
Sophomore				
3	Biology (3-5) Core or Area Elective Lecture, Biology Lab	CHEM C341 (3) Organic Chemistry	CHEM C343 (2) Organic Chem. Laboratory I	PHYS 218 (4) or PHYS 152 (4) Physics
4	Biology (3-5) Core or Area Elective Lecture, Biology Lab	CHEM C342 (3) Organic Chemistry II	CHEM C344 (2) Organic Chem. Laboratory II	PHYS 219 (4) or PHYS 251 (5) Physics
				Comm. C110 (3) Speech
Junior				
5	Biology (3-5) Core or Area Elective Lecture, Biology Lab		Elective (3) Behavioral and Social Sciences	Elective (3) Humanities
6	Biology (3-5) Core or Area Elective Lecture, Biology Lab	Elective (3)	Elective (3) Behavioral and Social Sciences	Elective (3) Humanities
				Biology K493 (1-2) Independent Research
Senior				
7	Biology (3) Core or Area Elective Lecture	Biology K493 (1-2) Independent Research	Computer Elective (3)	Elective
8	Biology (1-5) Elective	Biology K494 (1) Senior Thesis	Elective	Elective

Graduate Programs in Biology

Master of Science Degrees

Degree Options

M.S. Nonthesis in Interdisciplinary Biology 21 credits in Biology including a creative project to be defined in consultation with the graduate Advisory Committee; 9 credits in a supporting secondary area. Secondary areas may be chosen from a wide variety of subjects that relate to the student's career objective or interest. Examples would include, but not be limited to, chemistry, mathematics, public affairs, business, statistics, law, computer science, and health administration. The M.S. Teaching of Biology degree is conferred when the supporting area is education. Primary area courses must include Topics in Biotechnology (3 credit hours) and at least one course from each of the following areas: Concepts of Metabolism, Concepts of Homeostasis, and Continuity of Life. In addition, a creative project (595 Special Assignments, 3 credit hours) *must* be taken. The topic and nature of the project will be determined in consultation with the student's graduate advisor.

Course Areas in Interdisciplinary Biology

Concepts of Metabolism

- 501 Cell Physiology
- 530 Introductory Virology
- 532 Topics in Bacteriology
- 697 Special Topics (where appropriate)

Concepts of Homeostasis

- 551 Plant Physiology
- 552 Laboratory in Plant Physiology
- 556 General and Comparative Physiology
- 557 Mammalian Systemic Physiology
- 559 Endocrinology
- 561 Immunology
- 570 Biological Membranes
- 572 Comparative Animal Physiology
- 697 Special Topics (where appropriate)

Continuity of Life

- 566 Developmental Biology
- 567 Laboratory in Developmental Biology
- 571 Developmental Neurobiology
- 641 Microbial Genetics
- 697 Special Topics (where appropriate)

M.S. Thesis A minimum of 9 hours of coursework in Biology; intensive research leading to a thesis. Within the thesis program is a focused program in Biotechnology. There are five areas in Biotechnology where course and research experiences are available. They are Recombinant DNA, Protein Chemistry, Tissue Culture, Immunology, and Biomembrane Technology. Coursework requirements include Topics in Biotechnology (3 credits), 3 credits from the research Biotechnology area, and 3 credits from a secondary Biotechnology area.

Course Areas in Biotechnology

Recombinant DNA

- 530 Introductory Virology
- 532 Topics in Bacteriology
- 641 Microbial Genetics

Protein Chemistry

- 697 Special Topics (where appropriate)

Tissue Culture

- 697 Topics in Tissue Culture

Immunology

- 561 Immunology
- 697 Topics in Immunology

Biomembrane Technology

- 570 Biological Membranes

Admission Requirements

1. Students must hold a baccalaureate degree from an accredited institution of higher learning and demonstrate good preparation in the following subjects:
Biological Sciences
Organic chemistry
Physics
Mathematics
2. GRE aptitude tests
3. Three letters of recommendation
4. A minimum graduation grade-point index of 3.0 or equivalent is required for unconditional admission.

Transfer of Credit

Transfer credit to be used in the nonthesis option may be given for up to 9 credits of graduate work completed elsewhere with a grade of B or better. Such credits may be used only in the secondary area and will be accepted only after one semester of satisfactory work is completed in residence at IUPUI. Transfer credits are not accepted in the thesis option. Up to 9 hours of Biology graduate credits taken at IUPUI under graduate non-degree status may be transferred to the thesis or nonthesis options.

Grades

Only grades of A, B, or C are acceptable, although performance higher than C may be required. Pass/fail grades are unacceptable.

Requirements

Residence Requirements

Two units of residence (26 credits or more) are required for the M.S. degree. Students entering with advanced standing from another graduate school are credited with resident study commensurate with the graduate work accomplished.

Comprehensive Examination

A comprehensive written examination in the individual's primary area will be required of all non-thesis students to be administered at or near the end of the student's degree program.

All students are required to take Seminar (Biol. 696). For thesis students the results of the student's research project will constitute the seminar subject matter. The creative project required of all nonthesis students will provide the basis for the public presentation.

Financial Assistance

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

Other Programs

Prepharmacy Currently the prepharmacy program is designed to encompass one year at IUPUI followed by four years at Purdue University, West Lafayette. However, it is possible to complete two full years of credit prior to transfer. The prepharmacy program has also been designed to interface with the School of Pharmacy at Butler University.

Prepharmacy Sample Program

Freshman

1	BIOL K101 (5) Concepts of Biology I-Plants	CHEM C105 (5) Principles of Chemistry I	MATH 147 (3) or MATH 163 (5) or MATH 221 (3)	ENG W131 (3) English Composition	Elective (1)
2	BIOL K103 (5) Concepts of Biology II-Animals	CHEM C106 (5) Principles of Chemistry II	MATH 148 (3) or MATH 164 (5) or MATH 222 (3)	SPCH C110 (3) Speech	Elective (3)

Sophomore to Senior

Transfer to School of Pharmacy and Pharmacal Sciences, Purdue University, West Lafayette campus

Preoptometry This program is specifically designed for transfer to the professional program at Indiana University Bloomington. Typically, three preoptometry years are spent at IUPUI.

Preoptometry Program Requirements

Subject	Minimum hours required
Inorganic Chemistry	8
Organic Chemistry	3
English Composition	2
Calculus	4
General Physics	8
Psychology	
Introductory and above	4
Statistical Techniques	3
Biology/Zoology	
Introductory	4
Comparative or Human Anatomy	4
Advanced	3
Arts and Humanities	6
Social and Behavioral Sciences	6
Foreign Language	6-8
Elective as needed	—
<hr/> 90 credit hours	

Preveterinary Medicine IUPUI offers an organized four-semester preveterinary curriculum for student who want to meet the requirements for admission to the Purdue School of Veterinary Medicine. This curriculum also provides for a rigorous program in the biological and physical sciences which may be used as a basis for continued training in the Purdue School of Agriculture should the degree of Bachelor of Science be desired.

The student who has successfully completed two or more years of preveterinary instruction at IUPUI is eligible to apply for admission to the School of Veterinary Medicine at Purdue University in West Lafayette. Admission to the School of Veterinary Medicine is highly competitive. Students are selected on the basis of college course work and grades, Veterinary Aptitude Test scores, and the extent and nature of the applicant's experience with animals and practicing veterinarians. The selection committee is also concerned with the individual's level of motivation, degree of maturity, and general character.

The requirements for admission to the preveterinary curriculum are the same as those for other programs in the School of Agriculture.

Preveterinary Sample Program

Freshman

1	BIOL K101 (5) Concepts of Biology I-Plants	MATH 147 (3) or MATH 221 (3)	CHEM C105 (5) Principles of Chemistry I	ENG W131 (3) English Composition I
2	BIOL K103 (5) Concepts of Biology II- Animals	MATH 148 (3) or MATH 222 (3)	CHEM C106 (5) Principles of Chemistry II	ENG W132 (3) English Composition II

Sophomore

3	ECON E202 (3) Economics	CHEM C341 (3) Organic Chemistry I	CHEM C343 (2) Organic Chem. Laboratory I	PHYS 218 (4) Physics	BIOL K322 (3) Genetics	BIOL K323 (2) Genetics Laboratory
4	ANSC 221 (3) Animal Nutrition	CHEM C342 (3) Organic Chemistry II	CHEM C344 (2) Organic Chem. Laboratory II	PHYS 219 (4) Physics	COMM C110 (3) Speech	

Nine (9) credits of Arts and Humanities must be taken in conjunction with the above or during summer sessions.

Junior Senior

5-6 Transfer to School of Veterinary Science and Medicine, Purdue University, West Lafayette campus

Courses in Biology

All courses designed for the biology major are identified by the letter prefix K on the course number or have no prefix. All courses identified by the letter prefix N are primarily designed to serve students uncommitted to a degree in biology or for the student where these courses are normal to his or her curricular program (e.g., Allied Health).

Note: P—prerequisite; C—concurrent registration; R—recommended; 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.

Undergraduate Level

K101 Concepts of Biology—Plants I (5 cr.) P: High school or college chemistry. Fall, Spring; day, night. An introductory course emphasizing the principles of cellular biology, molecular biology, genetics, and plant anatomy, diversity, development, and physiology.

K103 Concepts of Biology II—Animals (5 cr.) P: K101. Fall, Spring; day, night. An introductory biology course emphasizing structure, physiology, development, diversity, and behavior in animals, and evolution and ecology of plants and animals.

K295 Special Assignments (arr.) P: Consent of instructor. Fall, Spring. Special work such as directed readings, laboratory or field work, or presentation of material not available in the formal courses in the department.

K309 Computer Applications in Biology and Medicine (3 cr.) P: Sophomore standing and 1 semester of Biology. Spring, day. Provides the undergraduate with experience in the major applications of the computer to the life sciences. Topics: Computer hardware, Software, BASIC programming concepts, and Application Packages. Projects: Micro and mainframe computer experiences with databases, simulations, statistical packages, computer graphics, networks, and computer interfacing to laboratory equipment. This course may not be used for Area IV (biology major) credit.

K313 Laboratory in Immunology (2 cr.) P or C: BIOL 561. Fall; day. Laboratory experiments and demonstrations designed to give experience in the performance of basic techniques of immunology and serology.

K317 Laboratory Techniques in Biology (3 cr.) P: CHEM C106 and one year of college biology. Spring; day, night. A laboratory course for undergraduate students designed to offer "hands on" experience in instrumentation and to develop technical as well as library and writing skills.

K322 Genetics (3 cr.) P: K103, CHEM C106. Fall; day. Principles of genetics at the

molecular, cellular, organismal, and and population level.

K323 Genetics Laboratory (2 cr.) P or C: K322. Fall; day. Applied principles of genetics using organisms of increasing complexity from viruses to the fruit fly.

K331 Embryology (4 cr.) P: K103. Spring; day, night. The development of animals through differentiation of cells, tissues, organs, and organ systems will be examined.

K332 Plant Growth and Development (3 cr.) P: K101, CHEM C341. Fall; day, night. An examination of growth and developmental patterns in plants as affected by growth regulators, age, heredity, photoperiod, and environmental factors.

K341 Principles of Ecology (3 cr.) P: K103. Fall day. A study of the basic concepts of the interrelation of living organisms and their environment.

K342 Ecology Laboratory (2 cr.) P or C: K341. Fall day. Experiments in the laboratory and field to illustrate the principles and techniques of Ecology.

K356 Microbiology (3 cr.) P: K103, CHEM C341. Spring; day, night. Introduction to microorganisms: cytology, nutrition, physiology, and genetics. Importance of microorganisms in applied fields including infectious disease.

K357 Microbiology Laboratory (2 cr.) P or C: K356. Spring; day, night. Laboratory experiments and demonstrations to yield proficiency in aseptic cultivation and utilization of microorganisms; experimental investigations of biological principles in relation to microorganisms.

K433 Medical Parasitology and Entomology (3 cr.) P: K103 or equivalent. Spring of odd numbered years; day, night. A case-oriented approach to the study of the major parasitic diseases of man. Emphasis will be placed on parasite and vector life cycles, disease symptomatology and treatment, and control measures.

K477 Techniques of Transmission Electron Microscopy (3 cr.) P: K103, CHEM C341, and consent of instructor. Spring; day, night. Biological tissue preparation, ultramicrotomy,

photography, and related laboratory techniques for transmission electron microscopy. Also considered are principles of fixation and staining, cytochemical techniques, and interpretation of ultrastructure.

K483 Biological Chemistry (3 cr.) P: CHEM C342 Fall; day, night. Chemistry of biologically important molecules including carbohydrates, lipids, proteins, and nucleic acids. Special emphasis on chemistry of intermediary metabolism.

K493 Independent Research (1-3 cr.) P: Consent of instructor. Fall, Spring, Summer. A course designed to give undergraduate students majoring in biology an opportunity to do research in a field in which they have a special interest.

K494 Senior Research Thesis (1 cr.) P: K493. Fall, Spring, Summer. A formally written report describing the results or accomplishments of K493.

Undergraduate and Graduate Level

501 Cell Physiology (3 cr.) P: K103, CHEM C342. Spring; day, night. A study of cells at the physiological level including the structure and function of organelles and membranes, enzymology, energy relationships and metabolic control, response to radiation, excitability and contractility, and the regulation of cell growth and differentiation.

530 Introductory Virology (3 cr.) P: K356, CHEM C342. Fall of odd numbered years; day, night. Detection, titration, and chemistry of viruses. Viral host interactions: Bacteriophage—bacterium, animal virus—animal cell, plant virus—plant cell. Tumor viruses: infection and transformation.

532 Topics in Bacteriology (2 cr.) P: K356 and CHEM C342. Fall of even numbered years; day, night. Selected topics in bacterial physiology: cell division, chemotaxis, bacterial plasmids, and sporulation, bacterial toxins, recombinant DNA.

551 Plant Physiology (3 cr.) P: K103; CHEM C342. Spring; day, night. The major processes of plant function (photosynthesis, carbohydrate metabolism, translocation, water relations, and ion uptake), and the integration of these processes in plant growth and development.

552 Laboratory in Plant Physiology (2 cr.) P or C: BIOL 551. Spring; day, night. Quantitative experiments in plant physiology. Emphasis on modern experimental methods of investigating physiological processes.

556 General and Comparative Physiology (3 cr.) P: K103, CHEM C342, PHYS 219. Fall;

day, night. Principles of physiology. Nerve and muscle, temperature regulation, ion and water balance.

557 Mammalian Systemic Physiology (3 cr.) P: BIOL 556 or consent of instructor. Spring; day, night. A study of human cardiovascular, pulmonary, blood, and gastrointestinal systems. Higher neuronal functions and intersystem interactions will be discussed.

559 Endocrinology (3 cr.) P: BIOL 556, or equivalent, and CHEM C342. Fall of even numbered years; day, night. The study of hormone function. Consideration will be given to the role of hormones in growth, development, metabolism, homeostasis, and reproduction.

561 Immunology (3 cr.) P: K103, C341. Fall; day. Introduction to the basic principles of immunology and serology at the molecular, cellular, and organismal level.

566 Developmental Biology (3 cr.) P: BIOL 501 and K322. Spring of odd numbered years; day, night. Principles of development with emphasis on concepts and underlying mechanisms, including descriptive, physiological, and molecular approaches.

567 Laboratory in Developmental Biology (1 cr.) P or C: BIOL 566. Spring of odd numbered years; day, night. Descriptive and experimental study of plants and animals.

570 Biological Membranes (3 cr.) P: Either BIOL 501, C342 or consent of instructor. Spring of odd numbered years; day, night. An examination of structure and function of biological membranes. Topics include lipid and protein composition and interactions, physiological properties of membranes, physiological methods of analysis, model membrane systems and survey of specific biological membranes and their mode of action.

571 Developmental Neurobiology (3 cr.) P: BIOL 501 or BIOL 572 or consent of instructor. Fall of odd numbered years; day, night. The major phases of nervous system development beginning with neurogenesis and ending with the onset of physiological activity will be studied in a variety of animals, mainly avians and mammals (including man). Neural developmental disorders and behavioral ontogeny will also be considered.

572 Comparative Animal Physiology (3 cr.) P: K103, CHEM C342, PHYS 219, Calculus. Fall of odd numbered years; day, night. Physiology of invertebrates and vertebrates with special reference to regulation of water and ionic content, excretion, respiration, oxygen transport, comparative intermediary metabolism, and responses to and regulation

of body temperature. Emphasis on reading original literature.

595 Special Assignments (1-3 cr.) P: Consent of instructor. Fall, Spring, Summer. Special work, such as directed reading, independent study or research, supervised library, laboratory or field work, or presentation of material not available in the formal courses of the department.

Graduate Level

641 Microbial Genetics (2 cr.) P: K323, CHEM C342, and consent of instructor. Spring of odd numbered years; day, night. Genetics of bacteria, bacterial viruses, and other microorganisms with emphasis on organization, replication, and function of the genetic material.

696 Seminar (1 cr.) (May be repeated for credit.) Fall, Spring. Each semester there are several separate offerings. They will likely be on the following topics: biochemistry, biology teaching, ecology and population biology, genetics, mechanisms of development, microbiology, neurobiology, and plant physiology. Oral presentations required.

697 Special Topics (1-3 cr.) (May be repeated for credit.) Fall, Spring. The frontiers of biology. Critical examination of developments in the various specialties represented by the members of the department. Currently, advanced work in the following and related fields can be offered: molecular genetics; structure and biosynthesis of biologically significant molecules; the nature of biological specificity and enzyme catalysis; the fine structure and chemistry of sub-cellular particles, cells, and tissues; microbial and plant metabolism; comparative biochemistry; genetics and physiology of viruses, bacteria, fungi, protozoa, helminths, and cells of higher forms of life; the genetics, structure, development and physiology of plants and animals, including endocrinology and work physiology; excitable membranes; neurobiology, ecology, systematics, and evolution of microorganisms, plants and animals; host-parasite relationships including immunology; and the teaching of biology. The field in which work is offered will be indicated in the student's record.

698 Research. M.S. Thesis (cr. arr.)
Research. M.S. Thesis (credit arranged).

Courses for the Nonmajor

N100 Contemporary Biology (3 cr.) P: None. Fall, Spring; day, night. Selected principles of biology with emphasis on issues and problems extending into everyday affairs of the student.

N107 Introduction to Zoology (4 cr.) P: None. Equiv. PU BIOL 109. Fall, Spring, Summer; 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.

N120 Topics in Biology (1-3 cr.) P: None. Fall, Spring; day, night. A course dealing with topical aspects of biology designed for undergraduate students not in the School of Science. A topic such as genetics and man, environmental biology and reproductive biology, will be offered as a separate course in a given semester.

N200 The Biology of Women (3 cr.) P: None. Fall Spring; day, night. This course examines the biological basis for bodily functions and changes that take place throughout the life of females.

N212 Human Biology (2 cr.) P: None. Equiv. PU BIOL 201. Fall; day. Two semester sequence in human biology with emphasis on anatomy and physiology providing a solid foundation in body structure and function.

N213 Human Biology Laboratory (1 cr.) P or C: N212. Equiv. PU BIOL 203. Fall; day. Accompanying laboratory for N212.

N214 Human Biology (2 cr.) P: N212. Equiv. PU BIOL 202. Spring; day. Continuation of N212.

N215 Human Biology Laboratory (1 cr.) P or C: N214. Equiv. PU BIOL 204. Spring; day. Accompanying laboratory for N214.

N217 Human Physiology (5 cr.) P: None. Equiv. IU PHYS P204. Fall, Spring, Summer; day. Lectures and laboratory work related to cellular, musculoskeletal, neural, cardiovascular, gastrointestinal, renal, endocrine, and reproductive function in man.

N251 Introduction to Microbiology (3 cr.) P: One semester general chemistry or one semester life science. Spring; day. The isolation, growth, structure, functioning, heredity, identification, classification, and ecology of microorganisms, their role in nature and significance to man.

N261 Human Anatomy (5 cr.) P: None. Equiv. IU ANAT 210. Fall, Spring, Summer; day, night. Lecture and laboratory studies of the histology and gross morphology of the human form, utilizing a cell-tissue-organ system-body approach.

N322 Introductory Principles of Genetics (3 cr.) P: N105 or N107 or K101. Equiv. PU AGRY 430. Spring; day, night. Basic principles of plant and animal genetics. Emphasis on transmission mechanisms as

applied to individuals and populations. For students in health and agricultural sciences. **N400 Contemporary Biological Skills for Teachers (3 cr.)** P: Consent of instructor. Fall; night. Concepts and laboratory skills

necessary to prepare teachers with diverse backgrounds to return to graduate academic biology courses are reviewed. Topics include general principles of biology, biochemistry and biomathematics.



Department of Chemistry

Professors Boschmann, Fife, O'Donnell, Rabideau (*Chairperson*), Zeldin

Professor Emeritus Welcher

Associate Professors Boaz, Cutshall, Dubin, Fricke, Lipkowitz, Malik, Nurok, Wyma

Assistant Professors Larter, Muhoberac

Adjunct Professors Boyd, Jackson, McCarthy, Scriven, Shields

Departmental Counselors For chemistry programs, all chemistry faculty. Contact the department for assignment to a counselor.

Chemistry is the science which studies substances, both natural and synthetic, their compositions, properties, transformations, and interactions with external forces.

The Department of Chemistry offers the Bachelor of Arts degree, the Bachelor of Science degree, and the Master of Science degree.¹ One Bachelor of Science degree option carries certification by the American Chemical Society Committee on Professional Training. The Master of Science degree has both a thesis and nonthesis option. An Industrial Co-op Program is also offered for the Master of Science degree. Qualified students may be authorized to pursue the Ph.D. degree in chemistry in areas where a program equivalent to that at West Lafayette can be arranged. Please contact the Department of Chemistry at IUPUI for further details.

To enter the curriculum in chemistry, a student should have completed a minimum of two years of algebra, one semester of trigonometry, one year each of chemistry and physics, and two years of a modern foreign language. The choice of a particular degree program in chemistry and the selection of courses for that degree must be made in consultation with a departmental counselor.

Students in programs which require only one semester of chemistry should take C101. Students with an insufficient background in high school chemistry to qualify for C105 should take C101 as a preparatory course. Students in programs which require two semesters of chemistry take either the C101-102 sequence, the C105-106 sequence, or the C111-C112 sequence (see specific program for degree major). The C101-C102 sequence is designed for students who do not need chemistry as a tool subject. The C105-C106 sequence is designed for students pursuing advanced work in scientific fields (e.g., biology, chemistry, geology, medicine, physics). The C111-C112 sequence is designed for students majoring in engineering or who desire a non-laboratory version of C105-C106. If engineering students wish to take a laboratory, they may enroll in either the C105-C106 sequence or enroll in C125 along with C111 and in C126 along with C112. C105 is considered equivalent to the combined courses C111-C125 and C106 is considered equivalent to the combined courses C112-C126. Credit can only be earned in either the C105-C106 sequence or the C111-C125 and C112-C126 sequence. If both C101 and C105 or C111 are taken, the credit hours earned in C101 will not count toward the total hours needed for graduation. Admission to C106 or C112 on a basis of C101 is not granted.

Bachelor of Arts

PREPROFESSIONAL CHEMISTRY MAJOR

For students who require a knowledge in chemistry as a basis for work in other fields. Suitable for students who plan chemical industry positions as laboratory technicians. Recommended for premedical students with minimum preparation.

Degree Requirements

Areas I, IIIA, and IIIB See the School of Science requirements in this bulletin. The second semester of English composition may be satisfied only by ENG W132, ENG W231, or TCM 320.

Area II Foreign Language No language required.

¹ All degrees carry the general requirements of the School of Science. These are described elsewhere in this bulletin.

Area IIIC Physical and Biological Sciences PHYS P201 and P202 (recommended PHYS 152 and 251). Also, at least two additional courses outside chemistry having a laboratory component, which may be chosen from, e.g., biology, geology, or physics.

Area IIID Mathematical Sciences MATH 221, MATH 222 (recommended MATH 163 and MATH 164), and CSCI 220.

Area IV Chemistry Concentration Requirements C105, C106, C224, C225, C341, C342, C343, C344, C360 (recommended C361). Recommended C483. Total of 31 credit hours of chemistry courses required.

Bachelor of Science

CHEMISTRY MAJOR

Recommended to students who plan to be professional chemists, secondary school teachers, and those who plan nonresearch industrial positions (e.g., sales). Not recommended to students who plan to pursue graduate studies in chemistry.

Degree Requirements

Areas I, IIIA, and IIIB See the School of Science requirements in this bulletin. The second semester of English composition may be satisfied only by ENG W132, ENG W231, or TCM 320.

Area II Foreign Language No language required.

Area IIIC Physical and Biological Sciences PHYS 152 and 251 and at least two additional courses outside chemistry having a laboratory component which may be chosen from, e.g., biology, geology, or physics.

Area IIID Mathematical Sciences MATH 163, MATH 164, MATH 261, and CSCI 220.

Area IV Chemistry Concentration Requirements C105, C106, C310, C311, C341, C342, C343, C344, C361, C362, C363 and at least one of the following—C410, C430, or C483. Total of 36 credit hours of chemistry courses required. In addition to the requirements in Areas I to III and the chemistry course requirements, the student must choose a minimum of two courses from the following list:

Business	A201 Introduction to Accounting I
	A202 Introduction to Accounting II
	L203 Commercial Law I
	L303 Commercial Law II
Economics	E201 Introduction to Microeconomics
	E202 Introduction to Macroeconomics
Engineering	EE201 Linear Circuit Analysis I
	ME270 Basic Mechanics I

If Economics courses are taken to fulfill this requirement, they may not be used to fulfill the Area IIIB Social and Behavioral Sciences requirement.

PROFESSIONAL CHEMISTRY MAJOR

A.C.S. Certified

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

Areas I, IIIA, and IIIB See the School of Science requirements in this bulletin. The second semester of English composition may be satisfied only by ENG W132, ENG W231, or TCM320.

Area II Foreign Language No language required.

Area IIIC Physical and Biological Sciences PHYS 152, 251, 342, and at least one additional course outside chemistry having a laboratory component which may be chosen from, e.g., biology, geology, or physics.

Area IIID Mathematical Sciences MATH 163, MATH 164, MATH 261, MATH 262, and CSCI 220.

