School of Science

Welcome to the School of Science at IU Indianapolis!

The School of Science at IU Indianapolis provides an environment where students are both challenged and nurtured by each other, faculty and staff on a campus with a multitude of resources to help students succeed.

The School of Science offers over 25 undergraduate, ten masters, and nine Ph.D. degree programs across seven departments. In addition to preparing students for science or technology-related careers and for advanced study in graduate school, an undergraduate program in one of the sciences is an excellent background for professional study in medicine (including veterinary medicine), dentistry, business administration, law, and areas of the social sciences where quantitative methods are important.

Students here reap the benefits of small classes, an interactive learning environment, and challenging material and lab work. As early as their freshman year, our undergraduates are able to participate in real research with renowned faculty. Our undergraduate students have co-authored research papers and presented at national conferences.

We're a community of learners and students thrive here. Students support each other through peer-led mentoring, providing a unique environment where students become leaders by teaching others. Student organizations and volunteer programs are just a couple of the ways for students to get involved outside of the classroom.

We're great scientists, but more importantly, we're innovative teachers. As a school and a university, we've developed teaching methods that engage and encourage students—and are used at universities throughout the United States. Simply put, we care about our students.

The School of Science and its seven departments are situated in the heart of Indianapolis, near five hospitals, the Indiana University schools of medicine, dentistry and nursing, and countless science and technology companies. Through internships and undergraduate research, our students have opportunities to collaborate across disciplines, across campus, and across the academic and business communities. Our graduates emerge as well-rounded scientists whose experiences have prepared them to solve the problems of the future.

The School of Science at IU Indianapolis is critical to the success of the life, health and technology industries in central Indiana—our graduates are the life blood of an economy that needs innovative thinkers, contributing team members and eager learners. Committed to having real impact in their work and community, our graduates emerge from the School of Science as well-rounded scientists whose experiences have prepared them to solve the problems of the future.

Overview

The School of Science offers undergraduate and graduate programs that prepare students for a variety of careers. As part of its instructional mission, the school also provides non-science majors with the scientific background to help them become more aware and better-informed consumers and citizens. Scientists advance the boundaries of our knowledge of the natural world through applied and basic research. Science benefits society by providing fundamental knowledge and technical advances in such areas as health, ecology, computer and software design, mathematical modeling, and chemistry. Science informs the social sciences with scientific understanding of psychology, applications of statistics, and an understanding of environmental issues. Science contributes to the arts and humanities by offering knowledge of the physical universe and the symmetry and wonder of nature. In addition to preparing students for science-related careers and for advanced study in graduate school, an undergraduate program in one of the sciences is an excellent background for professional study in medicine (including veterinary medicine), dentistry, business administration, law, and areas of the social sciences where quantitative methods are important. An education in the sciences also opens the door to employment in the high-tech industry in sales and management.

Over 140 faculty members, with ranks ranging from lecturer through full professor, are dedicated to helping students take steps toward reaching their educational, professional, and career goals. Our average student to faculty ratio is 15:1. We pride ourselves on our interdisciplinary approach, extensive undergraduate research opportunities, professional school placements, and service to our students. An education from the School of Science pays off: our students go on to top graduate programs, medical schools, and careers in academia, research, and the private sector.

Last Updated: March 2025

History

Indiana University (IU) established its first extension center at Indianapolis in 1916, although the first IU course was taught in Indianapolis in 1890. The Indianapolis campus of Purdue University (PU) grew out of World War II training programs sponsored by Purdue, and began its major operations in 1946. Indiana University established the Indianapolis regional campus in the mid-1960s. In 1968, the Trustees of Indiana University created Indiana University at Indianapolis, and less than a year later, in 1969, the Trustees of Indiana and Purdue universities merged their Indianapolis operations to form Indiana University–Purdue University at Indianapolis (IUPUI). Indiana University was selected to administer the campus. Purdue brought to the merger a growing complex of degree programs and Purdue's traditional strengths in the physical sciences, engineering, and technology.

A restructuring of undergraduate programs at IUPUI in the Fall of 1972 created three new schools: the School of Liberal Arts (humanities and the social sciences), the School of Engineering and Technology, and the School of Science (physical, behavioral, and life sciences).

After being housed for almost 22 years on the 38th Street campus, the School of Science made a historic move in two phases into two buildings on the main campus during 1991-1993.

The name of the campus was changed to Indiana University–Purdue University Indianapolis in 1992.