Area IV Chemistry Concentration Requirements C105, C106, C301 (or C302), C310, C311, C335, C341, C342, C343, C344, C361, C362, C363, C409 (3 credits), C410, C411, and C430. Total of 47 credit hours of chemistry courses required.

Chemistry Plans of Study

Bachelor of Arts—Preprofessional Chemistry Major

Freshman

1	C105 (5) Principles of Chem. I	MATH 221 (3) Calculus	ENG W131 (3) Composition I	Elective (4)
2	C106 (5) Principles of Chem. II	MATH 222 (3) Calculus	PHYS P201 (5) Gen. Physics 1	Second English Composition (3)

Sophomore

3	C341 (3) Organic Chem. I	C343 (2) Organic Chem. Lab. I	PHYS P202 (5) Gen. Physics 2	COMM C110 (3) Speech	Elective (3)
4	C342 (3) Organic Chem. II	C344 (2) Organic Chem. Lab II	CSCI 220 (3) Computer Programming	Electives (7)	

Junior

5	C224 (4) Quantitative Analysis	C360 (3) Elem. Physical Chemistry	Electives (9)
6	C225 (4) Quantitative Anal./Inst.	Electives (12)	

Senior

7	Electives (15)
8	Electives (15)

Bachelor of Science—Chemistry Major

Freshman

1	C105 (5) Principles of Chem. I	MATH 163 (5) Calculus I	ENG W131 (3) Composition I	Elective (3)
2	C106 (5) Principles of Chem. II	MATH 164 (5) Calculus II	PHYS 152 (4) Mechanics	Second English Composition (3)

Sophomore

3	C341 (3) Organic Chem. I	C343 (2) Organic Chem. Lab. I	MATH 261 (4) Multivar. Calculus	PHYS 251 (5) Heat, Elect., Optics	Electives (4)
4	C342 (3) Organic Chem. II	C344 (2) Organic Chem. Lab. II	COMM C110 (3) Speech	CSCI C220 (3) Computer Programming	

Junior

5	C310 (3) Analytical Chemistry	C311 (2) Anal. Chem. Lab.	C361 (3) Phys. Chem. I	Electives (9)
6	C362 (3) Phys. Chem. II	C363 (2) Experimental Phys. Chem.	Electives (10)	

Senior

7	Chemistry Elective (3)	Electives (12)		
8	Electives (15)			

Bachelor of Science—Professional Chemistry Major—A.C.S. Certified

Freshman

1	C105 (5) Principles of Chem. I	MATH 163 (5) Calculus I	ENG W131 (3) Composition I	COMM C110 (3) Speech
2	C106 (5) Principles of Chem. II	MATH 164 (5) Calculus II	PHYS 152 (4) Mechanics	Second English Composition (3)

Sophomore

3	C341 (3) Organic Chem. I	C343 (2) Organic Chem. Lab. I	MATH 261 (4) Multivar. Calculus	PHYS 251 (5) Heat, Elec., Optics	Electives (3)
4	C342 (3) Organic Chem. II	C344 (2) Organic Chem. Lab. II	MATH 262 (4) Lin. Algebra Diff. Eq.	CSCI 220 (3) Computer Programming	

Junior

5	C310 (3) Analytical Chemistry	C311 (2) Anal. Chem. Lab.	C361 (3) Phys. Chem. I	Electives (8)	
6	C362 (3) Phys. Chem. II	C363 (2) Experimental Phys. Chem.	C410 (3) Instrumental Methods	PHYS 342 (3) Modern Physics	Elective (3)

Senior

7	C430 (3) Inorganic Chemistry	C411 (2) Instrumental Methods Lab.	Electives (11)		
8	C409 (3) Chemical Research	C302 (1) Chemistry Seminar	C335 (2) Inorg. Chem. Lab.	Electives (10)	

The Department of Chemistry will not grant credit for a course where considerable duplication of course content may occur with another course taken. In general, credit will be allowed for the higher level course, but not for the lower level course. The following listings are considered to be duplications (lower level courses listed first):

CHEM	C224-C225	and	CHEM	C310-C311
CHEM	C360	and	CHEM	C361
MATH	221-222	and	MATH	163-164
PHYS	P201-P202 or 218-219	and	PHYS	152-251
PHYS	100 or 200	and	PHYS	P201, 218 or 152

For example, if a student has earned credit in MATH 163-164, the student will receive no credit for MATH 221-222, even if earned previously.

On occasion, a student who initially enrolled in the preprofessional B.A. in chemistry program decides to transfer to the B.S. in chemistry program, having already taken one or more of the above-listed lower level courses. The following policies will apply:

If a student has a minimum grade of B- in both C224 and C225, the C310-C311 requirement will be considered fulfilled. If the grade is less than B- in either C224 or C225, the student must take C310-C311.

If a student has a minimum grade of B (B- or lower unacceptable) in C360 and approval of the departmental chairperson, credit will be granted for C361 and the student may proceed to C362.

If a student has earned credit for the MATH 221-222 sequence, the student will be placed in MATH 164. If the student passes MATH 164, the MATH 163-164 requirement will be considered fulfilled. If the student does not pass MATH 164, the student must start with MATH 163.

If a student has earned credit for MATH 221 only, the student must take the MATH 163-164 sequence, and no credit will be allowed for MATH 221.

If a student has earned credit for the PHYS P201-P202 or 218-219 sequence, the student will be placed in PHYS 251. If the student passes PHYS 251, the PHYS 152-251 requirement will be considered fulfilled. If the student does not pass PHYS 251, the student must start with PHYS 152.

If a student has earned credit for PHYS P201 or 218 only, the student must take the PHYS 152-251 sequence, and no credit will be allowed for PHYS P201 or 218.

On occasion, a student who initially enrolled in the B.S. in chemistry program decides to transfer to the preprofessional B.A. in chemistry program, having already taken one or more of the above-listed higher level courses. In general, a higher level course will always substitute for a lower level course to satisfy the requirement. However, CHEM C310-C311 may be substituted for CHEM 224 only. CHEM C225 will still be required.

In all situations outlined above, the student will receive the total credit hours for the courses allowed.

The Department of Chemistry will accept a maximum of 15 credit hours towards graduation in courses outside the Schools of Science and Liberal Arts (e.g. technology, physical education, military science, therapy, etc.).

Master of Science

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 undergraduate chemistry) to enter graduate study

in chemistry. Anyone not meeting these requirements should take the Aptitude Test Section of the Graduate Record Examination or seek immediate counseling.

Incoming students with an undergraduate grade-point average of 3.00 or higher ($A=4.00$) will automatically be recommended for admission as regular graduate students. Those with an average below 3.00 will be admitted as temporary graduate students with the provision that a 3.00 average must be achieved in the first three graduate courses (or 9 credit hours) if they are to be admitted as regular graduate students.

Application for Admission

Regular graduate student application forms should 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 IUPUI Office of Graduate Programs in the Union Building. The temporary graduate classification is primarily for those who wish to take courses for personal improvement. Not more than 9 hours of credit earned under this classification may be applied toward an advanced degree.

Transfer Credit

The Department of Chemistry will accept by transfer a maximum of 6 hours of graduate credit from approved institutions which are in excess of undergraduate 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 Department of English to demonstrate their proficiency.

A plan of study should be drawn up by the student and the graduate adviser in advance of registration for the first semester of graduate work. 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

The requirements for each degree are designed to provide both depth and diversity in knowledge. Of the 30-hour requirement for the nonthesis program or the 20-hour course requirement for the thesis program, 12 hours must be at the CHEM 600-level and 9 hours must be in a declared major. Courses from three of the following areas must be taken: biochemistry, organic, analytical, inorganic, and physical. 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 3.00 must be maintained.

Financial Assistance

The Department of Chemistry has available financial support in the form of teaching assistantships, associate faculty positions, and research fellowships. More information can be obtained by writing to the departmental chairperson.

Master of Science Industrial Co-op Program in Chemistry

The combined effort of the Purdue University School of Science, IUPUI, and the industrial community of Indianapolis affords a unique opportunity to quality students seeking graduate work in chemistry. The M.S. Industrial Co-op Program requires 24 months of full-time study, and provides a Purdue M.S. degree in chemistry. It includes a parallel work experience of

20 hours per week during the final 20 months of the program. Graduates of this program may expect to be quite competitive in the industrial job market.

Academic Program

All academic requirements are identical to the normal Purdue M.S. with thesis program. The first semester provides the most intense period of study, including an introduction to laboratory research, seminar, and visits to local industry. At the end of the Fall Semester students will begin work experiences of 20 hours per week. Thesis research also formally begins at this point, and course work continues at a reduced rate throughout the 24-month program.

In this program, students are vital members of academic scientist research groups during the co-op period. Furthermore, meetings of the academic advisers, industrial supervisors, and students to discuss progress in all aspects of the program are required. These students will be much better prepared to contribute to the industrial effort than the usual co-op students since they will have completed a full semester of graduate study in addition to a baccalaureate degree.

Admission

Students must meet the usual admission requirements of the Purdue University Graduate School. Application materials are available from the Department of Chemistry, IUPUI. Completed applications, transcripts, and letters of recommendation should be sent to the graduate adviser in Indianapolis.

Acceptance into Co-op Option

During the first semester of graduate work, students will interview with local industry, and co-op assignments will be made by the graduate adviser and the industrial representatives. If a mutually satisfactory position cannot be found for a particular student, the student will be offered a research or teaching assistantship in the department assuming satisfactory performance in course work.

Financial Support

A stipend will be awarded for the first four months. This stipend will be increased for the successful student for the remaining 20 months of the program. Those who are qualified, but are not accepted or do not choose the co-op option can continue as teaching or research assistants in the department. Most students qualify for complete remission of tuition and fees.

Industrial Program

The industrial experience will consist of 20 hours per week for the last 20 months of the 24-month program at one of several fine laboratories within a five-mile radius of the University. (Students must furnish their own transportation.) Industrial participants include Eli Lilly and Co., EMS Laboratories, Inc., Indiana State Board of Health, Merrell Dow Pharmaceuticals, and Reilly Tar and Chemical Co. The types of industrial positions may include any of the four traditional areas of chemistry as well as medicinal (pharmaceutical) chemistry, and biochemistry.

Areas of Research

Students may select a major from any of the four areas of chemistry (analytical, inorganic, organic, or physical). The research programs of the department are supported by a variety of high quality modern instrumentation.

Commitments

Neither students nor employers have a commitment for continued employment at the end of the students' program. However, the program allows 20 months of close contact between students and employers, and serves as an excellent basis for career decisions.

Students will be involved in employee/employer relationships with the industrial laboratory, and as such will be subject to the normal terms of employment.

Courses in Chemistry

Note: P—prerequisite; C—concurrent registration; Equiv.—course is equivalent to the indicated course taught at Indiana University Bloomington or the indicated course taught at Purdue University West Lafayette.

C100 World of Chemistry (3 cr.) P: none. Fall, day; Spring, day. How molecules are built, react, and affect our lives. Lectures, demonstrations, and discussion. For students desiring only one semester of chemistry. Does not count toward any degree requirements in the School of Science.

C101 Elementary Chemistry I (5 cr., 3 cr. without laboratory) P: At least one semester of high school algebra. Equiv. PU CHEM 111-112. Fall, day, night; Spring, day, night; Summer, day, night. Essential principles of chemistry; atomic and molecular structure; bonding; properties and reactions of elements and compounds; stoichiometry; solutions; acids and bases. For students who are not planning careers in the sciences and for those with no previous course work in chemistry. Lectures, recitation, 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 or her program.

C102 Elementary Chemistry II (5 cr., 3 cr. without laboratory) P: C101. Continuation of C101. Equiv. PU CHEM 251-251L. Fall, day, night; Spring, day, night; Summer, day. Introduction to organic and biochemistry; organic compounds and their reactions. Lectures, recitation, laboratory.

C105 Principles of Chemistry I (5 cr., lecture, recitation, laboratory) P: Two years of high school algebra, one year of high school chemistry. Equiv. PU CHEM 125. Fall, day, night; Spring, day; Summer, day. Inorganic chemistry emphasizing physical and chemical properties, atomic and molecular structure, states of matter.

C106 Principles of Chemistry II (5 cr., lectures, recitation, laboratory) P: C105. Equiv. PU CHEM 126. Fall, day; Spring, day, night; Summer, day. Continuation of C105. Topics in inorganic chemistry emphasizing solution chemistry, thermodynamics, equilibrium, and kinetics.

C111 Chemical Science I (4 cr., lectures, recitation) P: Two years of high school algebra, one year of high school chemistry. Equiv. PU CHEM 101, IUPUI C105 lecture. Fall, day, night; Spring, day; Summer, day. Inorganic chemistry emphasizing physical

and chemical properties, atomic and molecular structure, states of matter. A lecture course for engineering and other students with no laboratory requirement.

C112 Chemical Science II (3 cr., lectures) P: C111. Equiv. PU CHEM 102, IUPUI C106 lecture. Fall, day; Spring, day, night; Summer, day. Continuation of C111. Topics in inorganic chemistry emphasizing solution chemistry, thermodynamics, equilibrium and kinetics. Included also are topics in organic chemistry.

C125 Experimental Chemistry I (1 cr., laboratory) P or C: C111 or its equivalent. Fall, day, night; Spring, day; Summer, day. Scheduled with the C105 laboratory. Laboratory work illustrating topics covered in the lecture of C105 and C111.

C126 Experimental Chemistry II (2 cr., recitation, laboratory) P or C: C112 or its equivalent. Fall, day; Spring, day, night; Summer, day. Scheduled with the C106 laboratory. Continuation of C125. Laboratory work illustrating topics covered in the lecture of C106 and C112.

C209 Special Problems (1-2 cr.) P: Two semesters of college chemistry and consent of instructor. Equiv. PU CHEM 290. 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.

C224 Quantitative Analysis (4 cr.) P: C106. Equiv. PU CHEM 224. Fall. Introduction to the major methods of chemical analysis for the chemical technician or preprofessional chemistry major.

C225 Quantitative Analysis/Instruments (4 cr.) P: C106. Equiv. PU CHT 225. Spring. Instrumental methods of chemical analysis and separation for the chemical technician or preprofessional chemistry major.

C301 Chemistry Seminar I (1 cr.) P or C: C409 and consent of instructor. Fall, day. Topics in various areas of chemistry. Students are required to attend departmental seminars and to prepare and present at least one seminar on their research. C301 and C302 may be elected three semesters for credit.

C302 Chemistry Seminar II (1 cr.) P or C: C409 and consent of instructor. Spring, day. Content same as C301.

C309 Cooperative Education in Chemistry (1 cr.) P: general and organic chemistry and consent of departmental chairperson. 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 (3 cr.) P: C106. With C311, Equiv. PU CHEM 321. Fall. Fundamental analytical processes including solution equilibria, theory and applications of electrochemistry and spectrophotometry, and chemical methods of separation.

C311 Analytical Chemistry Laboratory (2 cr.) P or C: C310. Fall. Laboratory instruction in the fundamental analytical techniques discussed in C310.

C335 Inorganic Chemistry Laboratory (2 cr.) P: C106 and consent of instructor. Preparation of inorganic and organometallic compounds illustrating special and advanced techniques, including characterization by modern physical methods.

C341 Organic Chemistry I (3 cr.) P: C106. Equiv. PU CHEM 261. Fall, day, night; Spring, day; 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 II (3 cr.) P: C341. Equiv. PU CHEM 262. Fall, day; 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 I (2 cr.) P or C: C341. Equiv. PU CHEM 265. Fall, day, night; Spring, day, night. Summer, day. Fundamental laboratory techniques of organic chemistry and general synthetic methods.

C344 Organic Chemistry Laboratory II (2 cr.) P or C: C342, P: C343. Equiv. PU CHEM 266. Fall, day; 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, MATH 222, PHYS P202. Spring, odd years, day; even years, night. Chemical thermodynamics, chemical equilibria, solutions, phase equilibria, electrochemistry, and kinetics. For students who desire a survey course in physical chemistry.

C361 Physical Chemistry I (3 cr.) P: C106, MATH 164, PHYS P202 or 251. Equiv. PU CHEM 373. Fall, day; Spring, even years, night. Kinetic-molecular theory, gases,

chemical thermodynamics, solutions, phase and chemical equilibria, and introduction to statistical thermodynamics.

C362 Physical Chemistry II (3 cr.) P: C361, MATH 164, PHYS P202 or 251, CSCI 220. Equiv. PU CHEM 374. Fall, even years, night; Spring, day. Introduction to quantum chemistry, symmetry, atomic and molecular structure and spectra, solids, liquids, electrochemistry, chemical kinetics and photochemistry.

C363 Experimental Physical Chemistry (2 cr.) P: C361, CSCI 220; P or C: C362. Equiv. PU CHEM 376. Fall, night; Spring, day. Experimental work to illustrate principles of physical chemistry and to introduce research techniques.

C409 Chemical Research (1-4 cr.) P: junior or senior standing and consent of instructor. Equiv. PU CHEM 499. Every semester. Time arranged. Chemical or literature research with a report. Can be elected only after consultation with research adviser and approval of program. May be taken for a total of 10 credit hours which count toward graduation. However, a maximum of 3 hours may be used to satisfy the 6 hours of advanced chemistry electives in the Bachelor of Science in chemistry degree programs.

C410 Instrumental Methods of Analysis (3 cr.) P: C310, C311, C361; P or C: C362. Equiv. PU CHEM 424. Spring. Modern analytical methods, including electroanalytical techniques, quantitative spectrophotometry, chromatography and radiochemical methods.

C411 Instrumental Methods of Analysis Laboratory (2 cr.) P: C311; P or C: C410. Fall. Laboratory instruction in the instrumental analysis techniques discussed in C410.

C430 Inorganic Chemistry (3 cr.) P: 1 year of physical chemistry. Equiv. PU CHEM 342. Fall. 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.

C483 Biological Chemistry (3 cr.) P: C342 or equivalent. Equiv. PU CHEM 533. Spring, night. Chemistry of biologically important molecules, including carbohydrates, lipids, proteins, and nucleic acids. Special emphasis on chemistry of intermediary metabolism.

533 Introductory Biochemistry (3 cr.) P: C342 or equivalent. Spring, night. A rigorous one-semester introduction to biochemistry.

542 Inorganic Chemistry (3 cr.) P: 1 year of physical chemistry. Equiv. IU C430. Fall. An introduction to the principles of inorganic

chemistry with emphasis on the chemistry of the nontransition elements.

561 Fundamental Organic Chemistry (3 cr.)

P: C342 or equivalent. Fall, odd years, night. Graduate students with a declared major in organic chemistry may not apply 561 for credit. A general survey of synthetic organic chemistry including some discussion of current organic theory.

575 Intermediate Physical Chemistry (3 cr.)

P: C362 or equivalent. Fall, night. Quantum theory of atoms and molecules; theories of chemical bonding; molecular spectroscopy; methods for determining molecular structure; electrical and magnetic properties.

599 Special Assignments (1-4 cr.) P: consent of instructor. 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. Equiv. IU C510. Fall, night. A critical survey of recent developments in chemical and instrumental methods of analysis.

629 Chromatographic Methods of Analysis (3 cr.)

P: C410 or equivalent. Spring, night. Principles and practice of modern gas and liquid chromatography are developed from an integrated point of view. Emphasis is placed on those features useful in practical analytical separations. Instrumentation is described and evaluated using chemical examples from recent literature. Although column techniques are emphasized, thin-layer chromatography and electrophoresis methods are also described.

634 Biochemistry: Structural Aspects (3 cr.)

P: C310, C342, C361 and C362 or equivalent. Fall, night. Chemistry of materials of biochemical interest; carbohydrates, lipids, proteins, amino acids, nucleic acids, porphyrins, biochemistry of blood.

636 Biochemical Mechanisms (3 cr.)

P: 1 year of physical chemistry and CHEM 651. Spring, day. The chemical basis of enzymatic catalysis with particular emphasis on catalytic interactions important in aqueous media.

641 Advanced Inorganic Chemistry (3 cr.)

P: C430 or CHEM 542. Equiv. IU C530. Spring, night. Bonding in inorganic chemistry, symmetry and group theory, transition metal chemistry, spectra and magnetism, mechanisms of inorganic reactions, limited survey of periodic table.

651 Advanced Organic Chemistry (3 cr.)

P: C342 or equivalent. Equiv. IU C540. Fall, night. Modern structural organic chemistry, including introductions to molecular orbital theory and reaction mechanisms.

652 Synthetic Organic Chemistry (3 cr.)

P: CHEM 651. Equiv. IU C543. Spring, odd years, night. An advanced treatment of methods for preparing major types of organic functionalities and bonds, stressing stereochemical control and involving mechanisms for understanding the reactions employed.

657 Reaction Mechanisms (3 cr.)

P: CHEM 651. Fall, even years, night. Mechanisms of representative reactions and methods used in their investigation.

669 Theoretical Organic Chemistry (3 cr.)

P: CHEM 651. Theoretical aspects of organic chemistry at the molecular level and its relationship to bonding and reactions.

672 Quantum Chemistry (3 cr.)

P: One year of physical chemistry. Equiv. IU C661. Fall, odd years, night. Basic principles of classical and quantum mechanics; exact solutions for simple systems; approximation methods; atomic structure; spectroscopy; application of group theory; theory of molecular binding.

675 Chemical Kinetics (2 or 3 cr.)

P: One year of physical chemistry. Equiv. IU C673. Spring, odd years, night. Experimental and theoretical considerations of chemical reaction rates and mechanisms.

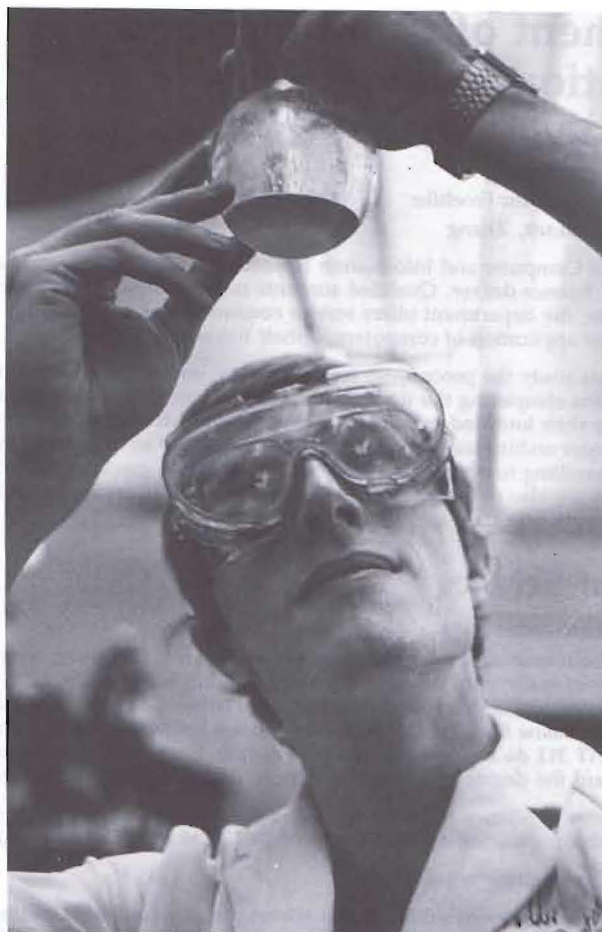
682 Statistical Thermodynamics (3 cr.)

P: C362 or equivalent. Spring, even years, night. Application of statistical mechanics to the description of imperfect gases, liquids, and solutions, to order-disorder phenomena in solids and surfaces; and to absolute reaction rate theory.

695 Seminar (1 cr.) For graduate students (may be repeated for credit). Groups meeting for review and discussion of important current literature in analytical, biological, inorganic, organic, and physical chemistry. Each graduate student is required to attend the seminar of his or her major subject.

696 Special Topics in Chemistry (1-3 cr.) On demand, night. Lectures on selected topics of current interest.

698 Research. M.S. Thesis (Credit arranged)



Department of Computer and Information Science

Professors de Korvin (*Chairperson*), John Gersting, Judith Gersting, Yovits

Associate Professor Olson

Adjunct Assistant Professor Froehle

Visiting Faculty Witaszek, Zhang

The Department of Computer and Information Science offers the Bachelor of Science degree and the Master of Science degree. Qualified students may be authorized to pursue the Ph.D. degree. In addition, the department offers service courses to acquaint students in other disciplines with the application of computers to their fields of interest.

Computer scientists study the processing, representation, and retrieval of information by computers. Students completing the undergraduate degree in Computer and Information Science may apply their knowledge to solve problems arising in almost any area of endeavor, design new computer architectures and systems, or may apply techniques of system analysis and information handling to a variety of situations in business, government, education, health sciences, etc. They are also prepared to pursue graduate work in computer and information science commensurate with their interests and abilities.

Bachelor of Science

Degree Requirements

See Graduation Requirements for general degree requirements. Computer science majors are admitted only provisionally until they have completed Math 163 and CSCI 220 with grades above C-. Computer and Information Science courses below CSCI 220, CSCI 308, Computer Technology courses below CPT 264, Mathematics courses below MATH 163, and statistics courses below STAT 311 do not count toward the degree. Certain School of Science courses do not count toward the degree program (see Item 10 under General Requirements).

Area I See Bachelor of Science requirements listed earlier in this bulletin. The second semester of English composition must be satisfied with TCM 320, Engineering Report Writing.

Area II No foreign language required.

Areas IIIA and IIIB Courses in other schools whose primary content is mathematical or concerns computers may not be used to fulfill Area IIIA or IIIB requirements. Consult the department for advice before registering for such courses.

Area IIIC Courses that may not be used to fulfill Area IIIC requirements include: Biology N100, N120, N200, Chemistry C100, C101, C102; Physics 100, 200, 218, 219; Astronomy A100, A105; Geology G107, G115, G130, all Agriculture courses. Consult the department counselor for advice concerning the acceptability of other courses.

The following engineering sequences may be applied toward Area IIIC requirements: EE 201, EE 207, EE261 and EE267.

Area IV Major Requirements Minimum requirements include 53 hours of designated Computer Science and Mathematics courses. Students who do not maintain a minimum GPA of 2.5 in MATH 163, 164, 261, and CSCI 220, 300, 320, 430 will not be permitted to continue as departmental majors.

Required courses:

1. The calculus sequence MATH 163, 164, 261
2. STAT 311 or STAT 511
3. The Computer and Information Science core CSCI 220, 320, 300, 430
4. Three of the following four two-course sequences: CSCI 402 and 403; 440 (or 380) and 541; 482 and 484; MATH 262 (or, preferably, MATH 351 and 361) and CSCI 414.
5. Two Computer and Information Science electives at the 400-level or above distinct from item 3 and the three two-course sequences of item 4.

6. Each student must complete at least one 500-level Computer and Information Science course (CSCI 512 is not acceptable).

For those courses counted toward the degree but taken outside the Schools of Science and Liberal Arts, the Department strongly urges that they be chosen so as to form a cohesive support area for the applications of computer and information sciences (e.g. certain courses in the School of Engineering and Technology or the School of Business).

Computer and Information Science Sample Program

A, B, C designate the 3 selected sequences in item 4 of Area IV Requirements.

Freshman				
1	CSCI 220 (3) Programming I	MATH 163 (5) Calculus	ENG W131 (3) Composition	Humanities or Soc. Science (3) Free Elective (3)
2	CSCI 320 (3) Programming II	MATH 164 (5) Calculus	COMM C110 (3) Speech	TCM 320 (3) Engineer. Writing Humanities or Soc. Science (3)
Sophomore				
3	CSCI 300 (3) Assembly Lang.	MATH 261 (4) Calculus	Laboratory Science (3-5)	Free Elective (3) Free Elective (3)
4	CSCI 430 (3) Data Structures	CSCI (3) ¹ Sequence A1	Laboratory Science (3-5)	Free Elective (3) Free Elective (3)
Junior				
5	CSCI (3) Sequence B1	CSCI (3) Sequence A2	STAT (3) Stat. Methods	Science Elective (3-5) Free Elective (3)
6	CSCI (3) Sequence B2	CSCI (3) Sequence A3	Science Elective (3-5)	Free Elective (3) Free Elective (3)
Senior				
7	CSCI (3) Sequence C1	Advanced CSCI Elective (3)	Humanities or Soc. Science (3)	Free Elective (3) Free Elective (3)
8	CSCI (3) Sequence C2	Advanced CSCI Elective (3)	Humanities or Soc. Science (3)	Free Elective (3) Free Elective (3)

Master of Science

This program, leading to a Purdue University degree, is offered in Indianapolis to serve primarily students from the Indianapolis area who are interested in computer and information science. Many courses are offered in the late afternoon or evening to accommodate working students.

Prerequisites for Admission

A bachelor's or equivalent degree and an overall grade point average of B or better are required by the Graduate School. Students must have completed the following courses or equivalents with grades of B or better before applying to the graduate program: Math 163, 164, 261 and CSCI 220, 300, 320, 430, 402, 403, 482, 484. These courses carry no credit toward the graduate degree.

The Graduate Record Exam, General (Aptitude) Test is required for admission. Regular graduate student application forms should be obtained from the Department of Computer and Information Science, IUPUI, P.O. Box 647, Indianapolis, IN 46223.

While the graduate application is being processed, the student may take courses as a temporary graduate student. Students may also use temporary graduate student status to take any courses required for admission in which they may be deficient. No more than 9 semester-hours of credit earned as a temporary graduate student may be applied toward a graduate degree. (Deficiency courses are not applied against the 9 semester-hours since these courses carry no credit toward the degree.) Temporary graduate student application forms may be obtained from the IUPUI Office of Graduate Programs. Temporary graduate students are

¹This assumes that the sequence chosen for A is MATH 351, MATH 361, CSCI 414. Those choosing a shorter sequence will have an additional free elective.

encouraged to talk to the department counselor as they plan toward admission to the graduate program.

Program Requirements

The program consists of at least 30 semester-hours of courses. The following courses are required of students who have not already had equivalent courses: CSCI 502 and CSCI 503; at least one of CSCI 514, 515, 516, 520; and at least one of CSCI 582 or MATH 585. The remaining courses are chosen by the student with the approval of the Graduate Committee. Generally these will consist of computer and information science courses numbered above 500, but a maximum of 6 semester-hours of courses numbered above 500 in a related discipline may be allowed if approved in advance on the plan of study.

The student's formal plan of study must be submitted to and accepted by the Graduate School *before* the semester in which the student expects to receive the degree; students should submit a plan of study as soon as possible after admission to the graduate program. The English requirement (see the Purdue University Graduate Degrees, Item 2, this Bulletin) must be satisfied before the plan of study can be approved. An applicant whose native language is not English must take the Test of English as a Foreign Language (TOEFL) before applying for admission.

Standard of Performance

In the courses on a plan of study, grades of A and B are expected; up to 6 semester-hours of grade C can be included provided an overall B average is maintained. Other grades are unacceptable.

Transfer of Credit

Credit for graduate courses taken at other institutions may be transferred with approval of the Graduate Committee and the Graduate School if the courses have not been used for other degree requirements. Transfer credits are normally limited to six semester-hours. Application for the transfer of credit is made when the plan of study is presented for approval.

Doctor of Philosophy

Qualified students may be authorized to pursue the Ph.D. degree. Please contact the Department of Computer and Information Science at IUPUI for further details.

Courses in Computer and Information Science

Note: P—prerequisite; C—concurrent registration; R—recommended

CSCI 201 Computer Literacy: Applications and Concepts (3 cr.) P: None. Not normally accepted for credit in computer science programs. An introduction to computers intended for students in the humanities and liberal arts. Some programming with emphasis on non-numerical programs. Computer applications that affect everyday life. The impact of computers on society, including both problems and benefits. Computer applications in the humanities.

CSCI 205 Computer Science for Allied Health (2 cr.) P: None. Not normally accepted for credit in computer science programs. An introduction to computers and computer programming. Programming in BASIC with emphasis on microcomputers. Graphics image processing, especially as it relates to medical imaging in the Allied Health Sciences.

CSCI 206 Computer Programming (3 cr.) P: None. Not normally accepted for credit in computer science programs. An introduction to computers and computer programming. Emphasis on problem solving and algorithm development using the BASIC and Pascal programming languages on microcomputers and mainframe computers. Primarily for Education majors.

CSCI 207 Computers in the Social Sciences (3 cr.) P: None. Not normally accepted for credit in computer science programs. An introduction to computers and computer programming. Elements of computer hardware and software, emphasis on problem solving, algorithm development, and programming in BASIC. Use of standard statistical packages. Social impact and ethical issues of computing.

CSCI 208 The Computer in Business (3 cr.) P: MATH 118 or MATH 119 and sophomore standing. Not normally accepted for credit in computer science programs. Introduction to computers and their use in business. Elements of computer organization and data storage. Programming in FORTRAN to solve business oriented problems; emphasis on structured programming. Developments in computing affecting business.

CSCI 220 Programming I (3 cr.) P or C: MATH 163 or MATH 221. An introduction to computer science. Emphasis on algorithm development and structured programming techniques. Programming in FORTRAN 77, including input/output, flow of control, arrays, subprograms. Program development

and debugging. Fundamental concepts of computer organization, social issues in computing.

CSCI 300 Assembly Language Programming (3 cr.) P: CSCI 220 or equivalent. Assembly language programming and structure of a simple computer and a typical computer. Number and character representation. Pseudo operations, address structure, subroutines and macros. File I/O and buffering techniques. Interfacing with programs written in high level languages. One and two pass assemblers. Programming assignments on bit/byte manipulation, I/O buffering and interfacing with high level languages including parameter passing.

It is recommended that students do not take CSCI 300 and CSCI 320 concurrently.

CSCI 308 The Microcomputer in Business (3 cr.) P: CSCI 208. Not normally accepted for credit in computer science programs. Microcomputer anatomy and operation. Selection and implementation of microcomputer hardware and software in a business environment: word processing; spreadsheet; database management; communications; payroll; general ledger; accounts payable; accounts receivable; inventory.

CSCI 320 Programming II (3 cr.) P: CSCI 220 or equivalent. Further emphasis on structured programming using a block structured higher level language such as Pascal. Advanced programming concepts: data types, recursion, scope of identifiers, elementary data structures. Program development and testing. Programming project required.

CSCI 402 Architecture of Computers (3 cr.) P: CSCI 430. Basic logic design. Storage systems. Processor organization: instruction formats, addressing modes, subroutines, hardware and microprogramming implementation. Computer arithmetic, fixed and floating point operations. Properties of I/O devices and their controllers. Interrupt structure. Virtual memory structure; cache memory. Examination of architectures such as microcomputers, minicomputers, vector and array processors.

CSCI 403 Systems Programming (3 cr.) P: CSCI 402. R: CSCI 461. Fundamental concepts of programming language processors and operating systems. Design of assemblers, macro processors, relocatable and linking loaders. BNF grammars, parsing, syntactic and semantic phases, optimization. Operating systems: design of monitors,

kernels; process management, virtual devices, memory management.

CSCI 414 Numerical Methods (3 cr.) P: MATH 262 (or MATH 351 and MATH 361) and CSCI 220 or equivalent. 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. Not open to students with credit in CSCI 512.

CSCI 430 Data Structures (3 cr.) P: CSCI 320 and CSCI 300. Specification, representation and manipulation of basic data structures, linked lists, arrays, stacks, queues, trees, strings. Symbol tables, Huffman codes, optimal search trees, pattern matching, priority queues, heaps, hash tables. Storage allocation, garbage collection, compaction, reference counts.

440 File Structures and Searching (3 cr.) P: CSCI 430. Basic techniques of file organization and design: indexing, sorting, searching, hashing. Access methods: secondary key searching, inverted files, multilists. Data analysis, file design, maintenance, reorganization. Illustrative examples from data processing using COBOL or PL/I. Introduction to database management systems: data models; data definition, manipulation, and query languages.

CSCI 446 Introduction to Microprocessor Architecture (3 cr.) P: CSCI 300 and CSCI 320. Introduction to programmable logic; elements of microprocessor system design; interrupt structures; interfacing using LSI devices; hardware timers; interactive debugging; physical device I/O programming; vectored and polled service; microprocessor architecture; self-paced laboratory using A/D converters, D/A converters, etc.

CSCI 450 Programming Methodology (3 cr.) P: CSCI 320 and CSCI 482. Tools and techniques used in software development. Lifecycle concepts applied to program specification, development and maintenance. Topics include: overall design principles in software development; the use of structured programming techniques in writing large programs; formal methods of program verification; techniques and software tools for program testing; maintenance and documentation.

CSCI 461 Introduction to Programming Languages (3 cr.) P: CSCI 320. R: CSCI 300. Study of syntax, semantics, and implementation of high level languages. Introduction to languages with features for large scale programming, (e.g., Ada,

Modula-2); systems programming, (e.g., Modula-2, C); parallel programming, (e.g., Ada, Modula-2); and functional programming, (e.g., Scheme and Lisp).

CSCI 482 Discrete Computational Structures (3 cr.) P: MATH 261. Discrete mathematical structures and their relationship to computer science. Topics from sets, relations, functions, permutations, combinatorics, graphs, trees, group theory, boolean algebra, recurrence relations, switching circuits, finite-state automata, codes.

CSCI 484 Theory of Computation (3 cr.) P: CSCI 482. Techniques for analyzing and comparing algorithms are presented. Algorithms analyzed include those for sorting, searching, graph theory, combinatorics, computational geometry, matrices and other problems. Computational complexity, including Turing machines, NP-completeness and effective computability.

CSCI 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.

Dual Level (Undergraduate-Graduate)

CSCI 502 Compiling and Programming Systems (3 cr.) P: CSCI 403. R: CSCI 484. Basic principles of compilers and compiler design; control of translation, loading and execution; symbolic coding systems; lexical and syntactic analysis; design and operation of assemblers and macroprocessors; design of interpretive systems. Students are expected to complete a large programming project as part of the course.

CSCI 503 Operating Systems (3 cr.) P: CSCI 502. Basic principles of operating systems: addressing modes, indexing, relative addressing, indirect addressing, stack maintenance; implementation of multitask systems; control and coordination of tasks, deadlocks, synchronization, mutual exclusion; storage management, segmentation, paging, virtual memory, protection, sharing, access control; file systems; resource management; evaluation and prediction of performance.

CSCI 512 Numerical Methods for Engineers and Scientists (3 cr.) P: MATH 351 or MATH 511, MATH 510, and CSCI 220 or equivalent. Not open to students with credit in CSCI 414. (Not normally accepted for graduate credit in computer sciences programs.) A survey of the useful methods of computation. Solution of nonlinear equations and systems of nonlinear equations.

Numerical methods for systems of linear equations. Approximate differentiation and integration. Numerical solution of ordinary differential equations. Introduction to partial differential equations and elementary approximation methods.

CSCI 514 Numerical Analysis (3 cr.) P: CSCI 414 or equivalent. Iterative methods for solving nonlinear equations; linear difference equations, applications to solution of polynomial equations; differentiation and integration formulas; numerical solution of ordinary differential equations; round-off error bounds.

CSCI 515 Numerical Analysis of Linear Systems (3 cr.) P: MATH 351 or MATH 511, and CSCI 220 or equivalent. Computational aspects of linear algebra; linear equations and matrices; direct and iterative methods; eigenvalues and eigenvectors of matrices; error analysis.

CSCI 516 Computational Methods in Applied Mathematics (3 cr.) P: CSCI 320, and MATH 510 or consent of instructor. A study of techniques such as direct integration, shooting, finite difference, finite element, method of weighted residuals, methods of characteristics and others for solving problems in fluid mechanics, solid mechanics, dynamics and other fields of applied mathematics.

CSCI 520 Computational Methods in Analysis (3 cr.) P: MATH 351 or 511, and CSCI 220 or equivalent. A treatment of numerical algorithms for solving classical problems in real analysis with primary emphasis on linear and non-linear systems of equations and on optimization problems; the writing, testing, and comparison of numerical software for solving such problems; a discussion of the characteristics of quality software for implementing these algorithms.

CSCI 536 Data Communication and Computer Networks (3 cr.) P: CSCI 402 or equivalent. Current hardware/software techniques in computer data communication. Data transmission techniques; data communication equipment such as terminals, modems, and communication controllers using microcomputer technology. Utilization of error detecting and correcting codes and techniques in data transmission. Application of data communication techniques in computer networks; circuit, message, and packet switching.

CSCI 541 Database Systems (3 cr.) P: CSCI 440 or equivalent. Fundamentals for the logical design of database systems. The entity-relationship model, semantic model, relational model, hierarchical model, network

model. Implementations of the models. Design theory for relational databases. Design of query languages and the use of semantics for query optimization. Design and verification of integrity assertions and security. Introduction to intelligent query processing and database machines.

CSCI 543 Discrete System Simulation (3 cr.) P: CSCI 220, and STAT 311 or STAT 511, or equivalent. 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.

CSCI 547 Information Storage and Retrieval and Natural Language Processing (3 cr.) P: CSCI 541. Complex data structures of fields within records; clustered, multilist, and inverted files; key decoding by tree and randomized techniques; overall techniques of classical document retrieval systems, e.g., the MEDLARS and NASA systems; overall techniques of automatic document retrieval systems, e.g., TIP and SMART; the internal structure of SMART; question answering systems; natural language translation.

CSCI 565 Programming Languages (3 cr.) P: CSCI 403. R: CSCI 484. An exploration of modern or unconventional concepts of programming languages, their semantics, and their implementations; program verification using Hoare's logic and Dijkstra's predicate transformers; abstract data types; monitors and distributed processes; LISP; applicative languages and APL; data flow languages.

CSCI 582 Automata and Formal Languages (3 cr.) P: CSCI 484. Finite automata, regular expressions; push-down automata, context-free grammars; their languages and behaviors. Closure properties, pumping lemmas, decision procedures. Deterministic context-free languages and LR(k) parsing; brief survey of the Chomsky hierarchy.

CSCI 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.

Graduate Level

CSCI 614 Numerical Solution of Ordinary Differential Equations (3 cr.) P: CSCI 514. Numerical solution of initial-value problems by Runge-Kutta methods, general one-step methods, and multistep methods. Analysis of truncation error, 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.

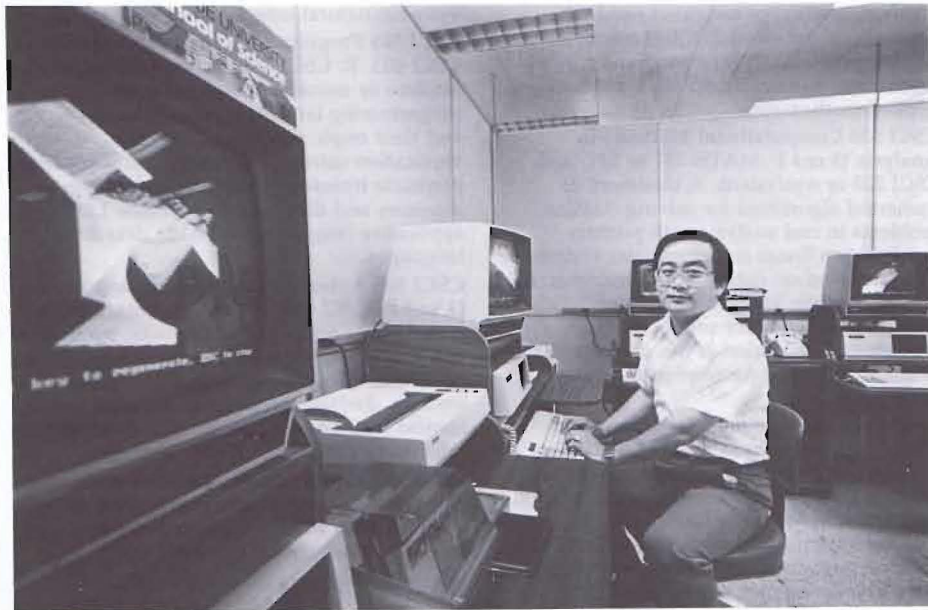
CSCI 615 Numerical Solution of Partial Differential Equations (3 cr.) P: CSCI 515 and MATH 523. The numerical solution of hyperbolic, parabolic, and elliptic equations by finite difference methods; iterative methods (Gauss-Seidel, overrelaxation, alternating direction) for solving elliptic equations; 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.

CSCI 660 Design of Translating Systems (3 cr.) P: CSCI 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.

CSCI 661 Formal Compiling Methods (3 cr.) P: CSCI 502. Application of concepts developed in formal language and automata theory to the design of programming languages and their processors. Models of

syntactic analysis, including canonical precedence, LR(k) and LL(k) parsing methods and variants; efficiency of each. Synthesis techniques, including symbol tables, storage administration, parameter mechanisms, garbage collection; optimization considerations. Models of synthesis, including level, affix, attributed grammars; prospects of fully automating compiler design. Applicative vs. procedural languages and their implementations based on semantic definition of a language (LISP, Lucid) and on proof-like techniques (PROLOG, equational systems); merits of such approaches.

CSCI 662 Introduction to Artificial Intelligence and Pattern Recognition (3 cr.) P: STAT 311. Introduction to the basic concepts and various approaches of making systems behave intelligently. The topics considered in this course include theory of neural nets, basic pattern recognition techniques and training methods, visual and speech recognition machines, game playing machines, heuristic programming, and problem solving machines.



Department of Geology

Professor Mirsky (*Chairperson*)

Associate Professors de Caprariis, Hall, Pachut, Rosenberg

Assistant Professor Amini

Adjunct Professors Banaszak and Park

Departmental Counselors Mirsky and Hall

Geology is the science of the earth—the systematic attempt by humans to understand the planet and the environment in which they dwell. 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, winds, glaciers, and other surficial earth processes. They 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 other planets in the solar system.

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 in which we live.

The following undergraduate degree options are offered in geology: Bachelor of Arts (B.A.) in geology (with General Geology Option or Earth Science Secondary Teaching Certification Option), and Bachelor of Science (B.S.) in geology. The choice of a particular degree option and proposed plan of study must be made in consultation with a departmental counselor. A graduate program leads to the Master of Science (M.S.) degree with a concentration in environmental geology.

Bachelor of Arts

(Granted by Indiana University)

GENERAL GEOLOGY OPTION

Degree Requirements

Area I See School of Science requirements. The second semester of English composition may be satisfied by ENG 132, ENG W 231, or TCM 220. Geology G205 may partially satisfy this requirement in Area I, but the 3 credits cannot then also be counted as part of the geology credits required in Area IV.

Area II Languages There is no requirement for a foreign language.

Area IIIA See School of Science requirements. First year of a foreign language does not apply towards satisfying this requirement.

Area IIIB See School of Science requirements.

Area IIIC Physical and Biological Sciences See School of Science requirements, but all four courses must include a laboratory, and at least two of the four courses must include Chemistry C105-C106, and at least one of the four courses must be in Biological Sciences. No grade below C- will be accepted in chemistry or in the other two courses to satisfy Area IIIC.

Area IIID Mathematical Sciences MATH 147-148 or MATH 151; and CSCI 220 or CSCI 206. No grade below C- will be accepted in any of these courses.

Area IV Geology Concentration Requirements 37 credits of geology (including G109, G110, G205, G206, G221, G222, G303, G323, G334, G404, and two courses from among 400-level or higher geology electives (but note that G409 or G410 must each total at least 3 credits). A maximum of 2 credits of G420 may be counted toward the geology concentration of 37 credits. Geology G107, G115, or G130 do not count towards the geology concentration of 37 credits but may be applied as electives towards the University-required total of 122 credits. Note that G205 is a prerequisite for G334 and all 400-level courses. This program can provide a broad general education and often an adequate background for professional employment in geology.

Other Requirements

See School of Science General Requirements. The Department of Geology will accept 10 credit hours toward graduation outside the Schools of Science and Liberal Arts.

EARTH SCIENCE SECONDARY TEACHING CERTIFICATION OPTION

Degree Requirements

A. Humanities 18-24 credits

Area I For teacher certification the requirement is met by the School of Science requirement. The second course in English composition may be satisfied by ENG W132, ENG W231, or TCM 220. Geology G205 may partially satisfy this requirement, but the 3 credits cannot then also be counted as part of the geology credits required in Area IV.

Area II No foreign language requirement.

Area IIIA See School of Science requirements. First year of a foreign language does not apply towards satisfying this requirement.

B. Social and Behavioral Sciences 9-15 credits

Area IIIB See School of Science requirements.

C. Life and Physical Sciences 9-15 credits

Area IIIC and D Same as under General Geology option above.

D. Electives as needed to obtain a total of 40 credits. Must include CSCI 220 or CSCI 206.

Earth Science Requirements (Area IV)

Fifty-one (51) credits of geology and related subjects (including G109, G110, G205, G206, G221, G222, G303, G323, G334, G404), Chemistry C105-C106. No grade below C- will be accepted in Geology and Chemistry. The additional related subjects are chosen from among those courses listed in the certification requirements.

Certification Requirements

Certification in science requires both a primary and support teaching area. Students pursuing the earth science secondary teaching certification option would earn a primary area of earth science, and must choose a supporting area of either physical science or physics.

The courses required for a supporting area of physical science are: 8-10 hours of chemistry and 5-7 hours of physics or 8-10 hours of physics and 5-7 hours of chemistry. The support area must total at least 15 hours of course work.

The courses required for a supporting area of physics are: Physics 218 and 219 or Physics 152 and 251 and 300-level physics electives to total 15 hours of physics.

In addition, general requirements for students seeking a science teaching major include nutrition, pharmacology, and in the case of an earth science primary area, one course in biology.

Students seeking a primary area of earth science must take Geology G300 or Geography G315 and Geology G416 in addition to the geology courses required of the baccalaureate degree.

The student should consult with a geology counselor for further information regarding courses to complete the certification requirements.

Professional Education Requirements

Refer to the front section of the Bulletin in the section on Special Programs—Secondary Teachers Certificate.

Other Requirements

See School of Science General Requirements, except electives to make a minimum of 124 credits, and an average of C or better for education courses (with at least a C in M449). The

Department of Geology will accept 10 credit hours toward graduation outside the Schools of Science and Liberal Arts and Education.

Bachelor of Science

(Granted by Indiana University)

Degree Requirements

Area I See School of Science requirements. The second semester of English Composition may be satisfied by ENG W132, ENG 231, or TCM 220. Geology G205 may partially satisfy this requirement in Area I, but the 3 credits cannot then also be counted as part of the geology credits required in Area IV.

Area II There is no requirement for a foreign language.

Area IIIA See School of Science requirements. First year of a foreign language does not apply towards satisfying this requirement.

Area IIIB See School of Science requirements.

Area IIIC Physical and Biological Sciences Chemistry C105-C106; Physics P201-P202 or 152-251; and two courses in biological sciences, with Department of Geology's approval. No grade below C- will be accepted in any of these courses.

Area IIID Mathematical Sciences Calculus MATH 163-MATH 164; CSCI 220, and one course in statistics with departmental approval. No grade below C- will be accepted in any of these courses.

Area IV Geology Concentration Requirements Geology: 44 credits including G109, G110, G205, G206, G221, G222, G303, G323, G334, G404, G429, and two courses from among 400-level or higher geology electives (but note that G409 or G410 must total at least 3 credits). A maximum of 2 credits of G420 may be counted toward the geology concentration of 44 credits. Geology G107, G115, and G130 do not count towards the geology concentration of 44 credits, but may be applied as electives towards the University-required total of 122 credits. No grade below C- will be accepted in any of these geology courses.

General Two courses at 300-400 level in one or more of the following departments: biological sciences, chemistry, computer and information science (CSCI 320 or CSCI 414), mathematical sciences and physics. With departmental approval, a third 400-level geology elective may substitute for one of these two courses. No grade below C- will be accepted in any of these courses.

Other Requirements

See School of Science General Requirements. The Department of Geology will accept 10 credit hours towards graduation outside the Schools of Science and Liberal Arts.

Geology Sample Plans of Study

There is no single semester-by-semester plan of study for any of the three baccalaureate degree options, because of the flexibility encouraged within the program for each option. However, one possible sequence of courses for each option is given below; variations from these samples of plans of study should be made in consultation with a departmental counselor.