In late 2013, The Science and Engineering Laboratory Building (SELB), the first non-medical building to be built on campus in 20 years, was completed along the Science corridor on Blackford Street between New York and Michigan Streets. The $25 million project is the new home for biology, chemistry and psychology research and teaching labs.

Innovation Hall, located on the southeast corner of Michigan and Blackford streets, was completed in early 2021. The building was constructed to meet the evolving teaching and research needs for programs in the School of Science, the School of Engineering and Technology, and the School of Informatics and Computing. Innovation Hall was designed specifically to enhance innovative collaboration across the three schools. In addition, this building is home to the university's first Class 100 Clean Room, a specific type of space that provides high levels of cleanliness. This provides the opportunity for faculty and students to fabricate nanodevices.

After a period of unprecedented change, IU Indianapolis became official on July 1, 2024. The realignment began in 2022 when Indiana University and Purdue University issued a joint memorandum of understanding to separate Indiana University Purdue University Indianapolis (IUPUI) into two institutions. As one of two Purdue Schools on this campus, beginning Fall 2024, the School of Science became an Indiana University school.

As of Fall 2024, IU Indianapolis enrolled more than 20,000 students.

Mission, Core Values, and Vision

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Mission

The IU Indianapolis School of Science is dedicated to conducting fundamental and applied scientific research and providing the highest quality undergraduate education and graduate training. In both our research and teaching, we promote an understanding of basic science and interdisciplinary approaches for addressing scientific questions, an appreciation of academic values, and translation of scientific findings to our communities. We foster an environment where students can access faculty for personalized mentoring and instruction, and where they can be meaningfully engaged in research and scholarship. The School is committed to providing the State of Indiana and beyond with graduates who possess deep knowledge of modern science and who are fully equipped to make an impact in science, industry, schools, and communities.

Core Values

The School of Science will achieve its mission through outstanding teaching, innovative research, strong commitment to diversity among faculty and students, relentless pursuit of academic excellence, and dedication to IU Indianapolis' vision as an urban research university with national and global impact.

Vision

The IU Indianapolis School of Science is recognized in the state of Indiana, nationally and internationally as a major contributor of high quality fundamental and applied research. For undergraduate education and graduate training, the School is recognized in the state of Indiana and nationally as the destination of choice for students seeking the highest quality science education that provides students with basic science education and problem solving skills they need to succeed. The School offers an environment that is supportive to a diverse population of students, faculty, and staff.

Administration

Administrative Officers

- JOHN F. DiTUSA, Ph.D., Dean
- CHRISTINE J. PICARD, Ph.D., Associate Dean for Research and Graduate Education
- RAJEEV R. RAJE, Ph.D., Associate Dean for Planning, Finance, and Faculty Affairs
- JANE R. WILLIAMS, Ph.D., Associate Dean for Academic Affairs and Strategic Initiatives

Departmental Chairpersons

- TERI BELECKY-ADAMS, Ph.D., Department of Biology
- PARTHA BASU, Ph.D., Department of Chemistry and Chemical Biology
- KATHY J. LICHT, Ph.D., Department of Earth and Environmental Sciences
- JEFFREY X. WATT Ph.D., Department of Mathematical Sciences
- RICARDO S. DECCA, Ph.D., Department of Physics
- JANE R. WILLIAMS, Ph.D., Interim Chair, Department of Psychology

Program Directors

- TERI BELECKY-ADAMS, Ph.D., Biotechnology
- KATHY J. LICHT, Ph.D., Environmental Science
- GINA M. LONDINO-SMOLAR, Ed.D., Forensic and Investigative Sciences
- JANE R. WILLIAMS, Ph.D., Interdisciplinary Studies
- BETHANY S. NEAL-BELIVEAU, Ph.D., Neuroscience

Bulletin Designation and Program Planning

Bulletin Designation

All colleges and universities establish certain academic requirements that must be met before a degree is granted. These regulations concern such things as curricula and courses, majors and minors, and campus residence. Advisors, 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 on the conferring of degrees. If requirements have not been satisfied, degrees will be withheld pending satisfactory completion of these requirements. For this reason, students need to acquaint themselves with all regulations and to remain informed throughout their university career.