Bachelor of Arts, General Geology Option

Freshman

1	G109 (4) Geology: Evolution of the Earth	MATH 147 (3) Algebra & Trig I	W131 (3) English Composition	Arts & Humanities (3)	
2	G110 (3) Geology: Earth's Environment	G206 (1) Physical Geology Laboratory	MATH 148 (3) Algebra & Trig II	N107 (4) Animal Biology	Second English Composition (3)

Sophomore

3	G221 (3) Mineralogy	C105 (5) Principles of Chemistry I	C110 (3) Speech	Arts & Humanities (3)	
4	G222 (3) Petrology	C106 (5) Principles of Chemistry II	Arts & Humanities (3)	G205 (3) Reporting Skills in Geoscience	Elective (3)

Junior

5	G303 (4) Maps & Air Photos	G323 (3) Structural Geology	Social & Behavioral Sciences (3)	Arts & Humanities (3)	Elective (3)
6	G334 (3) Sedimentation & Stratigraphy	Social & Behavioral Sciences (3)	Social & Behavioral Sciences (3)	Computers (3)	Elective (3) G410 (1) Undergraduate Research

Senior

7	G404 (3) Geobiology	G410 (1) Research in Geobiology	G415 (4) Geomorphology	Social & Behavioral Sciences (3)	300-Level Elective (3)	Elective (3)
8	G416 (3) Economic Geology	300-Level Elective (3)	300-Level Elective (3)	Elective (3)	Elective (3)	

Bachelor of Arts, Earth Science Secondary Teaching Certification Option

Freshman

1	G109 (4) Geology: Evolution of the Earth	MATH 147 (3) Algebra & Trig I	W131 (3) English Composition	Arts & Humanities (3)	Social & Behavioral Sciences (3)	
2	G110 (3) Geology: Earth's Environment	MATH 148 (3) Algebra & Trig II	N107 (4) Animal Biology	Arts & Humanities (3)	Second English Composition (3)	G206 (1) Physical Geology Laboratory

Sophomore

3	H340 (3) Education	G221 (3) Mineralogy	C105 (5) Principles of Chemistry I	C110 (3) Speech		
4	G222 (3) Petrology	C106 (5) Principles of Chemistry II	M201 (1) and P253 (3) Education	G205 (3) Reporting Skills in Geoscience		

Junior

5	G303 (4) Maps & Air Photos	G323 (3) Structural Geology	A100 or A105 (3) Astronomy	M300 (3) Education	M313 (3) and M301 (0) Education	
6	G115 (3) Oceanography	G334 (3) Sedimentation & Stratigraphy	M462 (3) and M401 (0) Education	G315 (3) Geography	Arts & Humanities (3)	

Senior

7	G404 (3) Geobiology	G410 (1) Research in Geobiology	G304 (3) Meteorology	M449 (5) and M401 (0) Education	400-Level Geology (3)	
8	400-Level Geology (3)	M480 (9) Education— Student Teach				

Summer Session (either between Junior and Senior year, or after Senior year)

Social & Behavioral Sciences (3)	Arts & Humanities (3)	Social & Behavioral Sciences (3)
----------------------------------------	--------------------------	----------------------------------------

Bachelor of Science

Freshman

1	G109 (4) Geology: Evolution of the Earth	MATH 147 (3) Algebra & Trig I	W131 (3) English Composition	Arts & Humanities (3)	
2	G110 (3) Geology: Earth's Environment	G206 (1) Physical Geology Laboratory	MATH 148 (3) Algebra & Trig II	C105 (5) Principles of Chemistry I	Second English Composition (3)

Sophomore

3	G221 (3) Mineralogy	C110 (3) Speech	MATH 163 (5) Calculus I	C106 (5) Principles of Chemistry II	
4	G222 (3) Petrology	MATH 164 (5) Calculus II	N107 (4) Animal Biology	G205 (3) Reporting Skills in Geoscience	

Junior

5	G303 (4) Maps & Air Photos	PHYS 152 (4) Physics I	G323 (3) Structural Geology	Computers (3)	
6	K101 (4) Botany	PHYS 251 (4) Physics II	Elective Area IV (3) 300-400 Level	Statistics (3)	

Senior

7	G404 (3) Geobiology	G410 (1) Research in Geobiology	Elective Area IV (3) 300-400 Level	Elective Area IV (3) 300-400 Level	Social & Behavioral Sciences (3)
8	G334 (3) Sedimentation & Stratigraphy	Elective Area IV (3) 300-400 Level	Elective (3)	Arts & Humanities (3)	Social & Behavioral Sciences (3)

G429—Summer Field Camp in Rockies—(7)

Master of Science

(Granted by Indiana University)

The Department of Geology graduate program leads to the Master of Science degree with a concentration in environmental geology. The Master of Science degree program is administered under the chairperson by a Graduate Advisory Committee composed of a graduate adviser and two graduate committee members appointed by the chairperson.

Admission Requirements

The prospective student in the master's program should have a baccalaureate degree in geology, including summer field camp, a B (3.0/4.0) average in geology courses, one year each of chemistry and physics, mathematics through calculus, and a course in computer programming. Each candidate must also submit Graduate Record Examination scores (on both the General Test and the subject test in geology) and three letters of recommendation. Persons with a baccalaureate degree in another area of science are also encouraged to apply; a special admissions committee will prescribe a plan of study to remove deficiencies.

Transfer Credit

The Department of Geology will accept by transfer a maximum of 6 hours of graduate credit from approved institutions which are in excess of undergraduate degree requirements.

Course Requirements

Both thesis and nonthesis options are available.

The thesis option requires a minimum of 30 credit hours, including 6 hours for the thesis.

The nonthesis option requires a minimum of 36 credit hours, 3 of which must be in a research course requiring a written report. Students electing the nonthesis option also must include among the 36 hours 6 hours in research-skill courses (e.g. computer science, statistics, etc.).

Both thesis and nonthesis options require at least 6 hours in allied science and mathematics courses approved for graduate credit. Up to 6 hours of 400-level (senior) geology courses approved for graduate credit may count towards major-field requirements.

Grades

A B (3.0/4.0) average or higher must be maintained, but no more than 6 hours of grades below B are acceptable and no grade below C is acceptable.

Financial Aid

Qualified candidates for the master's degree may be appointed as part-time lecturers in introductory-level courses. Several such positions are available each semester. Teaching positions include remission of about 80 percent of fees and tuition. In addition, grant-supported research assistantships may be available to exceptionally well-qualified candidates. Finally, all candidates may apply for University Fellowships.

Courses in Geology

Courses with numbers in the 100s and 200s are lower division undergraduate courses. Courses with numbers in the 300s and 400s are upper division undergraduate courses which may, in some cases, be used for graduate credit. Courses in the 300s may be used for graduate credit by graduate students in Education but not by other students. Courses in the 400s may be taken for graduate credit by all graduate students. Courses with numbers in the 500s or higher are graduate courses.

Note: P—prerequisite; C—concurrent registration; R—recommended; Fall—offered fall semester; Spring—offered spring semester; Summer—offered in the summer session; Day—offered as a daytime section; Night—offered as an evening section. For courses with no designed 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.

G107 Geology, Resources, and Man (3 cr.)
P: None. Fall, Spring, Summer. An introduction to geology through discussion of geological topics that show the influence of geology on modern society. Topics include mineral and energy resources, land use, and water supplies, geologic hazards and problems, geology and health, and new geological developments.

G109 Geology: Evolution of the Earth (4 cr., 3 cr. without laboratory) P: None. Fall, Spring, Summer. Basic principles of interpreting earth history: geologic time, stratigraphic analysis, reconstructing past environments. Physical development of the earth: its interior, mountainbuilding, continental drift, sea-floor spreading. Origin and development of life: evolution, the fossil

record. With laboratory, 4 credits (equiv. IU G104, IU G112, and PU GEOS 112); without laboratory, 3 credits.

G110 Geology: the Earth's Environment (4 cr., 3 cr. without laboratory) P: None. Fall, Spring, Summer. 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. With laboratory, 4 credits (equiv. IU G103, IU G111, and PU GEOS 111); without laboratory, 3 credits.

G115 Introduction to Oceanography (3 cr.)
P: None. Fall, Spring, Summer. Nonmathematical introduction to the history, geology, biology, and physical characteristics of the ocean. Includes volcanoes and earthquakes in the marine environment, currents of the world ocean, the life history of marine animals, and pollution of the marine ecosystem.

G130 Short Courses in Earth Science: Variable Title (1 cr.) P: None. Five-week short courses on a variety of topics in the earth sciences. Examples of topics include: lunar and planetary geology; geology of Indiana; geology of national parks; geology of Africa; geology of cities; geology of gemstones; energy; history of geology; earthquakes; volcanoes; prehistoric life, dinosaurs, fossil clocks and changing time. Each short course is one credit; no topic may be taken for credit more than once.

G205 Reporting Skills in Geoscience (3 cr.)
P: English W131, Geology G109 or G110. Spring. 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.

G206 Physical Geology Laboratory (1 cr.) P or C: G110. Fall, Spring. The laboratory study of minerals, rocks, topographic maps and aerial photographs, landforms and landscapes, structural geology, and geologic maps.

G221 Introductory Mineralogy (3 cr.) P: G206 or consent of instructor. Fall. Crystallography: symmetry, morphology, classes. Mineral chemistry, physics, and genesis. Description, identification, association, occurrence, and use of common and important minerals.

G222 Introductory Petrology (3 cr.) P: G221. Spring. Igneous, sedimentary, and metamorphic rocks: composition, field occurrence, characteristics, classification, and origin, laboratory description and identification.

G300 Environmental and Urban Geology (3 cr.) P: Geology G107, or G109 or G110 or Geography G107 or consent of instructor. 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 Geologic Mapping and Field Methods (4 cr.) P: G222 or consent of instructor. Pace-and-compass and plane-table mapping. Measuring and describing stratigraphic sections of sedimentary rocks and surficial deposits. Mapping geologic structures and structural interpretation of maps and aerial photographs. Introduction to geophysical studies. Environmental (land-use) mapping.

G309 Cooperative Education in Geology (1-3 cr.) P: G206, G222, G303. Industrial or government or similar experiences in geologically-oriented employment. Grade is determined on basis of a written student report, and a supervisor evaluation report. May be repeated for a maximum of 6 credits.

G323 Structural Geology (3 cr.) P: G206 and G222. R: G303. Nature and origin of primary and secondary structural features of the earth's crust, with emphasis on mechanics of deformation and origin, and three-dimensional problems illustrating structural concepts.

G334 Principles of Sedimentation and Stratigraphy (3 cr.) P: G205, G222 or consent of instructor. Spring. 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.

G403 Optical Mineralogy and Petrography (3 cr.) P: G205, G222. Identification of rock-forming minerals in fragments and thin-sections using principles of optical crystallography and the standard petrographic microscope. Description of common igneous, sedimentary, and metamorphic rocks and interpretation of their genesis using hand-specimens and thin-sections. Practical applications are considered.

G404 Geobiology (3 cr.) P: Geology G109 and G205 and Biology K101 or K103 or N107, or consent of instructor. Fall. Principles of paleontology. Application of biological principles and use of fossils in the study of earth history. Emphasis is on documentation of macroevolution and development of the basic theory of evolution. Laboratory exercises examine the form and ecology of major phyla with a fossil record. G410 (1 cr.) must be taken concurrently for field project by geology majors; optional for nonmajors.

G406 Introduction to Geochemistry (3 cr.) P: G205, G221, Chemistry C106 or consent of instructor. Chemistry in the study of the earth employing elementary chemical thermodynamics, the phase rule, chemical equilibria, redox reactions, the radioactive decay law, and organic chemistry.

G409 Independent Study in Geology (1-3 cr.) P: Consent of instructor. Fall, Spring, Summer; day, night. Supervised independent study of topics and techniques in geology that are not available in formal courses in the department.

G410 Undergraduate Research in Geology (1-6 cr.) P: G205, junior standing and consent of instructor. Fall, Spring, Summer; day, night. 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: G205 and consent of instructor. Physics in the study of the earth, its origins, history, and internal constitution. Exploration techniques.

G415 Principles of Geomorphology (4 cr.) P: G205, G222, G303, G323. P or C: G334. Natural processes that create landforms and landscapes. Physics and chemistry of weathering and soil formation. Dynamics of mass wasting, streams, glaciers, wind, and shoreline processes. Includes field and laboratory investigations and a research

project on a selected aspect of geomorphology.

G416 Economic Geology (3 cr.) P: G205, G222 or consent of instructor. 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: G205 or consent of instructor. Seminar and field investigation of selected regions for study of mineralogic, lithologic, stratigraphic, structural, paleontologic, geomorphologic, or other geological relationships. Seminar held during spring semester. Six to ten days in the field during first summer session.

G429 Field Geology in the Rocky Mountains (7 cr.) P: G205, G221, G222, G303, G323, and G334. Summer. Seven 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 Department of Geology at Indiana University Bloomington.

G430 Principles of Hydrology (4 cr.) P: G205, G206, MATH 148, CHEM C106, PHYSICS P202 or 251, and introductory biology. Introduction to the study of surface and subsurface water and water quality. Includes field and laboratory investigations and a research project integrating geologic and hydrologic characteristics of selected watersheds.

G451 Principles of Hydrogeology (3 cr.) P: G205, G110 or consent of instructor. R: G334. Water resources; occurrence, regulation, and management of water; hydrologic cycle, water movement, water quality and pollution; surface and subsurface investigations; basin-wide development of water resources.

G490 Seminar in Geology (2-3 cr.) P: junior or senior standing and consent of instructor. Readings and discussion of selected topics. May be repeated, provided different topics are studied, for a maximum of 6 credits.

G499 Honors Research in Geology (3 cr.) P: Approval of departmental Honors Committee.

Graduate Courses¹

G511 Stratigraphy of North America (3 cr.) P: G334 and G404, or equivalent. Lithostratigraphy, biostratigraphy, correlation, tectonic setting, and depositional environment of North American Phanerozoic rocks.

G525 Glacial Geology (3 cr.) P: G415 or consent of instructor. Formation, dynamics, and regimen of glaciers. Erosional and depositional processes and landforms. Glaciation of North America with emphasis on stratigraphy, soils, climates, and physical changes resulting from glacial processes and environments. Three one-day field investigations and a student research project are required.

G551 Advanced Hydrogeology (3 cr.) P: G430 or G451. Basic principles and quantitative aspects of physical flow systems and chemistry of ground water and surface water. The relationships between water and geologic materials.

G561 Paleoecology (3 cr.) P: G334 and G404. Relationships between modern and fossil organisms and their physical, chemical, and biological environments, emphasis on techniques for interpreting past environmental conditions.

G595 Data Analysis Techniques in Geoscience (3 cr.) P: Stat 301 and CSCI 220, or equivalent. Application of statistical and numerical analysis techniques to geoscience data, including error analysis, confidence intervals, least squares methods, correlation, time series analysis, and cluster analysis. Use of the computer to solve geoscience problems is emphasized, including petrological calculations and graphical displays.

G635 Soil Geomorphology (3 cr.) P: G415 recommended. Application of geomorphic principles in evaluation of weathering and soil formation, systems analysis of soil-landscape models, present and past environments, paleogeomorphology and paleopedology, lecture discussion, field and laboratory problems.

G690 Advanced Geology Seminar (credit arranged) P: Consent of instructor.

G700 Geologic Problems (1-5 cr.) P: Consent of instructor. Consideration of special geologic problems.

G810 Thesis Research (6 cr.)

¹These courses are currently available. Other courses are being proposed to complement the program.



Department of Mathematical Sciences

Professors Aliprantis, Alton, Bittinger, Bodonyi, Burkinshaw, Crown, Kaminker, Kleyle, Kuczkowski, Ng (*Chairperson*), Rothman

Professors Emeritus Bridges, Johnston, Sconce

Associate Professors Hutton, Loh, Luke, Miller (Columbus campus), Morrel, Patterson, Penna, Rigdon, Sen

Assistant Professors Frankel, Tam, Xia

Departmental Counselors (Subject to change; if necessary contact Department of Mathematical Sciences)

Undergraduate Counselors

Pure Mathematics Option: Morrel, Kleyle, Patterson, Burkinshaw, Sen, Xia

Applied Mathematics Option: Luke, Frankel

Secondary School Teaching Option: Alton, Hutton

Transfers and special cases: Loh

Graduate Counselors

Master of Arts in Teaching: Crown

Master of Science: Kaminker

Master of Science (Applied Mathematics): Bodonyi

Mathematical Sciences includes the areas of pure and applied mathematics, mathematics education, and statistics. Mathematics involves the study of problems in areas such as algebra, geometry, analysis and logic, and problems arising in the real world. Mathematics and statistics are used in the physical sciences, engineering, social, life, and management sciences. Mathematics education involves the training of prospective secondary teachers.

Degree Programs

The department offers the Bachelor of Science degree in mathematics with options in Pure Mathematics, Applied Mathematics, and Secondary School Teaching.

Graduate degrees offered are: Master of Arts in Teaching, Master of Science, and Master of Science (Applied Mathematics), Doctor of Philosophy.

Bachelor of Science (Mathematics)

In order to receive proper counseling, a student is encouraged to declare a mathematics major in the freshman year. An average grade of 2.5 with no failing grades in mathematics courses through MATH 351 is a minimum indication of success in this major.

Degree Requirements

The baccalaureate degree general requirements, the area requirements, and the bachelor of science degree requirements are listed earlier in this bulletin. For a Bachelor of Science degree in mathematics, the following additional requirements and restrictions apply:

Area I No additional requirement. The second semester of English composition may be satisfied by ENG W132, ENG W231, TCM 220 or TCM 320.

Area II (all options) One year in a modern foreign language.

Area III (all options)

1. Mathematics courses below MATH 163 and those mathematics courses with grades below C do not count toward the major requirements for the degree.
2. Courses that are primarily mathematical may not be used to fulfill the arts and humanities requirement, Area IIIA, or the social and behavioral science requirement, Area IIIB, of the School of Science. If in doubt about a particular course, the student should consult a mathematics department counselor.
3. Certain courses, such as Chemistry C101, C102; Physics 100, 200, 218, 219; Astronomy A100, A105; and Geology G107 may not be used to fulfill the science requirement, Area IIIC, of the School of Science. If in doubt about a particular course, the student should consult a mathematics department counselor.

Area IV

1. Requirements related to the minor.
2. Requirements related to the major.

The Area IV minor and major requirements for the three degree options are described in the following sections. There is no single semester-by-semester plan of study for any of the options because flexibility is encouraged within the various programs. However, a sample program is given for each option that shows one possible sequence of courses. Variations from the sample program should be made in consultation with the student's counselor. Because of the complexity of the above requirements, and because certain courses are not offered every semester, it is important that each student consult the assigned counselor as soon as possible in order to proceed through a proper plan of study for the chosen degree program. A minimum of a 2.5 grade-point average in all mathematics courses which count toward the major is required.

Area IV Minor Requirements

In order that each student acquire some depth of study in a subject outside of the major area, the Department of Mathematical Sciences requires the student to have a minor in an area outside of the department. The minor consists of at least 18 hours and includes at least three courses beyond the introductory level. It is subject to the approval of the student's counselor. While a minor is usually in one department it may be from two or more if the counselor approves.

Courses may be used for the double purpose of fulfilling general requirements and also fulfilling the minor requirements of the Department of Mathematical Sciences. For students in the Pure Mathematics Option, minor in one of the physical sciences or in a subject which makes serious use of mathematics, such as computer science or economics, is desirable. Students in the Applied Mathematics Option are required to take a minor in science or engineering. Students in the Secondary School Teaching Option satisfy the requirements for a minor by the sequence of courses that they take to meet the professional education requirement.

Area IV Major Requirements

PURE MATHEMATICS OPTION

With this option you would be well prepared for graduate work in pure mathematics. However, students with undergraduate degrees in pure mathematics have also been successful with graduate studies in business administration, computer science, economics, engineering, educational research, law, medicine, operations research, psychology, statistics, and physics. Persons with advanced degrees in pure mathematics find careers primarily in college teaching, but careers in business, industry, or government service are also possible.

The Area IV major requirements are:

1. The calculus sequence MATH 163, 164, 261
2. Computer Science CSCI 220
3. Linear and Abstract Algebra MATH 351 (or MATH 511) and MATH 453
4. Analysis MATH 361 and MATH 441
5. Twelve (12) additional hours selected from mathematics, computer science, or statistics courses at the 300 level or higher, and approved by your academic adviser.

Pure Mathematics Options Sample Program

Freshman					
1	MATH 163 (5) Calculus	COMM C110 (3) Speech	ENG W131 (3) Composition	Laboratory Science (3-5)	Free Elective (3)
2	MATH 164 (5) Calculus	CSCI 220 (3) Programming I	Second English Composition (3)	Laboratory Science (3-5)	Free Elective (3)
Sophomore					
3	MATH 261 (4) Calculus	Free Elective (3)	Humanities or Soc. Science (3)	Science Elective (3-5)	Free Elective (3)
4	MATH 351 (3) Linear Algebra	MATH 361 (3) Differential Eq.	Humanities or Soc. Science (3)	Science Elective (3-5)	Free Elective (3)
Junior					
5	MATH 441 (3) Analysis	MATH, STAT, or CSCI Elective (3)	Humanities or Soc. Science (3)	Free Elective (3)	Free Elective (3)
6	MATH 453 (3) Algebra I	Free Elective (3)	Humanities or Soc. Science (3)	Free Elective (3)	Free Elective (3)
Senior					
7	MATH, STAT or CSCI Elective (3)	MATH, STAT or CSCI Elective (3)	Free Elective (3)	Free Elective (3)	Free Elective (3)
8	MATH, STAT or CSCI Elective (3)	Free Elective (3)	Free Elective (3)	Free Elective (3)	Free Elective (3)

APPLIED MATHEMATICS OPTION

Graduates with training in applied mathematics are employed in business, industry, and government. You would probably work as part of a team and often would need to communicate mathematical ideas to persons trained in other subjects. In many instances, you would need to formulate problems for solution on a computer and then interpret the answers. Thus, besides a fundamental knowledge of mathematics, a knowledge of what computers can do is essential. This option is also a good preparation for graduate study in applied mathematics, computer science, statistics, and engineering.

The Area IV major requirements are:

1. The calculus sequence MATH 163, 164, 261
2. Computer Science CSCI 220, CSCI 320
3. Linear Algebra MATH 511 (or MATH 351)
4. Analysis MATH 361 and MATH 414 (or CSCI 512)
5. Mathematical Modeling MATH 426 or MATH 517 or CSCI 520
6. Statistics STAT 311
7. Six (6) additional hours, three of which must be in applied mathematics, selected from mathematics, computer science, or statistics courses at the 300 level or higher, and approved by your academic adviser.

Applied Mathematics Option Sample Program

Freshman					
1	MATH 163 (5) Calculus	Free Elective (3)	ENG W131 (3) Composition	Humanities or Soc. Science (3)	Free Elective (3)
2	MATH 164 (5) Calculus	CSCI 220 (3) Programming I	COMM C110 (3) Speech	Second English Composition (3)	
Sophomore					
3	MATH 261 (4) Calculus	CSCI 320 (3) Programming II	PHYS 152 (4) Mechanics	Humanities or Soc. Science (3)	Free Elective (3)
4	MATH 361 (3) Differential Eq.	Free Elective (3)	PHYS 251 (5) Heat, Electricity	Free Elective (3)	Free Elective (3)
Junior					
5	MATH 511 (3) Linear Analysis	Advanced CSCI Elective (3)	PHYS 342 (4) Modern Physics	Humanities or Soc. Science (3)	Free Elective (3)
6	STAT 311 (3) Probability	Free Elective (3)	PHYS 310 (3) Mechanics	Humanities or Soc. Science (3)	Free Elective (3)
Senior					
7	MATH 414 or CSCI 512 (3) Numerical Methods	Advanced MATH Elective (3)	PHYS 322 (3) Oscillations and Waves	Free Elective (3)	Free Elective (3)
8	MATH 426 or 517 or CSCI 520 (3) Mathematical Modeling	Free Elective (3)	PHYS 330 (3) Electricity and Magnetism	Free Elective (3)	Free Elective (3)

SECONDARY SCHOOL TEACHING OPTION

To teach in secondary schools, you must meet the requirements for teacher certification in the state in which you expect to teach. You can obtain these requirements by writing to the Department of Public Instruction, Certification Office, in the capital city of any state.

According to Indiana state law, a student should have 40 semester hours in general education courses and a specified core of professional education courses as part of the requirement for a teaching license. You should be sure to see an adviser to ensure that these hours are properly distributed and that the professional education requirements are met. The secondary teaching program here which has been approved by the State of Indiana requires the completion of at least 38 semester hours of mathematics courses.

The Area IV major requirements are:

1. The calculus sequence MATH 163, 164, 261
2. Computer Science CSCI 220
3. Linear and Abstract Algebra MATH 351 (or MATH 511) and MATH 453
4. Analysis MATH 361 and MATH 300
5. Geometry MATH 563 (or MATH 561)
6. Probability and Statistics STAT 311 (or MATH 519 or STAT 516)
7. Three hours selected from a mathematics, computer science, or statistics course at the 300 level or higher.

Secondary School Teaching Option Sample Program

Freshman					
1	MATH 163 (5) Calculus	Free Elective (3)	ENG W131 (3) Composition	Laboratory Science (3-5)	Humanities or Soc. Science (3)
2	MATH 164 (5) Calculus	PSY B104 or B105 (3) Psychology	ENG W132 (3) Composition	Laboratory Science (3-5)	Free Elective (3)
Sophomore					
3	MATH 261 (4) Calculus	CSCI 220 (3) Programming I	EDUC H340 (3) Ed. & Am. Culture	Laboratory Science (3-5)	COMM C110 (3) Speech
4	MATH 351 (3) Linear Algebra	MATH 361 (3) Differential Eq.	EDUC P253 (3) Ed. Psychology	Laboratory Science (3-5)	Free Elective (3)
Junior					
5	STAT 311 (3) Probability	MATH STAT or CSCI Elective (3)	EDUC M300 (3) Intro. Teaching	Foreign Language (5)	EDUC M313 (3) Secondary Teaching
6	MATH 453 (3) Algebra I	MATH 300 ¹ (3) Number Systems	EDUC M462 (3) Methods, Reading	Humanities or Soc. Science (3)	Free Elective (3)
Senior					
7	MATH 563 ¹ (3) Advanced Geometry	Free Elective (3)	EDUC M448 ¹ (4) Methods, Math	Humanities or Soc. Science (3)	Free Elective (3)
8	Free Elective (3)	EDUC M480—Student Teaching for 9 weeks—(9)			Free Elective (3)

¹MATH 563 is offered only in the fall of even numbered years, EDUC M448 only in the fall of odd numbered years, and MATH 300 only in the spring of even numbered years.

Graduate Programs

The Department of Mathematical Sciences offers complete programs leading to the following Purdue degrees: Master of Arts in Teaching, Master of Science, Master of Science (Applied Mathematics), and Doctor of Philosophy. These programs are designed for the part-time student, and all course offerings are normally offered on the IUPUI evening schedule.

Admission Requirements

Students entering a graduate program in mathematics should have completed an undergraduate program containing as many courses in abstract algebra, linear algebra, advanced calculus, differential equations, logic and foundations, and probability as possible.

Students entering the graduate program in applied mathematics should have completed an undergraduate program in mathematics, or an undergraduate program in engineering or physical sciences that is highly mathematics oriented.

Application for Admission

The student who wishes to pursue an advanced degree in the Department of Mathematical Sciences should see a graduate adviser in order to receive counseling, prepare an informal plan of study, and obtain a regular graduate student application form. While this application is being processed the student may enter IUPUI as a temporary graduate student. Not more than 9 hours of credit earned under this classification may be applied towards an advanced degree. Those who do not want to pursue an advanced degree, but desire to take graduate courses for personal improvement, may also take courses under the temporary graduate student classification.

Transfer Credit

The Department of Mathematical Sciences will accept by transfer a maximum of 9 hours of graduate credit which are in excess of undergraduate degree requirements from approved institutions.

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.

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.

The student's formal plan of study should be submitted and accepted by the Graduate School before the semester in which the student expects to receive the degree. The English requirement must be satisfied before the plan of study may be filed. No course in which the grade earned is below C, and normally no more than 6 hours of courses with a grade of C, may be accepted toward completion of the plan of study.

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 to any of the M.S. degree programs.

This nonthesis program requires a minimum of 33 credits. A plan of study will normally include 3 semester hours in algebra, 3 semester hours in geometry, 3 semester hours in analysis, and courses in mathematics, computer sciences, or statistics to be selected with the approval of the advisory committee. Courses which meet these requirements include MATH 547, 548, 550, 511, 561, 562, and 563. A student who has completed a course equivalent to any of these as an undergraduate must substitute a more advanced course unless it is determined by the advisory committee not to be feasible. Up to 12 hours may be in related areas.

Master of Science

This Master of Science is a strong master's degree with emphasis in pure mathematics. The program normally requires 30 hours of course work. Required courses are MATH 525, 544, 545, 553, 554, 571, and either one course for which some of these are prerequisites, or MATH

585. Nine (9) hours of electives are to be selected by the student and his or her advisory committee.

Master of Science (Applied Mathematics)

This program is authorized for Indianapolis by the Department of Mathematics of Purdue University. It leads to a Purdue University degree.

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. The program consists of:

A. Core requirements

1. Partial Differential Equations: MATH 523.
2. Qualitative Theory of Ordinary Differential Equations: MATH 522.
3. Complex Analysis: MATH 525 or MATH 530.
4. Real Analysis: MATH 544.
5. Numerical Methods: CSCI 614 and CSCI 615.

B. Options: 9 hours to be chosen from the following:

Mathematical Modelling of Physical Processes: MATH 626 and MATH 627.

Perturbation Methods: MATH 536.

Methods of Applied Mathematics: MATH 611, MATH 612.

Real Analysis: MATH 545.

Other appropriate graduate level courses subject to the approval of the student's graduate committee.

Doctor of Philosophy

Qualified students can pursue the Ph.D. degree at IUPUI in areas with equivalent programs to those at Purdue University, West Lafayette, Indiana. Please contact the Department of Mathematical Sciences at IUPUI for further details.

Courses in Mathematical Sciences

Note: Statistics courses follow MATH listings. P—prerequisite; C—concurrent registration; R—recommended. Equiv.—course is equivalent to the indicated course taught at Indiana University Bloomington or the indicated course taught at Purdue University, West Lafayette.

Special Service Courses

MATH 001 Remedial Algebra (3 cr.) P: Eighth Grade Mathematics. Fall, Spring. 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. Credit does not apply toward any degree. Offered only through Weekend College, Learn and Shop, and Continuing Education.

Undergraduate Level

Lower-Division Courses

MATH 110 Foundations of Algebra (4 cr.) P: Placement via the TOPS test. Fall, Spring, Summer. One and one-half years of high school algebra are covered in one semester. Integers, rational and real numbers, exponents, decimals, polynomials, equations,

word problems, factoring, roots and radicals, logarithms, quadratic equations, graphing, linear equations in more than one variable, inequalities. This course satisfies the prerequisites needed for MATH M118, MATH 147, MATH 150.

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

MATH M118 Finite Mathematics (3 cr.) P: MATH 110 or equivalent. Fall, Spring, Summer. Set theory, vectors, matrices, permutations, combinations, simple probability, conditional probability, linear programming, graphical and simplex methods, duality theorem.

MATH M119 Brief Survey of Calculus I (3 cr.) P: MATH M118 or two years of high school algebra. Fall, Spring, Summer. Sets, limits, derivatives and applications, integrals and applications, functions of several variables.

MATH 123 Elementary Concepts of Mathematics (3 Cr.) P: None. Mathematics

for liberal arts students; experiments and activities which provide an introduction to inductive and deductive reasoning, number sequences, functions and curves, probability, statistics, topology, metric measurement, and computers.

MATH 130 Mathematics for Elementary Teachers I (3 cr.) P: MATH 001 or one year of high school algebra. One year of high school geometry. Equiv. IU MATH T101. The sequence MATH 130, 131, 132 fulfills the mathematics requirements for elementary education majors. Fall, Spring. Numeration systems, mathematical reasoning, natural numbers, whole numbers, properties, algorithms, sets, sentences, logic.

MATH 131 Mathematics for Elementary Teachers II (3 cr.) P: MATH 130. Equiv. IU MATH T102. Fall, Spring. Number systems: numbers of arithmetic, integers, rationals, reals, mathematical systems, decimal and fractional notations; probability, simple and compound events, algebra review.

MATH 132 Mathematics for Elementary Teachers III (3 cr.) P: MATH 131. Equiv. IU MATH T103. Fall, Spring. Metric and nonmetric properties of geometric figures, measurement; introduction to the foundations of euclidean geometry; coordinate geometry.

MATH 147 Algebra and Trigonometry for Technology I (3 cr.) P: Three semesters of high school algebra. Fall, Spring, Summer Session I. MATH 147-148 is a two-semester version of MATH 150. MATH 147 covers algebra.

MATH 148 Algebra and Trigonometry for Technology II (3 cr.) P: Four semesters of high school algebra. Equiv. Fall, Spring, Summer Session II. MATH 147-148 is a two-semester version of MATH 150. MATH 148 covers trigonometry.

MATH 150 Mathematics for Technology (5 cr.) P: Three semesters of high school algebra. Fall, Spring. MATH 147-148 is a two-semester version of MATH 150. Fundamental laws of algebra, functions and graphs, trigonometric functions, linear equations, factoring, exponents, vectors, complex numbers, logarithms, ratio, proportion, variation.

MATH 151 Algebra and Trigonometry (5 cr.) P: Three semesters of high school algebra. Not open to students with credit in 147, 148, 150. Fall, Spring. College algebra and trigonometry for students with inadequate preparation for Calculus MATH 163. (For science and engineering students.)

MATH 163 Integrated Calculus and Analytic Geometry I (5 cr.) P: Two years of high

school algebra, one semester of trigonometry, one year of geometry. Equiv. IU MATH M215. Fall, Spring. The Cartesian plane, functions, limits, differentiation and applications, mean value theorem, definite integral and applications.

MATH 164 Integrated Calculus and Analytic Geometry II (5 cr.) P: MATH 163. Equiv. IU MATH M216. Fall, Spring, Summer (eight weeks). Transcendental functions, methods of integration, conics, polar coordinates, parametric equations, vectors, improper integrals.

MATH 221 Calculus for Technology I (3 cr.) P: MATH 150 or equivalent. Fall, Spring, Summer Session I. Analytic geometry, the derivative and applications, the integral and applications.

MATH 222 Calculus for Technology II (3 cr.) P: MATH 221. Fall, Spring, Summer Session II. Differentiation of transcendental functions, methods of integration, power series, Fourier series, differential equations.

MATH 261 Multivariate Calculus (4 cr.) P: MATH 164. Equiv. IU MATH M311. Fall, Spring, Summer Session I. Partial differentiation, multiple integration, vector functions and vector analysis, infinite series.

MATH 262 Linear Algebra and Differential Equations (4 cr.) P: MATH 261. Fall, Spring. Vector spaces, bases, orthogonality, determinants, differential equations, first order equations, applications, second order equations.

Upper-Division Courses

MATH 300 Logic and the Foundations of Algebra (3 cr.) P: MATH 163. Spring, even years. Logic and the principles of reasoning. Applications to the study of the integers, rational, real, and complex numbers, and polynomials. Bridges the gap between elementary and advanced courses. Recommended for prospective high school teachers.

MATH 351 Elementary Linear Algebra (3 cr.) P: MATH 261. Not open to students with credit in MATH 511. Fall, Spring. Systems of linear equations, matrices, vector spaces, linear transformations, determinants, inner product spaces, eigenvalues, applications.

MATH 361 Introduction to Ordinary Differential Equations (3 cr.) P: MATH 261. Fall, Spring. First order equations, the method of separation of variables, existence theorems, second order linear equations, initial and boundary value problems, power series solutions, systems of first order equations, stability for linear systems, Laplace transforms, applications.

MATH 362 Topics in Advanced Calculus (3 cr.) P: MATH 261 and 351. Multivariate calculus: partial differentiation, implicit function theorems and transformations, line and surface integrals, vector fields, theorems of Gauss, Green, Stokes. Infinite series of functions, uniform convergence.

MATH 375 Theory of Interest (3 cr.) P: MATH 261. Fall. An introduction to the theory of finance including such topics as compound interest, annuities certain, amortization schedules, sinking funds, bonds, and related securities.

MATH 385 (CSCI 385) Introduction to Logic (3 cr.) P: MATH 261. Propositional calculus and predicate calculus with applications to mathematical proofs, valid arguments, switching theory, and formal languages. Not open to students with credit in MATH 581.

MATH 414 (CSCI 414) Numerical Methods (3 cr.) P: MATH 262 or MATH 361, CSCI 220 or equivalent. Fall. 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. Not open to students with credit in CSCI 512.

MATH 426 Introduction to Applied Mathematics and Modelling (3 cr.) P: MATH 262 or 361. Fall. Introduction to problems and methods in applied mathematics and modelling. Formulation of models for phenomena in science and engineering, their solution, and physical interpretation of results. Examples chosen from solid and fluid mechanics, mechanical systems, diffusion phenomena, traffic flow, and biological processes.

MATH 441 Foundations of Analysis (3 cr.) P: MATH 261. Fall. Topology of Cartesian spaces, sequences, continuity, differentiation, Reimann-Stieltjes integral.

MATH 442 Multivariate Analysis (3 cr.) P: MATH 351 and 441. Euclidean spaces, differentiation, vector valued functions, measure and integration, exterior algebra, differential calculus, integration on manifolds.

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

MATH 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.

MATH S490 Senior Seminar (3 cr.)

Dual Level Courses

Undergraduate—Graduate

MATH 510 Vector Calculus (3 cr.) P: MATH 262. Calculus of functions of several variables and of vector fields in orthogonal coordinate systems. Optimization problems, implicit function theorem, Green's theorem, Stokes' theorem, divergence theorems, applications to engineering and the physical sciences.

MATH 511 Linear Analysis (3 cr.) P: MATH 261. Not open to students with credit in MATH 351. Matrices, rank and inverse of a matrix, linear programming, simplex method, eigenvectors, unitary and similarity transformations on matrices.

MATH 517 Discrete Modelling and Game Theory (3 cr.) P: MATH 262, MATH 351, or MATH 511 (or consent of instructor). Linear programming; mathematical modelling of problems in economics, management, urban administration, and the behavioral sciences.

MATH 519 Introduction to Probability (3 cr.) P: MATH 510. Algebra of sets, sample spaces, combinatorial problems, conditional probability, independence, random variables, distribution functions, characteristic functions, special distributions, limit theorems.

MATH 520 Boundary Value Problems of Differential Equations (3 cr.) P: MATH 262, or 361. Recommended P or C: MATH 510. Sturm-Liouville theory; singular boundary conditions, orthogonal expansions, separation of variables in partial differential equations; spherical harmonics.

MATH 522 Qualitative Theory of Differential Equations (3 cr.) P: MATH 262 or both 351, 361. Laplace transforms, systems of linear and nonlinear ordinary differential equations, brief introduction to stability theory, approximation methods, other topics.

MATH 523 Introduction to Partial Differential Equations (3 cr.) P: MATH 262 or 361. Recommended P or C: MATH 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 of hyperbolic and parabolic equations; Poisson integral method for elliptic equations.

MATH 525 Introduction to Complex Analysis (3 cr.) P: MATH 510. Complex numbers and complex-valued functions; differentiation of complex functions; power series, uniform convergence; integration,

contour integrals; elementary conformal mapping.

MATH 526 Principles of Mathematical Modelling (3 cr.) P: MATH 361 and MATH 510. Ordinary and partial differential equations of physical problems, simplification, dimensional analysis, scaling, regular and singular perturbation theory, variational formulation of physical problems, continuum mechanics, and fluid flow.

MATH 527 Techniques of Applied Mathematics I (3 cr.) P: MATH 262. MATH 527 and 528 constitute a two-semester sequence covering a broad range of topics including advanced calculus, linear algebra, complex variables, and differential equations, both ordinary and partial.

MATH 528 Techniques of Applied Mathematics II (3 cr.) P: MATH 527. Continuation of MATH 527.

MATH 529 Operational Calculus (3 cr.) P: MATH 525. Oriented towards solving problems in engineering. Generalized functions, two-sided operational calculus. Applications to initial value problems, steady-state solutions, partial differential equations.

MATH 530 Functions of a Complex Variable I (3 cr.) P: Must be preceded or accompanied by MATH 544. Complex numbers, holomorphic functions, harmonic functions, linear transformations. Power series, elementary functions, Riemann surfaces, contour integration, Cauchy's theorem, Taylor and Laurent series, residues. Maximum and argument principles. Special topics.

MATH 532 Elements of Stochastic Processes (3 cr.) P: MATH 519, 525. A basic course in stochastic processes including normal processes, covariance processes, Poisson processes, renewal processes, and Markov processes.

MATH 534 Advanced Analysis for Engineers and Scientists (3 cr.) P: MATH 510 or consent of instructor. Metric spaces, convergence and uniform convergence, Banach and Hilbert spaces.

MATH 535 Theoretical Mechanics (3 cr.) P: MATH 361 and PHYS 152. Kinematics and dynamics of systems of particles and of rigid bodies; Lagrange and Hamilton-Jacobi equations; oscillations about equilibrium; Hamiltonian systems; integral invariants; transformation theory.

MATH 536 Perturbation and Asymptotic Analysis (3 cr.) P: MATH 525 (or 530) and MATH 523. Matched asymptotic expansions, inner and outer expansions, strained

coordinates and multiple scales, turning point analysis.

MATH 544 Real Analysis and Measure Theory (3 cr.) P: MATH 441 or consent of instructor. Algebras of sets, real number system, Lebesgue measure, measurable functions, Lebesgue integration, differentiation, absolute continuity, Banach Spaces, Metric Spaces, general measure and integration theory, Riesz representation theorem.

MATH 545 Principles of Analysis II (3 cr.) P: MATH 544. Continues the study of measure theory begun in MATH 544.

MATH 546 Introduction to Functional Analysis (3 cr.) P: MATH 545. By arrangement. Banach spaces, Hahn-Banach theorem, uniform boundedness principle, closed graph theorem, open mapping theorem, weak topology, Hilbert spaces.

MATH 547 Analysis for Teachers I (3 cr.) P: MATH 261. Set theory, logic, relations, functions, Cauchy's inequality, metric spaces, neighborhoods, Cauchy sequence.

MATH 548 Analysis for Teachers II (3 cr.) P: MATH 547. Functions on a metric space, continuity, uniform continuity, derivative, chain rule, Riemann integral, fundamental theorem of calculus, double integrals.

MATH 550 Algebra for Teachers I (3 cr.) P: MATH 351. Definitions and elementary properties of groups, rings, integral domains, fields. Intended for secondary school teachers.

MATH 551 Algebra for Teachers II (3 cr.) P: MATH 550. Polynomial rings, fields, vector spaces, matrices.

MATH 553 Introduction to Abstract Algebra (3 cr.) P: MATH 453. Group theory: Sylow theorems, Jordan-Holder theorem, solvable groups. Ring theory: unique factorization in polynomial rings and principal ideal domains. Field theory: ruler and compass constructions, roots of unity, finite fields, Galois theory, solvability of equations by radicals.

MATH 554 Linear Algebra (3 cr.) P: MATH 351. Review of basics: vector spaces, dimension, linear maps, matrices determinants, linear equations. Bilinear forms; inner product spaces; spectral theory; eigenvalues. Modules over principal ideal domain; finitely generated abelian groups; Jordan and rational canonical forms for a linear transformation.

MATH 556 Introduction to the Theory of Numbers (3 cr.) P: MATH 261. Divisibility, congruences, quadratic residues, Diophantine equations, the sequence of primes.

MATH 561 Projective Geometry (3 cr.) P: MATH 261. Projective invariants, Desargues' theorem, cross-ratio, axiomatic foundation, duality, consistency, independence, coordinates, conics.

MATH 562 Introduction to Differential Geometry and Topology (3 cr.) P: MATH 351. Linear Algebra and Calculus, curves and surfaces in three dimensions, Frenet formulas, fundamental form, curvature. Applications are made to physical science and elementary geometry: classical vector analysis and differential equations of mathematical physics in the language of differential forms; minimal surfaces and soap films, models for non-Euclidean geometry.

MATH 563 Advanced Geometry (3 cr.) 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.

MATH 571 Elementary Topology (3 cr.) P: MATH 441. Topological spaces, metric spaces, continuity, compactness, connectedness, separation axioms, nets, function spaces.

MATH 581 Introduction to Logic for Teachers (3 cr.) P: MATH 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. Not open to students with credit in MATH 385.

MATH 583 History of Elementary Mathematics (3 cr.) P: MATH 261. 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.

MATH 585 (CSCI 585) Mathematical Logic I (3 cr.) P: MATH 351. Formal theories for propositional and predicate calculus with study of models, completeness, compactness. Formalization of elementary number theory; Turing machines, halting problem, and the undecidability of arithmetic.

MATH 587 General Set Theory (3 cr.) P: MATH 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.

MATH 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.

MATH T501 Remedial Mathematics for the Middle School—Junior High School Teacher (3 cr.) Set theory, systems of numeration, operations on whole numbers, mathematical sentences, integers, rational numbers, real numbers.

MATH T502 Geometry for Middle School—Junior High School Teachers (3 cr.) Rational numbers, real numbers, measurement, geometry.

MATH T503 Mathematics for Middle School—Junior High School Teachers (3 cr.) Additional topics not covered in MATH T501 or MATH T502.

Graduate Level

MATH 611 Methods of Applied Mathematics I (3 cr.) Introduction to Banach and Hilbert spaces, linear integral equations with Hilbert-Schmidt kernels, eigenfunction expansions, and Fourier transforms.

MATH 612 Methods of Applied Mathematics II (3 cr.) P: MATH 611. Continuation of theory of linear integral equations; Sturm-Liouville and Weyl theory for second order differential operators, distributions in n dimensions, and Fourier transforms.

MATH 626 Mathematical Formulation of Physical Problems I (3 cr.) P: Graduate standing and consent of instructor. Topics to be chosen from the following: Tensor formulation of the field equations in continuum mechanics, fluid dynamics, hydrodynamic stability, wave propagation, and theoretical mechanics.

MATH 627 Mathematical Formulation of Physical Problems II (3 cr.) P: MATH 626. Continuation of MATH 626.

Courses in Statistics

Undergraduate Level

Upper-Division Courses

STAT 301 Elementary Statistical Methods I (3 cr.) P: College algebra. Not open to students in the Department of Mathematical Sciences. Fall, Spring. 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. Multiple regression and analysis of variance, with emphasis on statistical inference and applications to various fields.

STAT 311 Introductory Probability (3 cr.) P: MATH 261 or equivalent. Fall, even years. 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.) Supervised reading and reports in various fields.

Dual Level

Undergraduate-Graduate

STAT 511 Statistical Methods I (3 cr.) P: MATH 164. Fall, Spring. Descriptive statistics; elementary probability; normal, binomial, Poisson, hypergeometric distributions; sampling distributions; testing hypotheses, and estimation; one-way analysis of variance; chi-square test; correlation and regression.

STAT 512 Applied Regression Analysis (3 cr.) P: STAT 511. Linear and multiple regression; nonlinear 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 Statistical Quality Control (3 cr.) P: STAT 511. Control charts and acceptance sampling, continuous sampling plans, sequential analysis, statistics of combinations, and some nonparametric 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: MATH 164 or equivalent. MATH 261 desirable. Fall, odd years. 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: MATH 519 or STAT 516. An introduction to the mathematical theory of statistical inference. Topics include sampling distributions, order statistics and their applications, point and interval estimation emphasizing the maximum likelihood method, the Neyman-Pearson Lemma, likelihood ratio tests, introduction to the normal linear Model.

STAT 519 Introduction to Probability See MATH 519.

STAT 528 Foundations and Methods of Statistics I (3 cr.) P: STAT 516 or MATH 519 or Equivalent. Topics include sampling distributions derived from normally distributed populations, asymptotic sampling distribution, the multivariate normal distributions and linear models, sufficient statistics, the Cramer-Rao inequality, the Rao-Blackwell Theorem, asymptotic properties of maximum likelihood estimates, hypothesis testing, asymptotic properties of likelihood ratio tests.

STAT 532 Elements of Stochastic Processes See MATH 532.



Department of Physics

Professors Kaplan, Meiere, Pearlstein (*Chairperson*), Rao, Vasavada

Associate Professors Kemple, Kleinhans, Novak, Paik, Seubert, Thatcher

Assistant Professor Wassall

Departmental Counselors Professors Meiere and Seubert

Physics is the study of matter and energy, from the smallest scale, as in the study of elementary particles, to the largest, as in the study of the formation and evolution of stars and galaxies. In this sense, physics is the science that underlies all of the other sciences. In principle, as well as in practice, physics is involved in virtually all scientific and technical endeavors (e.g. biophysics, geophysics, health physics, etc.)

Physicists tend to view themselves primarily as solvers of problems, especially problems that can be expressed in mathematical terms. Physics students are trained to solve complex problems by learning to analyze complex relations in mathematical terms, often with the help of today's fast computers. Because of this broadly based and flexible problem solving background, physics graduates find employment in a variety of fields, many of which are not directly associated with physics.

The Department of Physics offers a program leading to a Bachelor of Science degree. In addition, the department provides service courses in physics and astronomy. The department also offers graduate courses which lead to the Master of Science degree. Qualified students may be authorized to pursue the Ph.D. degree in physics at IUPUI in areas where a program equivalent to that at West Lafayette can be arranged. Please contact the Department of Physics at IUPUI for further information.

Members of the department conduct research in several disciplines of physics and participate in joint projects with a number of other research groups such as ICFAR or the IU School of Medicine. Student participation in these projects is welcomed and encouraged.

Guide to Service Courses

Each student should consult an adviser in the department in which a degree is sought to determine which service course is appropriate. A general guide to the schools and divisions served by these courses is:

100: Allied Health, Business, and Liberal Arts (a traditional survey course).

200: Education, SPEA, and Liberal Arts (a nontraditional course).

218-219: A noncalculus sequence for technology students.

P201-P202: A noncalculus sequence designed for preprofessional students.

152-251-342: Science and Engineering (for students requiring a calculus-based sequence).

Bachelor of Science

Areas I, II, III Minimum requirements for the School of Science are given in this bulletin (pages 11-12). The second semester English composition may be satisfied only with ENG W132, W231, W250, W290, W331, or W350. The Department of Physics has the following additional requirements:

Area IIIC Physical and Biological Sciences Courses must include Chemistry C105 and C106 with lab or their approved equivalent.

Area IIID Mathematical Sciences 24 hours. Courses must include MATH 163, MATH 164, MATH 261, and MATH 262 or equivalent, plus 6 more hours approved by the Department of Physics. (MATH 351 and MATH 361 replace MATH 262 for dual math-physics majors.) The computer requirement may be satisfied only with CSCI 206, CSCI 220 or any CSCI course for which CSCI 220 is a prerequisite.

Area IV Concentration A concentration program in physics must include Physics 152, 251, 310, 322, 330, 342, 342L, 350, 351, 515, 550, plus at least one approved course above the 300 level.

Courses taken outside the Schools of Science and Liberal Arts must receive departmental approval. No more than 6 hours of the clinical, athletic or performing arts type will be approved. See the departmental counselor for details.

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

For the secondary school teaching option the Department of Physics may substitute other Science courses for the 500-level courses and recommend education courses in order to meet teacher certification requirements.

Electives should be chosen to satisfy the general requirements for a Bachelor of Science degree from Purdue University. They also may be chosen to satisfy requirements for certification as a high school teacher.

Bachelor of Science in Physics

Freshman

1	MATH 163 (5) Calculus	CHEM C105 (5) Principles of Chemistry I	ENG W131 (3) English Composition	Elective (3)
2	MATH 164 (5) Calculus	CHEM C106 (5) Principles of Chemistry II	PHYS 152 (4) Mechanics	Second English Composition (3)

Sophomore

3	MATH 261 (4) Calculus	PHYS 251 (5) Heat, Elec- tricity, and Optics	Computers (3)	Elective (3)
4	MATH 262 (4) Linear Alge- bra and Diff. Equations	PHYS 342 (3) Modern Physics	PHYS 342L (1) Modern Physics Lab	COMM C110 (3) Speech Elective (3)

Junior

5	PHYS 310 (4) Intermediate Mechanics	PHYS 322 (3) Oscillations and Waves	PHYS 350 (2) Intermediate Lab I	Electives (6)
6	PHYS 330 (3) Electricity and Magnetism	PHYS 351 (2) Intermediate Lab II	Electives (12)	

Senior

7	PHYS 550 (3) Quantum Mechanics	PHYS 490 (1-3) Research	Electives
8	PHYS 515 (3) Thermodynamics	PHYS 490 (1-3) Research	Electives

Master of Science

The Department of Physics offers a graduate program which leads to the M.S. degree in physics. The program is designed to meet the needs of a student employed in the metropolitan Indianapolis area as well as the traditional student who is preparing for a career in research-directed areas. Both thesis and non-thesis options are available.

Admission Requirements

The student who seeks to enroll in the Physics graduate program should have a baccalaureate degree from an accredited institution with a background in the usual complement of undergraduate physics, mathematics, and other science courses. A B average in physics courses is expected. Students may be required to take additional undergraduate physics courses to account for any deficiencies. Application materials and information can be obtained from the Department of Physics, IUPUI.

Transfer Credit

The Department of Physics will accept credit for graduate courses taken from approved institutions provided those courses were not required for the undergraduate degree.

Degree Requirements

General requirements include admission to graduate status, completion of the University requirement in English, and completion of an approved plan of study. Specific requirements include successful completion of 30 credit hours of work in courses in the 500 and/or 600 level. This will include 6 hours of a minor subject, e.g. mathematics or chemistry, and 24 hours of physics. The physics courses may include up to 9 hours of research and independent study. Only grades of A, B, and C are acceptable, and the student is expected to maintain an overall B average. In addition, the student must pass a Qualifying Examination which covers upper level undergraduate material. Students who elect the thesis option will submit an approved thesis and pass an examination on that thesis. Students who elect the non-thesis option will obtain experience in physics research areas which could be directly related to their employment. Students who are engaged in full-time employment can take all courses in the evening and could finish the degree requirements in five semesters.

Financial Assistance

Tuition remission is available at the School level. In addition the department has both teaching and research assistantships.

Doctor of Philosophy

Qualified students may be authorized to pursue the Ph.D. degree in physics in areas where a program equivalent to that at Purdue University in West Lafayette can be arranged. Please contact the Department of Physics at IUPUI for further details.

Research Interests and Facilities

The research facilities and expertise of the department are excellent and are a valuable resource to the program, especially for students interested in biological physics. There are four magnetic resonance spectrometers in two locations under the direction of physics faculty.

In addition, there is a high quality absorption spectrophotometer equipped to examine cryogenic samples, as well as other instrumentation for biophysical research. Using these facilities, various research has been carried out in such areas as electron paramagnetic resonance, nuclear magnetic resonance, and the biophysics of photosynthesis. Some of this research has been conducted in close collaboration with several components of the IU Medical School, the Methodist Hospital of Indiana, and several departments of the School of Science.

Students may do their thesis work in any of the laboratories.

Students will also have access to the IUPUI computing facilities which include DEC20 and IBM4341 system as well as the mini- and micro-computers in the department.

Admission

A student who seeks to enroll in the Physics Graduate Program should have a B.S. degree in physics. Otherwise a student may be admitted to this program by special approval of the Graduate Committee.

The undergraduate record should include at least a B average in physics, one year of chemistry, and one year of mathematics beyond calculus and differential equations.

Financial Support

No financial support has been guaranteed. Tuition remission can be applied for at the campus level and student support funds exist in several grants to individual faculty members. Teaching assistantships will be available.

Curriculum

Requirements

1. Thirty (30) semester credit hours of graduate work. This will include 24 credits of physics or biophysics and 6 credits of mathematics. PHYS 520 Mathematical Physics may be used to satisfy either mathematics or physics requirements, but not both.

2. The plan of study will include laboratory experience. This can be either a laboratory-based research thesis or, with approval of the Graduate Committee, a laboratory course (nonthesis option).
3. The plan of study may include 6 credits of M.S. thesis work if a written thesis is approved by the student's major professor and the Graduate Committee.
4. All courses must be completed with a grade of B- or better except that one course with a C grade will be accepted.

Students who are engaged in full-time employment can take all the courses in the evening and finish the degree requirements in five semesters.

Full-time students may be able to finish all the required work in three semesters.

Courses in Physics

Note: P—prerequisite; C—concurrent registration; Equiv.—course is equivalent to the indicated course taught at Indiana University-Bloomington or the indicated course taught at Purdue University-West Lafayette.

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 nonmathematical introduction to physical concepts and methods by means of examples from daily life and current technological applications.

218 General Physics (4 cr.) P: MATH 150 or equivalent. Fall, Spring, Summer; day, night. Mechanics, conservation laws, gravitation; simple harmonic motion and waves; kinetic theory, heat and thermodynamics for students in technology fields.

219 General Physics (4 cr.) P: PHYS 218. Fall, Spring, Summer; day, night. Electricity, light and modern physics.

P201 General Physics I (5 cr.) P: Math 151 or equivalent. Fall, Spring, Summer. Newtonian mechanics, wave motion, heat and thermodynamics. Application of physical principles to related scientific disciplines, especially life sciences. Intended for students preparing for careers in the life sciences and the health professions. Three lectures, one discussion section, and one two-hour laboratory period each week.

P202 General Physics II (5 cr.) P: 201. Fall, Spring, Summer. Electricity and magnetism, geometrical and physical optics, introduction to concepts of relativity, quantum theory, atomic and nuclear physics. Three lectures, one discussion section, and one two-hour laboratory period each week.

152 Mechanics (4 cr.) P or C: MATH 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: MATH 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 hydro-mechanics 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: MATH 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. Fall. (The prerequisite is waived for students enrolled in the Science Education Degree Program.) 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. (The prerequisite is waived for students enrolled in the Science Education Degree Program.) 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.)

480 Solar Energy Usage (3 cr.) P: MATH 164 or equivalent and two terms of general physics. Theoretical and practical aspects including collector design, modeling of solar systems, economic evaluation of solar alternatives, and photo-voltaics.

490 Undergraduate Reading and Research (1-3 cr.) Independent study for undergraduates.

501 Physical Science (3 cr.) P: None. 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.

510 Physical Mechanics (3 cr.) P: PHYS 310 or equivalent, and courses in calculus and differential equations. Mechanics of particles, rigid bodies, and vibrating systems.

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.

520 Mathematical Physics (3 cr.) P: PHYS 310, 322, 330 or consent of instructor. Vectors and vector operators, tensors, infinite series, analytic functions and the calculus of residues, partial differential equations, special functions of mathematical physics. When interests and preparation of students permit, calculus of variations and/or group theory are covered.

530 Electricity and Magnetism (3 cr.) P: PHYS 330 or equivalent. Electrostatic problems; theory of dielectrics; theory of electric conduction; electromagnetic effects due to steady and changing currents; magnetic properties of matter; Maxwell's equations; electromagnetic radiation.

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 Selected Topics in Physics (3 cr.) Specialized topics in physics selected from time to time.

590 Reading and Research (1-3 cr.)

593 Advanced Physics Laboratory (3 cr.)

600 Methods of Theoretical Physics (3 cr.) P: graduate standing in Physics or consent of instructor. PHYS 600 is designed to provide first-year physics graduate students with the mathematical background for subsequent studies of advanced mechanics, electrodynamics, and quantum theory.

Topics treated include functions of a complex variable, ordinary and partial differential equations, eigenvalue problems and orthogonal functions. Green's functions, matrix theory, and tensor analysis in three and four dimensions.

698 Research M.S. Thesis (credit arranged)

Courses in Astronomy

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

A100 The Solar System (3 cr.) P: None. Fall. Survey of the solar system including the earth, sun, moon, eclipses, planets and their satellites, comets, laws of planetary motion, etc. Discussion of the origin of the solar system, life on earth, and the possibilities of extraterrestrial life. Also astronomical instruments and celestial coordinates.

A105 Stellar Astronomy (3 cr.) P: None. Spring. Survey of the universe beyond the solar system including stars, pulsars, black holes, principles of spectroscopy and the H-R diagram, nebula, the Milky Way, other galaxies, quasars, expanding universe, cosmology, and extraterrestrial life.



Department of Psychology

Professors Davis, Hanford, Morris, Tzeng

Professor Emeritus Neel

Associate Professors Aeschleman, Bond, Bringle, Evenbeck, Fleener, Fortier, Goldberg, Hazer (*Chairperson*), Kremer, Lauer, Rajecki, Rytting (Columbus Campus), Svanum, Ware

Assistant Professors Moehle, Rasmussen, Rice

Adjunct Professors Levitt, Mannan, McBride

Lecturer Loher

Psychology is the study of behavior and, as such, psychologists apply the scientific method to gain increasing understanding of human and animal behavior. Behavior is enormously diverse and psychologists seek answers to a range of questions that are as varied as how eyes perceive light, how children develop a sense of morality, or under what conditions people help in emergencies. As an applied profession, psychologists use the results of their research to solve personal and social problems.

Because the subject matter of psychology is broad, psychologists have become specialized. Specialization allows each psychologist to apply the general principles of science and behavior to some given area of interest. These include motivation and learning, child development, social behavior of humans and animals, personality, thought processes, consumer behavior, and many more. Psychologists who function as applied professionals have specialized in areas that include clinical, counseling, health care, rehabilitation and industrial psychology.

The IUPUI Department of Psychology provides a varied undergraduate curriculum that leads to either the Bachelor of Arts or the Bachelor of Science degree in psychology. Graduate programs include a Master of Science degree in three specialty areas of psychology (applied social, industrial/organizational, and rehabilitation) and a Doctor of Philosophy degree in rehabilitation psychology. In addition, qualified students may be authorized to pursue the Ph.D. degree in psychology in areas where a satisfactory program can be arranged. Please contact the Department of Psychology at IUPUI for further details. Besides this professional and preprofessional training, the department serves the needs of students in many other fields by providing introductory and advanced courses in psychology.

The choice of a particular program for majors should be made in consultation with one of the academic counselors. The department strongly recommends that undergraduate students include a practicum (B362, B372, B382, or B472) and independent research experience (B292 and B492) in their curricula.

Undergraduate Programs in Psychology

Bachelor of Arts Degree Requirements

The School of Science requirements for a Bachelor of Arts degree are listed in this bulletin.

The Department of Psychology will accept 20 credit hours toward graduation outside the Schools of Science and Liberal Arts.

Area I See School of Science requirements. The second semester of English composition may be satisfied with ENG W132, ENG W290, or ENG W231.

Area II There is no requirement for a foreign language.

Area III See School of Science requirements. The computer requirement may be satisfied with any computer science course (CSCI 207 recommended).

Area IV See description below, Requirements for Psychology Major.

Bachelor of Science Degree Requirements

The School of Science requirements for a Bachelor of Science degree are listed in this bulletin.

The Department of Psychology will accept 20 credit hours toward graduation outside the Schools of Science and Liberal Arts.

Area I See School of Science requirements. The second semester of English composition may be satisfied with ENG W132, ENG 290, or ENG W231.

Area II There is no requirement for a foreign language.

Area III See School of Science requirements. The computer requirement may be satisfied with any computer science course (CSCI 207 recommended).

Area IV See description below, Requirements for Psychology Major.

Area IV Requirements for Psychology Major (B.A. or B.S.) The Department of Psychology at IUPUI has a program for majors requiring 33 hours of selected courses. These same requirements apply to both B.A. and B.S. majors and are as follows:

Psychology Major (33 Hours)

Introductory Psychology	Research Methods	Core Areas
(2 courses totaling 6 hrs.)	(3 courses totaling 9 hrs.)	(6 of the following 9 courses totaling 18 hrs.)
B104	B211	
B105	B305	6 courses from:
	1 Psychology lab	B307 B356
	course from:	B310 B370
	B423 B457	B320 B380
	B425 B461	B334 B424
	B427 B471	B344
	B431 B499	
	B445	

Counseling Suggestions

The Department of Psychology offers counseling suggestions for students interested in completing course work that will help prepare them for graduate school or appropriate employment after graduation. These programs are known informally as the Graduate School Option, the Psychological Services Option, and the Personnel-Industrial Option. Each of these options is outlined below:

The Graduate School Option (36 hours) is designed to help students acquire an appropriate background, particularly in research areas, prior to applying to graduate programs. The Psychological Services Option (42 hours) is designed to help students acquire an appropriate background in order to improve chances of obtaining employment in public and private agencies dealing with human and social problems. The Personnel-Industrial Option (42 hours) is designed to help students acquire the appropriate background to improve chances of obtaining employment in a variety of business settings. However, it should be noted that the department cannot guarantee entrance to graduate school, or employment, and these options are not recognized officially on diplomas.

Successful completion of any of the three options will satisfy the Area IV Requirements for Psychology Majors. Beyond 6 hours of Introductory Psychology (B104 and B105), the following courses are recommended for each option:

Option	Research Methods	Core Areas	Other
Graduate School (36 hrs.)	B211 B305 Any lab	Any six courses from nine listed in Major Requirements.	B492 Readings and Research or B499 Honors Research.
Psychological Services (42 hrs.)	B211 B305 1 lab from: B425 B461 B471	B307 B310 B370 B380 B424 1 course from: B320 B334 B344 B356	2 practica from: B362, B382, B472 1 course from: B364, B376, B460 or relevant 500-level psychology courses.
Personnel-Industrial (42 hrs.)	B211 B305 1 lab from: B425 B445 B457 B471	B307 B344 B356 B370 B424 1 course from: B310 B320 B334 B380	B366 B368 B372

Psychology Plans of Study

There is no single semester-by-semester plan of study for any of the degrees offered by the Department of Psychology. However, one possible sequence of courses for the B.A. degree and one for the B.S. degree are given below.

Bachelor of Arts Sample Program

Freshman				
1 PSY B104 (3)	ENG W131 (3)	COMM C110 (3)	AREA IIIA (3)	Elective (3)
2 PSY B105 (3)	AREA IIIA (3)	AREA IIIB (3)	Second English Composition (3)	Computer Course (3)
Sophomore				
3 PSY B211 (3)	PSY CORE (3)	AREA IIIC (3-5)	AREA IIIA (3)	AREA IIIB (3)
4 PSY B305 (3)	PSY CORE (3)	AREA IIIC (3-5)	AREA IIIA (3)	AREA IIIB (3)
Junior				
5 PSY CORE (3)	PSY Elective (3)	PSY Elective (3)	AREA IIIC (3-5)	AREA IIIB (3)
6 PSY CORE (3)	PSY LAB (3)	AREA IIIC (3-5)	Electives (4-6)	
Senior				
7 PSY CORE (3)	PSY Elective (3)	Electives (11)		
8 PSY CORE (3)	Electives (12-14)			

Bachelor of Science Sample Program

Freshman					
1	PSY B104 (3)	ENG W131 (3)	COMM C110 (3)	AREA IIID (3-5)	Elective (1-3)
2	PSY B105 (3)	AREA IIIA (3)	AREA IIIB (3)	Computer Course (3)	Second English Composition (3)
Sophomore					
3	PSY B211 (3)	PSY CORE (3)	AREA IIIA (3)	AREA IIIB (3)	AREA IIIC (3-5)
4	PSY B305 (3)	PSY CORE (3)	AREA IIIC (3-5)	AREA IIID (3-5)	Elective (1-3)
Junior					
5	PSY CORE (3)	PSY Elective (3)	PSY Elective (3)	AREA IIIC (3-5)	Elective (1-3)
6	PSY CORE (3)	PSY LAB (3)	AREA IIIC (3-5)	Electives (4-6)	
Senior					
7	PSY CORE (3)	PSY Elective (3)	Electives (11)		
8	PSY CORE (3)	Electives (14)			

Undergraduate Honors Program in Psychology

Psychology majors admitted to the IUPUI Honors Program will be eligible to participate in all psychology honors courses and to graduate "With Honors in Psychology." Students who are not in the IUPUI Honors Program but who meet the minimum GPA criterion will be able to participate in honors courses but will not receive honors credit. For currently enrolled students (who have completed at least 12 credit hours), the GPA criterion for admission to the Honors Program is 3.30. For new students, the criteria for admission are SAT scores of 1200 or graduation in the top 10 percent of the high school class.

To graduate with honors, students must earn at least 24 hours of honors credit, 6 of which must be in psychology and 6 of which must be outside of psychology (the remaining 12 can be either). At least 3 hours of this credit must be from PSY B499 Honors Research, which should culminate in an honors thesis. Only grades of A or B will count for honors credit. To graduate with honors, the student must have an overall GPA of 3.30, with at least 3.50 in honors courses and at least 3.50 in psychology courses.

For additional information, contact the director of the IUPUI Honors Program or the psychology honors adviser.

Psi Chi Honorary Society To become a member of the Psi Chi Honorary Society the undergraduate student must have an overall GPA of 3.0, and a GPA of 3.5 in Psychology. The fee for membership is \$25 for life. Interested students should submit an application to the Psi Chi faculty adviser.

Graduate Programs in Psychology

The department offers master's (M.S.) and doctoral (Ph.D.) programs. At the M.S. level, programs are offered currently in Applied Social Psychology, Industrial/Organizational Psychology, and Rehabilitation Psychology. At the Ph.D. level, an emphasis is offered currently in Rehabilitation Psychology. Doctoral study is also possible in other areas of psychology on an individualized basis if a satisfactory plan of study is developed and approved.

Description of M.S. Programs

Graduate training at the M.S. level is designed to provide students with theory and practice that will enable them to apply psychological techniques and findings in a subsequent job setting. The M.S. degree may be completed on a full-or part-time basis and normally takes two or three years to finish. In most cases, a minimum of 36 credit hours is required including

departmental core, area core, and elective courses. Students are advised to complete a research thesis if they intend to continue doctoral studies or pursue other research career paths. If the M.S. is to be a terminal degree, students may elect a nonthesis option in most programs.

Applied Social Psychology The purpose of the program is to train students in the application of scientific principles and methods for the assessment of social problems, the development of remedial social programs, and the evaluation of existing programs which were designed to solve recurrent social problems. The subject matter of the program will focus on significant social issues and problems that affect individuals, organizations, and institutions in contemporary society. Training in research methods will emphasize investigations in natural settings, in conjunction with laboratory experimentation.

Industrial/Organizational Psychology The industrial/organizational emphasis is designed to provide students with the necessary knowledge and skills to work in personnel and other human resource areas. The course content of the program emphasizes the traditional personnel functions of selection, training, and performance evaluation. In addition, students become acquainted with other human resource functions such as supervision, job design, group processes for decision-making, and the analysis of work motivation and satisfaction as related to individual adjustment and organizational effectiveness. Through selection of elective courses and topics for supervised individual research, a student can specialize in either traditional personnel or other human resource functions. The program follows the applied research model, which means that students are taught analytic methods for diagnosing organizational problems, developing solutions, and evaluating the effectiveness of those solutions.

Rehabilitation Psychology Traditionally, training programs in rehabilitation counseling have focused on helping disabled people adjust to their immediate environment, community, or society through individual and/or group counseling. A major goal is to assist them in entering or reentering the work force. While retaining essential elements of the conventional approach, the M.S. concentration in rehabilitation provides training directed at the development of the student as an agent of social change. Toward that end, institutional structures and dynamics are examined to help students understand how these systems impinge upon and affect the lives of all people in general and minority groups in particular. At the master's level, the rehabilitation counselor is a key member of the rehabilitation team which may include a physician, psychologist, social worker, physical therapist, occupational therapist, special teacher, and/or other professional personnel. Typically, the counselor is responsible for the coordination and integration of services provided by these people. The counselor provides continuing services throughout the rehabilitation process with the goal of restoring disabled persons to the fullest possible physical, mental, social, vocational, and economic usefulness.

Description of Ph.D. Rehabilitation Program

Utilizing a scientist-practitioner model, this program is designed to train leaders in the field of rehabilitation psychology. Graduates of the program will be qualified to assume positions as executives, direct service providers, planners, academicians, trainers, evaluators, researchers, and consultants. The emphasis of the program is on rigorous academic training, combined with practical application in a wide variety of rehabilitation centers available in Indianapolis and elsewhere. Full-time study and a minimum of 96 course credits (post baccalaureate) are required, and the program is expected to take five years to complete. The program includes diverse training in psychology including a psychology core, statistics and measurement, rehabilitation psychology, internships and practica, and an empirical thesis and doctoral dissertation. Rehabilitation specialty courses covering a broad range of disabling conditions and intervention techniques are offered.

Qualified students may be authorized to pursue the Ph.D. degree in psychology in other areas where a satisfactory program can be arranged.

Financial Support

Financial support for eligible graduate students at both the M.S. and Ph.D. levels is available through teaching and research assistantships. All assistantships require a minimum of 20 hours work per week and include at least partial tuition remission in addition to salary.

Admission Requirements

Undergraduate training in psychology, mathematics, and the physical sciences is highly desirable, though not required. Applicants should have had at least one undergraduate course in statistics, as well as in tests and measurements. If those courses have not been completed, the student will be required to complete them as prerequisites for admission to the program.

For an applicant to be considered for unconditional admission to the terminal M.S. program, he or she must obtain: (a) a baccalaureate degree from a college or university of recognized standing; (b) a GPA of 3.0 or higher on a 4-point scale; (c) a minimum GRE score (verbal and quantitative) of 1100 with a quantitative score of at least 550; and (d) three favorable letters of recommendation. The student who does not meet the above standards but shows potential for graduate studies could be recommended for conditional admission. Usually, the department will specify a minimum standard of performance that must be satisfied by the student after conditional admission in order to continue.

The Ph.D. program seeks talented and motivated persons who have an interest in psychology and rehabilitation, and who have the potential to make creative contributions as professional rehabilitation psychologists. Admission to the Ph.D. program is competitive and only under unusual circumstances will students be considered for admission who fail to meet these minimum standards: (a) a master's degree in rehabilitation psychology or in a cognate area from a college or university of recognized standing; (b) an undergraduate and graduate grade-point average of 3.0 or higher on a 4-point scale; (c) a minimum composite GRE score (verbal and quantitative) of 1150; (d) three favorable letters of recommendation; and (e) a personal statement displaying an interest in the field of rehabilitation psychology. (Prior experience in rehabilitation is desirable but not required for admission.)

Prospective applicants who have not received a master's degree are encouraged to apply to the master's program in rehabilitation psychology at IUPUI and may later apply to the Ph.D. program.

Admissions Information

Students interested in information about admission to graduate programs in this department should write directly to the Graduate Secretary, Department of Psychology, Purdue University School of Science, 1125 E. 38th Street, P.O. Box 647, Indianapolis, IN 46223.

Research Facilities

The Department of Psychology has extensive laboratory and computer facilities to support faculty and student research. These facilities include more than 5000 square feet of renovated space including research cubicles and counseling offices. These facilities are computer controlled and equipped with closed circuit videotape recording capability. Animal facilities are also available. Computer support includes several microcomputers within the department, and terminal connections to an IBM 4341, two DEC 20's, and a CDC 855. Internship and practicum sites are available at such centers as Hook Rehabilitation Center of Community Hospital, Crossroads Rehabilitation Center, the Indiana University Medical Center, and other organizations in the metropolitan Indianapolis area.

Transfer Credit

A maximum of 9 credit hours can be transferred into the M.S. program, and a maximum of 36 credit hours can be transferred into the doctoral program. Transfer hours will be accepted only if they are appropriate and judged acceptable by a student's plan-of-study committee.

Temporary Student Status

A student may enroll in courses of the graduate program without formal admission after making application as a temporary graduate student. Not more than 9 hours of credit may be applied to an advanced degree program if an individual is later admitted as a regular graduate student. However, if an application to a regular degree program is approved during the session in which a person is enrolled for the ninth credit hour as a nondegree registrant, then all credits taken prior to and during that term will be eligible for inclusion on a plan of study for a degree program. For inclusion, the courses must be appropriate to the degree program and acceptable to the department and the Graduate School. No course in which a grade of less than B has been received will be permitted on a plan of study if the course was taken

while enrolled as a nondegree registrant. Nondegree registrants may be required to secure consent from each of the departments in which they would like to register for courses.

Research Interests of Faculty

Major research interests of faculty include the following: applied behavior analysis, applied experimental psychology, applied social psychology, biofeedback, cross-cultural investigations, industrial/organizational psychology, quantitative psychology, measurement theory and development, physiological psychology, program planning and evaluation, rehabilitation psychology, and vocational and prevocational training of disabled persons. A current and more detailed listing of faculty research interests is available from the department.

Undergraduate Courses

Note: P—prerequisite; C—concurrent registration; Fall—offered fall semester; Spring—offered spring semester; Summer—offered during the summer session. For courses with no designated semester, 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.

B104 Psychology as a Social Science (3 cr.) Equiv. to IU P102 and PU 120. Fall, Spring, Summer. 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. Fall, Spring, Summer. Research methods and content areas of learning, sensation-perception, psychophysiology, motivation, emotions, and statistics.

B125 Cognitive and Behavioral Self-Control (1 cr.) Students will be introduced to the basic principles of cognitive and behavioral self-control and will design and carry out a self-control program.

B211 Introductory Laboratory in Psychology (3 cr.) P: PSY B105. Equiv. to IU P111, P211 and PU 200. Fall, Spring. Introductory laboratory in psychology experimental methods, statistical treatment of data, in several areas of psychology; introduction to experimental report writing.

B292 Readings and Research in Psychology (1-3 cr.) P: Consent of instructor. Fall, Spring. Independent readings and research on psychology problems. For freshman and sophomore students only.

B305 Statistics (3 cr.) P: PSY B105 and one year of high school algebra or equivalent. Equiv. to IU P354, K300, K310 and PU 301. Fall, Spring, Summer. Introduction to basic statistical concepts; descriptive statistics and inferential statistics.

B307 Tests and Measurement (3 cr.) P: 3 hours of psychology and B305. Equiv. to IU

P336 and PU 302. Fall, Spring, Summer. An introduction to psychological measurement, including psychophysics, scaling techniques, psychological testing, and individual differences.

B310 Life Span Development (3 cr.) P: 3 hours of psychology. Fall, Spring, Summer. This course emphasizes the life span perspective of physical and motor, intellectual and cognitive, language, social and personality, and sexual development. Commonalities across the life span as well as differences among the various segments of the life span are examined. Theory, research, and practical applications are equally stressed.

B320 Physiological 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. Equiv. to IU P329 and PU 328. Spring. This course will consider vision, audition, taste, smell, touch, temperature sensitivity, and the vestibular and kinesthetic senses and their relation to behavior.

B326 Animal Behavior (3 cr.) P: PSY B105. An introduction to the psychological and ethological accounts of behavior development. Emphasis on the application of the comparative method to the study of behavior of organisms.

B334 Perception (3 cr.) P: PSY B105. Equiv. to IU P329 and PU 310. Fall. 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. Fall, Spring, Summer. History, theory, and research involving human and animal learning and cognitive processes.

B354 Adult Development and Aging (3 cr.) P: PSY 310 or consent of instructor. The course content examines changes which

occur with age in the following areas: intelligence, memory, personality, sexuality, health, living environments, economics, developmental disorders, and treatment for developmental disorders.

B356 Motivation (3 cr.) P: 3 hours of psychology. Equiv. to IU P327 and PU 333. Fall, Spring, Summer. Study of motivational processes in human and animal behavior, how needs and incentives influence behavior, and how motives change and develop.

B360 Child and Adolescent Psychology (3 cr.) P: PSY B310 or consent of instructor. Equiv. to IU P316 and PU 235. Fall, Spring, Summer. 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: PSY B360. Spring. Experience in working with children in field settings. May be repeated once.

B364 Introduction to Community Psychology (3 cr.) Begins with historical and conceptual underpinnings, community mental health practices, and alternative conceptions of deviance. Models of social intervention, including rational planning, organizational development, alternative institutions, community organizing, and experimental reform are discussed in the context of public education, mental health, criminal justice, and urban housing. Also included are community research, evaluation, and training issues for the helping professions.

B366 Introduction to Organizational Psychology in Business and Industry (3 cr.) The study of organizational psychology as applied to business and industry. Brief coverage of historical development of organizational theory through current theories. Theory weaknesses and strengths. Special problems for business and industry and the methodology for scientific research on these problems will be presented. Some areas or problems to be discussed are organizational structure and climate, leadership and management, communication, motivation, morale, and productivity.

B368 Introduction to Personnel Psychology in Business and Industry (3 cr.) Psychological methods of assessment in personnel selection and placement, evaluation, and training. Methods and problems of psychological measurement, occupational analysis, human factors engineering, job evaluation, and wages and salary administration.

B370 Social Psychology (3 cr.) P: 3 hours of psychology. Equiv. to IU P420 and PU 340. Fall, Spring, Summer. Study of the individual in social situations including socialization, social perception, social motivation, attitudes, social roles, and small group behavior.

B372 Practicum in Industrial Psychology (3 cr.) P: PSY B366, B368, or equivalent. This course will provide students with work experience, one day per week, in local organizations. Practice will be obtained in using the applied skills of industrial psychology to solve actual organizational problems.

B374 Group Dynamics, Theory and Research (3 cr.) P: PSY B370. An intensive survey of research and theory on the behavior of small groups and the research methods by which groups are studied.

B376 The Psychology of Women (3 cr.) P: 3 hours of psychology. Equiv. to IU P460. Fall, Spring. A survey of topics in psychology as related to the biological, social, and psychological development of women in modern society.

B380 Abnormal Psychology (3 cr.) P: 3 hours of psychology. Equiv. to IU P324 and PU 350. Fall, Spring, Summer. Various forms of mental disorders with emphasis on cause, development, treatment, prevention, and interpretation.

B382 Practicum in Community Psychology (3 cr.) P or C: PSY B364, B370 or B380 and consent of instructor. Spring. Experience in working with individuals who may have a wide range of psychological problems. Focus is upon both the individual and helping agency as factors in the community.

B388 Human Sexuality (3 cr.) P: One introductory course in psychology. Fall, Spring. A survey of human sexuality to increase knowledge and comfort regarding sexuality in a variety of aspects; i.e., sexual behavior and response, influences of culture and environmental factors, psychological issues, disability effects on sexuality, sexual research, anatomy and physiology.

B420 Humanistic Psychology (3 cr.) A comprehensive survey of the field of humanistic psychology. The course will explore human experience as a focal point in the study of psychology. The instructor will utilize didactic and experiential teaching methods.

B423 Laboratory in Physiological Psychology (3 cr.) P: PSY B320. Equiv. to IU P426, PU 427. Spring. 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. 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 and PSY B305. Equiv. to PU 424. Spring. Demonstrations and experiments in personality research.

B427 Advanced Laboratory in Physiological Psychology (3 cr.) P: B423. Spring. Experiments and demonstrations in physiological psychology.

B431 Laboratory in Sensation and Perception (3 cr.) P: PSY B211, B305, and either B324 or B334. 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.

B452 Seminar in Psychology (1-3 cr.) Topics in psychology and interdisciplinary applications. May be repeated, provided different topics are studied, for a maximum of 6 credits.

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.

B460 Behavior Management (3 cr.) P: Consent of instructor. Equiv. to IU P468. Spring. Conducted as a seminar and a practicum for psychology majors and teachers in the principles and methods of behavior management.

B461 Laboratory in Developmental Psychology (3 cr.) P: PSY B211, PSY B305, and PSY B310 or PSY B360. Equiv. to IU P429. Spring. Principal research methods in developmental psychology and their application to selected problems.

B464 Psychology of Language (3 cr.) P: 9 hours of psychology, or permission of instructor. Fall. 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 Developmental Psychology (3 cr.) P: PSY B310 or PSY B360. Integration of practical experience with relevant psychological literature.

B471 Laboratory in Social Psychology (3 cr.) P: PSY B211 and PSY B305 and P or C: PSY

B370. Equiv. to IU P421 and PU 346. 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, Summer. 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 PU 498. Fall, Spring, Summer. Independent readings and research on psychological problems.

B499 Honors Research (cr. arr.) P: Consent of departmental honors committee. Equiv. to IU P499 and PU 499. Fall, Spring, Summer. Independent readings and research resulting in a research paper.

Graduate Courses

(500-level courses also open to seniors.)

500 Statistical Methods Applied to Psychology, Education, and Sociology (3 cr.) P: PSY B105 and one year of high school algebra or equivalent. Descriptive statistics and 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.

518 Memory and Cognition (3 cr.) A survey of theories and research concerned with processes in the acquisition, storage, and retrieval of information, as well as selected additional topics in cognitive psychology.

I521 Introduction to Applied Behavior Analysis (3 cr.) P: Consent of instructor. The course is designed to provide an advanced introduction to the philosophy, principles, and procedures of applied behavior analysis and a review of selected research. Practical, ethical, and legal constraints on behavior interventions will be considered. Research conducted in institutional, educational, and home settings will be emphasized.

523 Introduction to Theories of Psychotherapy (3 cr.) A survey of the major approaches to psychotherapy, including their theories of illness and cure. Three traditions are represented: psychoanalytical (e.g., Freud, Adler, Jung), behavioral (e.g., Miller and Dollard, Wolpe, Stampfl) and cognitive-

phenomenological (e.g., Rogers, Kelley, Binswanger).

526 Psycholinguistics (3 cr.) P: Consent of instructor. An introduction to the descriptive devices, central issues, and varying methodologies of psycholinguistics.

535 Psychology of Death and Dying (3 cr.) An examination of psychological research and theory related to death and the dying process. Topics include death concepts, attitudes, and fears, psychosocial predictors of death, effects of death on survivors, psychosocial factors related to individual differences and normative dying behaviors, stages of dying, effects of pain and drugs, and managing the dying process.

540 History of Psychology (3 cr.) A review of the philosophical, theoretical, and methodological issues which entered into the development of modern psychology. Emphasis is placed on historical themes which continue to be active in the science and profession of psychology.

1549 Introduction to Vocational Rehabilitation (3 cr.) P: 9 hours of psychology. Philosophy, procedures, and practices underlying the vocational rehabilitation movement, including the historical, social, cultural, and economic factors and recent legislation that have contributed to its rapid development.

550 Introduction to Clinical Psychology (3 cr.) P: 12 hours of psychology. The case-study method, including a discussion of the importance of historical information, the contribution of clinical tests to diagnosis, and a general survey of prevention and treatment techniques.

1552 Psychological Counseling Theory and Practice in Rehabilitation (3 cr.) P: 9 hours of psychology. Theories of counseling and their applicability in the individual counselor and his or her prospective counseling situation. The use of various tools in counseling.

1553 Introduction to Community Resources for Vocational Rehabilitation (3 cr.) P: Consent of instructor. Survey of rehabilitation and rehabilitation-related agencies and services in Indiana and the issues involved in their utilization. Includes site visits.

1554 Psychosocial Aspects of Disability (3 cr.) P: 9 hours of psychology. An examination of the effect of the socio-emotional impact of traumatic injury or chronic illness on human functioning and its role in the rehabilitation process.

1555 Medical Aspects of Disability (3 cr.) P: 9 hours of psychology including PSY 1549.

Provides medical information for rehabilitation counselors and introduces students to medical terminology. Includes knowledge of the etiology, prognosis, methods of treatment, effects of disabling conditions, and implications for the rehabilitation counselor. Counselor relationships with other health-related personnel are emphasized.

557 Psychology of the Urban Environment (3 cr.) P: PSY 500 or equivalent. Introductory course on the effects of the urban environment on human behavior. Theories and empirical studies concerning environmental stresses in urban settings will be discussed with a major emphasis given to field studies. Implications of theory and research findings for urban planning will be specified.

565 Interpersonal Relations (3 cr.) P: 9 hours of psychology. Review of major current theoretical formulations of the interpersonal relationship, including a discussion of some of the more prominent research. Focus is primarily upon two-person interpersonal relations.

570 Industrial Psychology (3 cr.) Survey of the applications of psychological principles and of research methodology to the various human problems in the 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.

1578 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.

1580 Survey of Clinical Approaches with Children and Adolescents (3 cr.) P: Nine hours in Psychology. Introduction to the following as they relate to children and adolescents: (1) Psychopathological disorders and behavior problems, (2) theories of psychopathology and behavior problems, (3) evaluation techniques, and (4) therapeutic and behavioral change procedures. This is a lecture course.

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. 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.

593 Ethology (3 cr.) P: Consent of instructor. Animal behavior is analyzed in natural and experimental situations. Emphasis is on the observation of wild and domesticated animals. The effects of early experience, motivation, physiological mechanisms, adaptiveness, and the evolution of behavior are considered.

594 Special Topics in Ethology (3 cr.) P: PSY 593 or equivalent. Special topics such as imprinting, human ethology, territoriality, orientation, communication, ethology of mammals, etc., will be critically examined in the light of current research findings. One selected topic at a time will be covered in each semester when the course is offered.

1595 Seminar in Teaching Psychology (0 cr.) P: Consent of the Department of Psychology. A problem-solving approach to teaching psychology at IUPUI. Planning the course; anticipating problems; dealing with ongoing teaching problems. Current faculty members will present their innovative techniques. Participants will evaluate each other's classroom performance.

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.

605 Applied Multivariate Analysis (3 cr.) P: PSY 600. A survey of the most frequently employed multivariate research techniques, such as multivariate generalizations of univariate tests and analysis of variance, principal components, canonical analysis, and discriminant analysis. A central theme of the course is the general linear model, both univariate and multivariate. A multipurpose program for this model provides the student with practical experience in conducting multivariate research.

606 Special Topics in Quantitative Psychology (3 cr.) P: Consent of instructor. A seminar covering such topics as linear models, statistical decision making, multidimensional scaling.

607 Scaling and Measurement (3 cr.) An introduction to the theory of measurement and a survey of modern scaling methods (unidimensional and multidimensional, metric and nonmetric) within the framework of the modern theory of measurement.

608 Measurement Theory and the Interpretation of Data (3 cr.) P: PSY 600 and PSY 505 or equivalent. The theory of measurement and the development of reliability and the Spearman-Brown equations, true scores and variables, and correction for attenuation. Variance or covariance of combinations of variables. Item analysis and test construction strategies. Reliability and validity of measurements and the influence of measurement error and measurement threats to research design.

1610 Dynamic Modeling in Rehabilitation and Health Systems (3 cr.) P: Consent of instructor. An introduction to System Dynamics as a method of computer modeling of rehabilitation and health systems. Includes weekly modeling exercises, and a simulation experiment using an already existing model.

611 Factor Analysis (3 cr.) P: PSY 600. Theory and applications of factors analysis in psychological research.

612 Advanced Test Theory (3 cr.) P: PSY 608 or consent of instructor. Item Sampling and latent ability theories of test scores, together with related problems and possible solutions. Developments by Lord, Cronbach, Rasch, and Birnbaum will be covered.

1612 Deinstitutionalization and the Planning of Community-Based Rehabilitation Service Systems (3 cr.) P: Graduate standing. An overview of the successes and failures of the deinstitutionalization movement in developmental disabilities and psychiatric disability. Covers principles of

conceptualizing, planning, and implementing community-based residential, vocational, and social skills training programs.

615 Introduction to Psychobiology (3 cr.) A survey of the integrated neurosciences for nonconcentrators emphasizing human physiological psychology. Neural processes of sensory and motor function, arousal and sleep, motivation, learning and memory, language function, and personality disorders will be presented with selected coverage of neuroanatomy, neurophysiology, neuropharmacology, and neuroendocrinology. Both normal and pathological functions will be covered.

624 Human Learning and Memory (3 cr.) P: Consent of instructor. (Formerly numbered PSY 630.) Theory of and experimental findings in human learning and memory.

628 Perceptual Processes (3 cr.) P: PSY B334 or equivalent. General review of basic concepts and findings in the area of perception.

633 Seminar in Experimental Psychology (3 cr.) P: Consent of instructor. Critical analysis of current problems in experimental psychology. Emphasis upon reviewing literature, preparing, and presenting papers.

640 Survey of Social-Personality Psychology I (3 cr.) P: PSY B370 or equivalent. An extensive survey of methods, research, and theory in social-personality psychology.

641 Survey of Social-Personality Psychology II (3 cr.) P or C: PSY 600. An extensive survey of methods, research, and theory in social-personality psychology.

I642 Cross-Cultural Social Psychology (3 cr.) P: PSY 600, PSY 640. A survey of methodology and findings from cross-cultural analysis of social behavior. Findings are applied to the development of techniques for cross-cultural training.

I643 Field Methods and Experimentation (3 cr.) P: PSY 600. The course will cover methods appropriate for field experimentation and program evaluation. Topics will include quasi-experimental designs, sampling procedures, and issues associated with program evaluation.

646 Seminar in Social-Personality Psychology (3 cr.) P: Consent of instructor. A seminar covering a special topic in personality or social psychology. Specific topic varies from seminar to seminar.

I648 Practicum in Applied Social Psychology (3 cr.) P: Consent of instructor. Students will participate in applied research and/or program evaluation in a community agency. The field experience, combined with a

seminar, will provide on-site training and skill development under the supervision of the Department of Psychology and agency personnel.

I649 Internship in Applied Social Psychology (0 cr.) P: Consent of instructor. Open only to applied social psychology students in approved internship facilities. Provides opportunity for application of knowledge of program evaluation and/or social research under supervision of the agency and monitored by the Department of Psychology.

I650 Developmental Psychology (3 cr.) Major concepts, principles, and facts concerning the biological and environmental influences on behavioral and psychological development. Particular emphasis given to essential principles of ontogenetic development (life span) emerging from current research in genetics and psychology.

651 Development in Infancy and Childhood (3 cr.) P: Admission by consent of instructor. Critical review of physical-motor, cognitive, and social development with special emphasis on infancy and early childhood.

655 Cognitive Development (3 cr.) P: Consent of instructor. An analysis of research findings and current theories relevant to the development of cognitive processes. Emphasis is placed upon the changing characteristics of some fundamental cognitive processes. Special attention is given to verbal behavior and language.

657 Language Acquisition (3 cr.) An examination of research and theory dealing with language acquisition in children. A linguistic framework is used to describe developing language. Topics considered include speech perception, grammatical development, meaning, language in non-modal populations. Supervised laboratory experience.

659 Seminar in Developmental Psychology (3 cr.) P: Admission by consent of instructor. A critical review of selected concepts, problems, and methods of research in developmental psychology.

680 Seminar in Industrial-Personnel Psychology (3 cr.) P: 570, 572, and 601. Extensively surveys the various areas of industrial-personnel psychology (e.g., selection, placement, training, performance appraisal). Course provides a critical and up-to-date review of recent and classical research in these areas. (Previously PSY 681.)

681 Seminar in Research Methodologies of Industrial/Organizational Psychology (3 cr.) P: PSY 570, 572, 601 or consent of instructor. Intensive analysis of application of various

research and statistical methods to the study of human behavior in organizational settings. (Previously PSY 680).

682 Advanced Seminar in Industrial/Organizational Psychology (3 cr.) P: PSY 570, 572 or equivalent. Special topics in industrial and organizational psychology are offered on a rotating basis. Examples of the special topics are: work motivation, leadership, advanced selection and placement, and performance appraisal. One topic will be treated each semester.

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.

684 Practicum in Industrial/Organizational Psychology (3 cr.) P: PSY 570, 572, and consent of instructor. Practical experience in the development and implementation of field research in organizational settings. This course will give students the opportunity to spend eight hours per week within local business organizations in order to gain experience and skills in industrial/organizational psychology.

1688 Human Sexuality (3 cr.) P: Graduate standing or consent of instructor. The course covers the total field of knowledge concerning human sexual behavior, including

anatomy, physiology, endocrinology, development, norms, deviations, special problems and remediation, and attitudes.

1689 Practicum in Rehabilitation Psychology (3 cr.) P: PSY 1549 and consent of instructor. Supervised practice of rehabilitation psychology in a community agency or organization.

1690 Career Development, Selection, and Placement in Rehabilitation (3 cr.) P: 9 hours of psychology. A survey of current methods and criteria used in job development, selective placement, and follow-up of handicapped and deprived individuals.

1691 Seminar in Rehabilitation Psychology (3 cr.) P: Consent of instructor. Current trends, problems, and developments in rehabilitation. Students pursue a special interest and mutually share information and experience with the group. Individual report and group discussions.

1697 Internship in Rehabilitation Psychology (0 cr.) P: Permission of instructor. Opportunities for application of theory and practice of rehabilitation psychology and case management in a rehabilitation setting under supervision of the Department of Psychology and agency.

698 Research M.S. Thesis (3 cr.)

699 Research Ph.D. Dissertation (0 to 12 cr.)



Resident Faculty

Aeschleman, Stanley, *Associate Professor of Psychology* (1978); B.A., 1968, *Western Illinois University*; M.A., 1973, Ph.D., 1977, *University of Kentucky*. Specialties: Applied Behavioral Analysis, Learning in Developmentally Delayed Children.

Aliprantis, C.D., *Professor of Mathematics and Adjunct Professor of Economics* (1975); B.S., 1968, *University of Athens, Greece*; M.S., 1971; Ph.D., 1973, *California Institute of Technology*. Specialties: Functional Analysis, Operator Theory, Mathematical Economics.

Alton, Elaine V., *Professor of Mathematics* (1964); A.B., 1946, *State University of New York at Albany*; M.Ed., 1951, *St. Lawrence University*; M.A., 1958, *University of Michigan*; Ph.D., 1965, *Michigan State University*. Specialty: Mathematics Education.

Amini, Hassan, *Assistant Professor of Geology* (1985); B.S., 1974, *University of Tabriz, Iran*; M.S., 1978, Ph.D., 1983, *University of Colorado, Boulder*. Specialties: Volcanology, Petrology, Geochronology, Paleomagnetism.

Banaszak, Konrad J., *Adjunct Professor of Geology*; B.S., 1966, *Beloit College*; M.S., 1969, *Northwestern University*; Ph.D., 1975, *Northwestern University*. Specialties: Low Temperature Geochemistry, Environmental Hydrology, Economic Geology.

Bard, Martin, *Associate Professor of Biology* (1975); B.S., 1965, *City College of New York*; Ph.D., 1971, *University of California, Berkeley*. Specialty: Biochemical Genetics.

Bayer, Shirley A., *Professor of Biology* (1982); B.A., 1963, *St. Mary-of-the-Woods*; M.A., 1969, *California State University, Fullerton*; Ph.D., 1974, *Purdue University*. Specialty: Neurobiology.

Bittinger, Marvin, *Professor of Mathematics* (1968); B.S., 1963, *Manchester College*; M.S., 1965, *Ohio State University*; Ph.D., 1968, *Purdue University*. Specialty: Mathematics Education.

Boaz, Patricia A., *Associate Dean of the Faculties, Dean for Student Affairs, and Associate Professor of Chemistry* (1967); B.S., 1944, *Vassar*; Ph.D., 1951, *State University of Iowa*. Specialties: General Chemistry, Physical Chemistry, and Geochemistry.

Bond, Gary R., *Associate Professor of Psychology* (1983); B.S., 1966, *Michigan State University*; M.A., 1972, Ph.D., 1975, *University of Chicago*. Specialties: Psychiatric Rehabilitation, Program Evaluation.

Boschmann, Erwin, *Professor of Chemistry* (1968); B.A., 1963, *Bethel College (Kansas)*; M.S., 1965, Ph.D., 1968, *University of Colorado*. Specialties: General Chemistry, Inorganic Chemistry, and Bioinorganic Chemistry.

Boyd, Donald, *Adjunct Professor of Chemistry* (1986); B.S., 1963, *Pennsylvania State University*; Ph.D., 1968, *Harvard University*. Specialty: Organic Chemistry.

Bringle, Robert Gordon, *Associate Professor of Psychology* (1974); B.A., 1969, *Hanover College*; M.S., 1972, Ph.D., 1974, *University of Massachusetts*. Specialties: Social Psychology, Program Evaluation, Methodology.

Burkinshaw, Owen, *Professor of Mathematics* (1972); B.S., 1966, M.S., 1968, *Ohio University-Athens*; Ph.D., 1972, *Purdue University*. Specialty: Functional Analysis.

Butler, Larry D., *Adjunct Assistant Professor of Biology* (1983); B.S., 1973, *Yale University*; M.S., 1975; Ph.D., 1979, *Cleveland State University*. Specialty: Immunology.

Chernoff, Ellen A.G., *Assistant Professor of Biology* (1986); B.A., 1973, *University of Chicago*; Ph.D., 1978, *University of Chicago*. Specialty: Developmental Biology.

Crown, J. Conrad, *Professor of Mathematics* (1969); B.S., 1943, *Polytechnic Institute of Brooklyn*; M.S., 1962, Ph.D., 1965, *University of Connecticut*. Specialties: Numerical Analysis, Operations Research, Discrete Mathematics.

Cutshall, Theodore W., *Associate Professor of Chemistry* (1961); B.S.Ch.E., 1949, *Purdue University*; M.S., 1959, Ph.D., 1964, *Northwestern University*. Specialty: Organic Chemistry.

Davis, Robert, *Professor of Psychology* (1976); B.S., 1958, *Salisbury State College*; M.Ed., 1962, *Pennsylvania State University*; Ed.D., 1968, *University of Maryland*. Specialties: Rehabilitation Psychology, Counseling.

de Caprariis, Pascal, *Associate Professor of Geology* (1978); B.S., 1964, M.S., 1967, *Boston College*; Ph.D., 1973, *Rensselaer Polytechnic Institute*. Specialties: Geophysics, Quantitative Hydrology.

deKorvin, Andre, *Professor of Computer and Information Science* (1983); B.A., 1972, *University of Paris, France and University of California, L.A.*; M.A., 1963, *University of California, L.A.*; Ph.D., 1967, *University of California, L.A.* Specialties: Decision Making, Stochastic Processes, Information Science.

Dubin, Paul, *Associate Professor of Chemistry* (1981); B.S., 1962, C.U.N.Y.; Ph.D., 1970, *Rutgers University*. Specialties: Analytical Chemistry, Polymer Chemistry.

Evenbeck, Scott, *Associate Dean of the Indiana University School of Continuing Studies, Director of the IU/PUI Division of Continuing Studies, and Associate Professor of Psychology* (1972); A.B., 1968, *Indiana University*; M.A., 1971, Ph.D., 1972, *University of North Carolina*. Specialties:

Social Psychology, Program Evaluation, Methodology.

Fife, Wilmer K., *Professor of Chemistry* (1971); B.S., 1955, *Case Institute of Technology*; Ph.D., 1960, *Ohio State University*. Specialties: General Chemistry, Organic Chemistry, and Biochemistry.

Fleener, Don E., *Associate Professor of Psychology* (1966); B.S. (Ed), 1949, *Indiana Central University*; Ph.D., 1967, *Indiana University*. Specialties: Behavioral Medicine, Clinical Psychology, Developmental Psychology.

Fortier, Robert H., *Associate Professor of Psychology* (1966); B.S., 1947, Ph.D., 1952, *Western Reserve University*. Specialties: Child Psychology, Personality.

Frankel, Michael L., *Assistant Professor of Mathematics* (1984); M.S., 1971, Ph.D., 1984, *University of Tel-Aviv*. Specialties: Applied Mathematics.

Fricke, Gordon H., *Associate Professor of Chemistry* (1972); B.A., 1964, *Goshen College*; M.S., 1966, *State University of New York at Binghamton, N.Y.*; Ph.D., 1970, *Clarkson College of Technology*. Specialties: General Chemistry and Analytical Chemistry.

Froehke, Kristin, *Adjunct Professor of Computer and Information Science* (1981); B.A., 1968, *Marion College*; M.S., 1970, *Purdue University*. Specialty: Computer Science.

Gersting, John M., Jr., *Professor of Computer and Information Science* (1970); B.S., 1962, *Purdue University*; M.S., 1964, Ph.D., 1970, *Arizona State University*. Specialties: Database Systems and Computational Methods.

Gersting, Judith L., *Professor of Computer and Information Science* (1970); B.S., 1962, *Stetson University*; M.A., 1964, Ph.D., 1969, *Arizona State University*. Specialties: Logic and Fault-tolerant Computing.

Goldberg, Carlos L., *Associate Professor of Psychology*, (1969); B.A., 1961, *Brooklyn College*; M.A., 1964, Ph.D., 1969, *The City University of New York*. Specialties: Social Psychology, Urban Psychology.

Hall, Robert D., *Associate Professor of Geology* (1974); B.S., 1963, *Purdue University*; M.S., 1966, *University of Colorado*; Ph.D., 1973, *Indiana University*. Specialties:

Geomorphology, Environmental Geology, Hydrology, Physical Geology.

Hanford, Peter Vance, *Professor of Psychology, School of Science and Adjunct Professor of Psychology, School of Medicine* (1960); B.S., 1952, M.S., 1953, Ph.D., 1958, *Pennsylvania State University*. Specialties: Experimental Analysis of Behavior, Motivation.

Hazer, John T., *Chairperson and Associate Professor of Psychology* (1975); B.A., 1970,

Miami University; M.A., 1974, Ph.D., 1976, *Bowling Green State University*. Specialties: Industrial and Organizational Psychology, Human Resource Management.

Hutton, Lucreda, *Associate Professor of Mathematics* (1975); B.S., 1967, *Butler University*; M.S., 1972, *Purdue University*; Ed.D., 1975, *Indiana University*. Specialty: Mathematics Education.

Inglis, Thomas D., *Adjunct Associate Professor of Biology* (1983); B.S., 1974, *University of Illinois, Urbana*; Ph.D., 1978, *University of California, Berkeley*. Specialty: Biochemistry.

Jackson, Billy G., *Adjunct Associate Professor of Chemistry* (1971); B.S., 1953, Ph.D., 1957, *Iowa State University*. Specialty: Organic Chemistry.

Jarrett, Harry W., III, *Assistant Professor of Biology* (1982); B.S., 1972, *University of South Carolina*; Ph.D., 1976, *University of North Carolina*. Specialty: Biochemistry.

Juillierat, Florence, *Associate Professor of Biology* (1966); B.S., 1962, M.S., 1967, Ph.D., 1974, *Purdue University*. Specialties: Cell Biology, Biology for Teachers, Biology for Nonmajors.

Kaminker, Jerome Alvin, *Professor of Mathematics* (1973); B.A., 1963, *University of California, Berkeley*; M.A., 1965; Ph.D., 1968, *University of California at Los Angeles*. Specialties: Operator Algebras, K-Theory.

Kaplan, Jerome I., *Professor of Physics* (1974); B.S., 1950, *University of Michigan (Ann Arbor)*; Ph.D., 1954, *University of California, Berkeley*. Specialties: Condensed Matter, Solar Energy, Biological Physics.

Keck, Robert William, *Associate Dean for Administrative Affairs, and Associate Professor of Biology* (1972); B.A., 1962, M.S., 1964, *University of Iowa*; Ph.D., 1968, *Ohio State University*. Specialty: Plant Physiology.

Kemple, Marvin D., *Associate Professor of Physics* (1977); B.S., 1964, *Purdue University*; M.S., 1965; Ph.D., 1971, *University of Illinois Champaign-Urbana*. Specialties: Chemical Physics, Biological Physics.

Kirk, Ronald, *Assistant Professor of Biology* (1968); A.S., 1955, *Vincennes University*; B.S., 1958, M.S., 1959, Ph.D., 1966, *Purdue University*. Specialties: Invertebrate Zoology, Entomology, Ecology.

Kleinhans, Frederick W., *Associate Professor of Physics and Adjunct Associate Professor of Biophysics, School of Medicine* (1972); B.S., 1965, *University of Michigan*; Ph.D., 1971, *Ohio State University*. Specialties: Biological Physics, Computational Physics.

Kleyle, Robert M., *Professor of Mathematics* (1973); B.A., 1960, *Duquesne University, Pittsburgh*; M.S., 1962, *University of Pittsburgh*;

Ph.D., 1968, *Harvard University*. Specialty: Statistics.

Kremer, John F., *Associate Professor of Psychology, School of Science and Adjunct Assistant Professor of Psychology, School of Medicine* (1975); B.A., 1966, *St. Meinrad College*; M.S., 1969, *University of Notre Dame*; Ph.D., 1975, *Loyola University*. Specialties: Clinical Psychology, Aging, Program Evaluation.

Kuczkowski, Joseph E., *Assistant Dean for Academic Affairs, and Professor of Mathematics* (1966); B.S., 1961, *Canisius College*; M.S., 1963, Ph.D., 1968, *Purdue University*. Specialties: Semigroup Theory, Mathematics Education.

Larter, Raima M., *Assistant Professor of Chemistry* (1981); B.S., 1976, *Montana State University*; Ph.D., 1980, *Indiana University Bloomington*. Specialty: Theoretical Physical Chemistry.

Lauer, Joan B., *Associate Professor of Psychology* (1973); A.B., 1964, Ph.D., 1973, *Indiana University*. Specialties: Physiological Psychology, Learning.

Lees, Norman Douglas, *Associate Professor of Biology* (1973); A.B., 1967, *Providence College*; Ph.D., 1973, *Northwestern University*. Specialties: Microbiology, Molecular Biology.

Levitt, Eugene, *Professor of Clinical Psychology and Director of the Section of Clinical Psychology, Department of Psychiatry, School of Medicine, and Adjunct Professor of Psychology* (1976); B.A., 1948, *City University of New York*; M.A., 1950, Ph.D., 1952, *Columbia University*. Specialty: Clinical Psychology.

Lipkowitz, Kenneth B., *Associate Professor of Chemistry* (1976); B.S., 1972, *State University of New York at Geneseo*; Ph.D., 1975, *Montana State University*. Specialties: Theoretical and Synthetic Organic Chemistry.

Loh, Peter C., *Associate Professor of Mathematics* (1968); B.S., 1963, *Purdue University*; Ph.D., 1968, *Stanford University*. Specialty: Differential Equations.

Loher, Brian T., *Lecturer in Psychology* (1986); B.S., 1980, *Indiana University*; M.A., 1984, *Michigan State University*. Specialty: Industrial/Organizational Psychology.

Luke, Jon, *Associate Professor of Mathematics* (1975); B.S., 1962, M.S., 1963, *Massachusetts Institute of Technology*; Ph.D., 1966, *California Institute of Technology*. Specialty: Applied Mathematics.

Malik, David J., *Associate Professor of Chemistry* (1980); B.S., 1968; M.S., 1969, *California State University*; Ph.D., 1976, *University of California at San Diego*. Specialties: Theoretical Physical Chemistry, Chemical Physics.

Mannan, Golam, *Associate Professor of Education, and Adjunct Associate Professor of Psychology* (1978); B.Sc., 1954, *Carmichael College, Rangpur, Bangladesh*; M.A., 1959, B.Ed., 1961, M.Sc., 1963, *Rajshahi University, Bangladesh*; M.S., 1966, Ph.D., 1967, *Indiana University*. Specialty: Educational Psychology.

McBride, Angela B., *Adjunct Professor of Psychology* (1980); B.S.N., 1962, *Georgetown University*; M.S.N., 1964, *Yale University*; Ph.D., 1978, *Purdue University*. Specialties: Developmental Psychology, Psychiatric Mental Health.

McCarthy, James, *Adjunct Associate Professor of Chemistry* (1978); A.A., 1963, *Phoenix College*; B.S., 1965, *Arizona State University*; Ph.D., 1969, *University of Utah*. Specialty: Organic Chemistry.

McCracken, Richard O., *Associate Professor of Biology* (1977); B.S., 1965, M.S.T., 1967, *University of Wisconsin-Whitewater*; Ph.D., 1972, *Iowa State University*. Specialties: Comparative Physiology, Cell Biology, Helminth Chemotherapy.

Meiere, Forrest T., *Professor of Physics* (1969); B.S., (Physics) and B.S. (Math), 1959, *Carnegie-Mellon University*; Ph.D., 1964, *Massachusetts Institute of Technology*. Specialties: High Energy Physics, Biological Physics.

Miller, John Grier, *Associate Professor of Mathematics* (1978, *Columbus*); S.B., 1963, S.M., 1964, *University of Chicago*; Ph.D., 1967, *Rice University*. Specialty: Geometric and Algebraic Topology.

Mirsky, Arthur, *Chairperson and Professor of Geology* (1967); B.A., 1950, *University of California at Los Angeles*; M.S., 1955, *University of Arizona*; Ph.D., 1960, *Ohio State University*. Specialties: Urban Geology, History of Applied Geology, Paleontology-Stratigraphy, Geowriting, Evolution of the Earth.

Moehle, Kurt A., *Assistant Professor of Psychology* (1984); B.A., 1977, M.A., 1980, *Southern Illinois University*; Ph.D., 1984, *Memphis State University*. Specialties: Clinical Psychology, Neuropsychology, Rehabilitation Psychology, and Behavioral Medicine/Health Psychology.

Morrel, Bernard B., *Associate Professor of Mathematics* (1977); B.A., 1962, M.A., 1966, Ph.D., 1968, *University of Virginia*. Specialties: Operator Theory, Functional Analysis.

Morris, Barnett B., *Professor of Psychology* (1965); B.A., 1948, *Brooklyn College*; M.A., 1951, *University of Nebraska*; Ph.D., 1959, *University of Oklahoma*. Specialties: Sensation, Perception, Statistics, Testing.

Muhoherac, Barry B., *Assistant Professor of Chemistry* (1985); B.S., 1972, *Louisiana State*

University; Ph.D., 1978, University of Virginia. Specialty: Biophysical Chemistry.

Neel, Robert G., Professor Emeritus of Psychology (1964); B.A., 1948, M.S., 1949, University of Denver; Ph.D., 1962, University of Michigan. Specialties: Personnel and Industrial Psychology.

Ng, Bart, Chairperson and Professor of Mathematics (1975); B.S., 1968, St. Joseph College; M.S., 1970, Ph.D., 1973, University of Chicago. Specialty: Applied Mathematics.

Novak, Gregor M., Associate Professor of Physics (1964); M.S., 1964, University of Chicago; Ph.D., 1975, Indiana University. Specialties: Mathematical Physics, ICAI on Microcomputers.

Nurok, David, Associate Professor of Chemistry (1978); B.Sc., 1959, Ph.D., 1966, University of Capetown. Specialties: Analytical Chemistry, Chromatography.

Ockerse, Ralph, Professor of Biology (1976); B.A., 1956, State Teachers College, Netherlands; B.S., 1962, Baldwin Wallace College; Ph.D., 1966, Yale University. Specialties: Plant Physiology, Cellular Biochemistry.

O'Donnell, Martin J., Professor of Chemistry (1975); B.S., 1968, University of Iowa; Ph.D., 1973, Yale University. Specialty: Organic Chemistry.

Olson, Andrew M., Associate Professor of Computer and Information Science (1984); B.S., 1959, University of Wyoming; M.S., 1961, University of Wisconsin; D.Sc., 1969, Washington University. Specialties: Applied Mathematics, Computer Science, Symbolic-numeric Algorithms.

Pachut, Joseph F., Jr., Associate Professor of Geology (1978); B.A., 1972, State University of New York, College at Oneonta; Ph.D., 1977, Michigan State University. Specialties: Invertebrate Paleontology, Paleogeology, Geobiology, Biometrics, Evolution of the Earth.

Paik, Han Won, Associate Professor of Physics (1962); B.S., 1956, M.S., 1958, Yonsei University, Seoul, Korea; M.S., 1962, Northwestern University; Ph.D., 1970, Indiana University. Specialty: High Energy Physics.

Park, Richard A., Jr., Adjunct Professor of Geology; B.S., 1961, Louisiana State University; M.S., 1965, Ph.D., 1966, University of Wisconsin. Specialties: Ecology, Multivariate Statistical Analysis, Modeling Ecosystems.

Patterson, Richard R., Associate Professor of Mathematics (1974); B.A., 1961, DePaul University; Ph.D., 1966, University of California, Berkeley. Specialty: Geometric Modeling.

Pearlstein, Robert M., Chairperson and Professor of Physics (1982); A.B., 1960, Harvard

University; Ph.D., 1966, University of Maryland. Specialties: Biological Physics, Statistical Mechanics.

Penna, Michael A., Associate Professor of Mathematics (1973); B.A., 1967, Union College, Schenectady, N.Y.; A.M., 1968, Ph.D., 1973, University of Illinois, Urbana. Specialty: Differential Geometry.

Petersen, Bruce H., Adjunct Professor of Biology (1978); B.S., 1962, Utah State University; M.S., 1967, Ph.D., 1969, Indiana University. Specialty: Immunology.

Pflanzer, Richard Gary, Associate Professor of Biology (1969); A.B., 1964, Ph.D., 1969, Indiana University. Specialty: Medical Physiology.

Rabideau, Peter W., Chairperson and Professor of Chemistry (1970); B.S., Loyola University, 1964; M.S., Case Institute of Technology, 1967; Ph.D., 1968, Case Western Reserve University. Specialty: Organic Chemistry.

Rajcecki, D. W., Associate Professor of Psychology (1980); B.A., 1968, Kent State University; Ph.D., 1972, University of Michigan. Specialties: Aggression, Attitudes and Public Opinion, Animal Behavior.

Rao, B.D. Nageswara, Professor of Physics (1978), B.S. (Honors), 1955, M.S., 1956, Andhra University, Waltair (A.P.), India; Ph.D., 1961, Aligarh Muslim University, Aligarh, (U.P.), India. Specialties: Nuclear Magnetic Resonance, Biological Physics.

Rasmussen, Jeffrey L., Assistant Professor of Psychology (1984); B.A., 1979, University of Wisconsin; M.S., 1981, Ph.D., 1983, Tulane University. Specialties: Quantitative Psychology and Computer Applications in Psychology.

Rice, James M., Assistant Professor of Psychology (1984); B.S., 1977, Wright State University; M.A., 1979, Drake University; Ph.D., 1983, Southern Illinois University. Specialties: Rehabilitation Psychology and Behavior Therapy.

Rigdon, Robert, Associate Professor of Mathematics (1975); A.B., 1965, Princeton; Ph.D., 1970, University of California, Berkeley. Specialty: Algebraic Topology.

Rosenberg, Gary D., Associate Professor of Geology (1979), B.S., 1966, University of Wisconsin; Ph.D., 1972, University of California at Los Angeles. Specialties: Biomineralization, Evolution, Paleobiochemistry, Historical Geology.

Rothman, Neal J., Professor of Mathematics (1982); B.S., 1951, University of Delaware; M.S., 1954, Tulane University; Ph.D., 1958, Louisiana State University. Specialties: Functional Analysis, Harmonic Analysis.

- Russo, Raymond J., *Associate Professor of Biology* (1976); B.S., 1966, *Southeast Missouri State University*; M.S., 1971, *Northeast Missouri State University*; Ph.D., 1977, *University of Notre Dame*. Specialties: Ecology, Population Dynamics of Medically Important Insects.
- Rytting, Marvin, *Associate Professor of Psychology* (1975) (IUPUI Columbus); B.S., 1971, *Brigham Young University*; M.S., 1973, Ph.D., 1975, *Purdue University*. Specialties: Personality, Social Psychology, Sociology of the Family.
- Schauf, Charles, *Chairperson and Professor of Biology*, (1986); S.B., 1965, *University of Chicago*; Ph.D., 1969, *University of Chicago and Pritzger School of Medicine*. Specialty: Neurophysiology.
- Scriven, Eric, *Adjunct Professor of Chemistry* (1983); B.S., 1965, *University of Salford, U.K.*; M.S., 1967, *University of Guelph, Canada*; Ph.D., 1969, *University of East Anglia, U.K.* Specialty: Organic Chemistry.
- Sen, Asok K., *Associate Professor of Mathematics* (1981); B.S., 1972, *Indian Institute of Technology (India)*; M.S., 1975, *University of Minnesota*; Ph.D., 1979, *Cornell University*. Specialty: Applied Mathematics.
- Seubert, James W., *Associate Professor of Physics* (1968); A.B., 1958, *Washington University*; M.S., 1964, Ph.D., 1968, *Indiana University*. Specialty: Nuclear Physics.
- Shields, James E., *Adjunct Professor of Chemistry* (1977); A.B., 1956, *DePauw University*; Ph.D., 1961, *University of California at Berkeley*. Specialty: Biochemistry.
- Stillwell, William H., *Associate Professor of Biology* (1978); B.S., 1967, *State University of New York, Albany*; M.S., 1973, Ph.D., 1974, *Pennsylvania State University*. Specialties: Biochemistry, Membranes, Origin of Life.
- Svanum, Soren, *Associate Professor of Psychology* (1976); A.B., 1971, *San Francisco State University*; M.A., 1973, Ph.D., 1976, *University of Montana*. Specialties: Clinical Psychology, Chemical Dependence, Health Care Psychology.
- Tam, Richard Yiu Hang, *Assistant Professor of Mathematics* (1986); B.S., 1980, *University of Alberta, Edmonton, Canada*; M.Sc., 1982, *Virginia Polytechnic Institute and State University, Virginia*; Ph.D., 1986, *Cornell University*. Specialty: Applied Mathematics.
- Thatcher, Frederick C., *Associate Professor of Physics* (1970); B.S., 1961, *University of Chicago*; M.S., 1964, *DePaul University*; Ph.D., 1969, *University of California, Riverside*. Specialties: Condensed Matter Physics, Applied Optics.
- Tzeng, Oliver C.S., *Professor of Psychology* (1976); B.Ed., 1966, *National Taiwan Normal University*; M.S., 1969, *University of Wisconsin-Stout*; Ph.D., 1972, *University of Illinois*. Specialties: Quantitative Psychology; Cross-cultural Social Psychology, Personality.
- Vasavada, K.V., *Professor of Physics* (1970); B.S., 1958, *University of Baroda, India*; M.S., 1960, *University of Delhi, India*; Ph.D., 1964, *University of Maryland*. Specialties: High Energy Physics, Biological Physics.
- Ware, Joseph Roger, *Associate Professor of Psychology* (1982); B.S., 1957, M.S., 1961, *University of Louisville*; Ph.D., 1972, *University of Kentucky*. Specialties: Humanistic Psychology, Group Dynamics, Psychological Type.
- Wassall, Stephen R., *Assistant Professor of Physics* (1984); B.Sc., *Hons 1st Class*, 1973, *Southampton University*; Ph.D., 1981, *Nottingham University*. Specialties: Nuclear Magnetic Resonance, Biological Physics.
- Wilson, Kathryn J., *Associate Professor of Biology* (1976); B.A., 1971, *University of Wisconsin, Madison*; M.S., 1976, Ph.D., 1976, *Indiana University*. Specialties: Plant Developmental Anatomy and Morphology, Electron Microscopy.
- Witzmann, Frank A., *Assistant Professor of Biology* (1985) (IUPUI Columbus); B.A., 1976, *The Defiance College*; M.S., 1978, *Ball State University*; Ph.D., 1981, *Marquette University*. Specialty: Muscle Physiology.
- Wyma, Richard J., *Associate Professor of Chemistry* (1969); A.B., 1958, *Hope College*; M.S., 1960, Ph.D., 1964, *University of Michigan*. Specialties: General Chemistry and Physical Chemistry.
- Xia, Jingbo, *Assistant Professor of Mathematics* (1985); Ph.D., 1983, *State University of New York at Stony Brook*. Specialties: Functional Analysis and Operator Theory.
- Yovits, Marshall C., *Dean of the School of Science and Professor of Computer and Information Science* (1980); B.S., 1944, M.S., 1948, *Union College*; M.S., 1950, Ph.D., 1951, *Yale University*. Specialty: Computer and Information Science.
- Zeldin, Martel, *Professor of Chemistry* (1981); B.S., 1959, *Queens College*; M.A., 1962, *City University of New York*; Ph.D., *Pennsylvania State University*. Specialties: Inorganic Chemistry, Organometallic Chemistry, Polymer Chemistry.

Degree Checklist for School of Science Bachelor of Arts Degree

The School of Science requirements are listed. For all areas see appropriate sections of the Bulletin for additional requirements or restrictions by schools or departments.

Area I English Composition and Communicative Skills Two courses in composition totaling 6 credits. One course in speech of 3 credits.

Composition _____ Speech _____

Area II Foreign Language No required courses by the school.

Area IIIA Arts and Humanities Four courses totaling at least 12 credits.¹

Area IIIB Social and Behavioral Sciences Four courses totaling at least 12 credits.¹

Area IIIC Physical and Biological Sciences At least four science courses totaling a minimum of 12 credits outside the major department. (At least one of the above must be a laboratory course.²)

Area IIID Mathematical Sciences One course in computer science.

Area IV Major Consult departmental listing for courses required in major as well as courses required in other areas by the department.

¹ There must be at least two courses in one discipline in either III A or III B.

² Courses not acceptable for III C include BIOL N100, N120, N200, all agriculture courses, and CHEM C100.

Degree Checklist for School of Science Bachelor of Science Degree

The School of Science requirements are listed. For all areas see appropriate sections of the Bulletin for additional requirements or restrictions by schools or departments.

Area I English Composition and Communicative Skills Two courses in composition totaling 6 credits. One course in speech of 3 credits.

Composition|_____ Speech|_____

Area II Foreign Language No required courses by the school.

Area IIIA Arts and Humanities Two courses totaling at least 6 credits.¹

Area IIIB Social and Behavioral Science Two courses totaling at least 6 credits.¹

Area IIIC Physical and Biological Sciences At least four science courses totaling a minimum of 12 credits outside the major department. (At least one of the above must be a laboratory course.²)

Area IIID Mathematical Sciences At least two courses beyond algebra and trigonometry, totaling a minimum of 6 credits. One course in computer science.

Area IV Major Consult departmental listing for courses required in major as well as courses required in other areas by the department.

¹There must be two courses in one discipline in either III A or III B.

²Courses not acceptable for III C include BIOL N100, N120, N200, all agriculture courses, and CHEM C100.

Index

A

Academic Probation, 16
Academic Regulations, 13
Academic Standing, 16
Admissions and Transfers, 7
Adult Nondegree Students, 8
Advanced Standing, 8
Area Requirements, for Baccalaureate Degrees, 10
Astronomy, 77
Audio-visual Facilities, 17
Auditing Classes, 15

B

Baccalaureate Degrees, General Requirements, 9
Bachelor of Arts, Requirements for, 10
Bachelor of Science, Requirements for, 11
Beginning Students, 7
Biology, 21

C

Candidates for Baccalaureate Degrees, 15
Career Information, 4
Checklists for Degrees, 97, 98
Chemistry, 33
Class Standing, 15
Computer and Information Science, 44
Computing Services, 17
Cooperative Education Program, 19
Costs and Fees, 5
Counseling Guidelines, 4
Credit by Examination Fee Structure, 6
Credit by Examination and Special Credit, 14

D

Dean's Honor List, 15
Degree Checklist, Bachelor of Arts, 97
Degree Checklist, Bachelor of Science, 98
Degree Programs, List of, 26
Departmental Programs, 21
 Biology, 21
 Chemistry, 33
 Computer and Information Science, 44
 Geology, 51
 Mathematical Sciences, 60
 Physics, 73
 Psychology, 79
Dismissal, 16
Distinction, Graduation with, 16
Double Degree, 15
Double Major, 15

E

Entrance Requirements, 7
Examination, Credit by, 14
Expenses and Financial Aid, 5

F

Faculty, Full-Time Resident, 92
Fees, 5
Financial Aid, 6
Foreign Students, Admission of, 9
Foreign Students, Information for, 5
FX Option, 14

G

General Requirements, Baccalaureate Degrees, 9
Geology, 51
Grade Change, Petition for, 15
Grades, 13
Grade-Point Average (GPA), 13
Graduate Degrees, Purdue University, 12
Graduate Students, Admission of, 9
Graduation Requirements, Baccalaureate Degrees, 9
Graduation Requirements, Master's Degrees, 12

H

Health Care, 6
History of IUPUI, 1
Honors, 2
Honor List, Dean's, 15
Honors, Graduation with, 16
Honors Program, 18
Housing, 4

I

Incompletes, 14
Insurance, 6
IUPUI Perspective (Origins), 1

J

Job Placement, 4

L

Libraries, 17

M

Major, Requirements for
 Biology, 21
 Chemistry, 33
 Computer and Information Science, 44
 Geology, 51
 Mathematical Sciences, 60
 Physics, 73
 Psychology, 79
Master's Degree, Information on, 12
Mathematical Sciences, 60

N

Non-degree Students, 8

O

Officer Training Programs, 19
Origins of IUPUI (Perspectives), 1

P

Pass/Fail Option, 13
Physics, 73
Placement, 4
Pre-College Age Program, 8
Predental Program, 18
Premedical Program, 18
Preoptometry Program, 28
Prepharmacy Program, 27
Preveterinary Program, 28
Probation, 16
Program Planning, 4
Psychology, 79

R

Readmission, 16
Refund Policy, 5
Rehabilitation, Program in, 83
Repeated Courses, 14
Residency Requirements, 8
Resident Faculty, 92
ROTC, 19

S

Scholastic Aptitude Test (SAT), 7
Scholastic Probation, 16
Science Scholars, 15
Second Bachelor's Degree, 16
Secondary Teacher's Certificate, 17
Special Programs, 17
Statistics, 60
Student Conduct, 4
Student Welfare and Responsibility, 3

T

Teacher's Certificate, 17
Transfer Credit, 8
Transfer Students, 8
Transient Students, 8

U

University Origins, 1

V

Veterans' Benefits, 6

W

Withdrawal, 13

IUPUI Offices

Joseph E. Kuczkowski
Assistant Dean for Academic Affairs
School of Science
Krannert Building 155
(317) 274-0625

Mary Ellen Alig
Administrative Assistant for Academic
Affairs
School of Science Recorder
Krannert Building 155
(317) 274-0625

Admissions Office
Cavanaugh Hall 129
(317) 274-4591

Burdellis Carter
Associate Dean
International Student Services
Union Building 574
620 Union Drive
Indianapolis, IN
46202-2697 USA
(317) 274-7294

Bursar's Office
Cavanaugh Hall 147
(317) 274-2451

Patricia A. Boaz
Dean for Student Affairs
Administration Building 108A
(317) 274-2546

Non-Academic Counseling Center
419 North Blackford St.
(317) 274-2548

Registrar's Office
Cavanaugh Hall 119
(317) 274-1501

Office of Career Counseling and Placement
Business/SPEA Building 2010
(317) 274-2554

Student Financial Aids
Cavanaugh Hall 103
(317) 274-4162

School of Science Bulletin Committee

Dean J. Kuczkowski, *Chairperson*
Professor T. Cutshall
Professor P. Loh
Professor A. Mirsky
Professor J. Lauer
Professor H. Paik
Professor D. Lees
Professor A. Olson