This bulletin lists the requirements and regulations in effect for students who are admitted to the School of Science in August 2025 (Fall semester). Students who enter after this date may be subject to different requirements; students who entered before August 2025 may elect to follow the graduation requirements that were in effect at the time of their admission to their degree program or the graduation requirements that became effective thereafter. However, the requirements chosen must be from only one bulletin. If a student has not completed a bachelor's degree program within eight years of admission, the student may be obliged by the major department to meet the requirements of a subsequent bulletin. Additionally, students in good standing who have not been enrolled at the university for two or more consecutive years must satisfy the requirements of the School of Science bulletin in effect upon their return.

Program Planning and Advising Guidelines

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

- Students should be thoroughly familiar with all academic requirements that must be met before a degree is granted.
- Students should seek appointments with academic advisors in their major areas before the dates established by the university calendar for registration. In such meetings students should, at a minimum objective, make certain that they review their degree requirements and that they have made an appropriate plan for the next semester.
- Each student should understand that the responsibility for determining an appropriate academic program and for meeting every degree requirement rests with the student; faculty or staff members acting in the capacity of advisors are obligated only to assist students in meeting this responsibility. Any student who needs clarification of any of the requirements for the degree program is urged to obtain this clarification from their academic advisor or from the School of Science, Science Building, Room LD 222, phone (317) 274-0625.

Degree, Minor and Certificate Programs

Degree Programs in the School of Science

The School of Science at Indiana University Indianapolis awards students degrees from Indiana University (IU). This list shows all the degrees awarded and the institution granting the degree.

Biology

- Bachelor of Arts
  - Biology
  - Biology Teaching Option
- Bachelor of Arts (Biology) / Master of Public Health (Public Health) dual degree program
- Bachelor of Science
- Bachelor of Science (Biology) / Master of Science (Bioinformatics) dual degree program
- Bachelor of Science (Biology) / Master of Public Health (Public Health) dual degree program
- Bachelor of Arts (Biology) / Master of Public Health (Public Health) dual degree program
- Master of Science
  - Non-Thesis Option
  - Thesis Option
  - Biology for Educators Concentration Option
- Master of Arts in Teaching Online Degree Program
- Doctor of Philosophy

Biotechnology

- Bachelor of Science

Chemistry

- Bachelor of Arts
  - Chemistry

    - Chemistry Teaching Option
- Bachelor of Science in Chemistry
    - Biological Chemistry Concentration
    - Chemistry Option
    - Medicinal Chemistry Concentration
- Master of Science
    - Non-Thesis Option
    - Thesis Option
- Doctor of Philosophy

Environmental Science

- Bachelor of Science
    - Earth and Water Resources Concentration
    - Environmental Management Concentration
    - Environmental Remote Sensing & Spatial Analysis Concentration

FIS Programs

- Bachelor of Science in Forensic and Investigative Sciences
    - Forensic Biology Concentration
    - Forensic Chemistry Concentration
- Master of Science
    - Non-Thesis Option
    - Thesis Option

Geology

- Bachelor of Arts
- Bachelor of Science
- Bachelor of Science (Geology) / Master of Science (Geology) dual degree program
- Master of Science
- Doctor of Philosophy in Applied Earth Sciences

Interdisciplinary Studies

- Bachelor of Science

Mathematical Sciences

- Bachelor of Science
    - Actuarial Science Concentration
    - Applied Math Option
    - Applied Statistics Concentration
    - Pure Math Option
    - Math Education
- Bachelor of Science
    - Actuarial Science 100% Online Collaborative
    - Applied Statistics 100% Online Collaborative
- Bachelor of Science (Mathematical Sciences) / Bachelor of Science (Physics) double major
- Master of Science
    - Pure/Applied Math Non-Thesis Option
    - Pure/Applied Math Thesis Option
    - Applied Statistics
    - Computational Data Science
    - Math Education Non-Thesis Option
    - Math Education Thesis Option
- Doctor of Philosophy (Mathematics)
    - Applied Math
    - Pure Math
    - Mathematical Statistics
- Doctor of Philosophy (Biostatistics)
    - Indiana University Ph.D. program, pursued at IU Indianapolis, in collaboration with the Richard M. Fairbanks School of Public Health. The degree is awarded through the Richard M. Fairbanks School of Public Health.

Neuroscience

- Bachelor of Science

Physics

- Bachelor of Science
    - Physics
    - Biophysics Option
    - Physics Teaching Option
- Bachelor of Science (Physics) / Bachelor of Science (Mathematical Sciences) double major - PU
- Master of Science
- Doctor of Philosophy

Psychology

- Bachelor of Arts
- Bachelor of Science
- Master of Science
    - Applied Social and Organizational Psychology
    - Industrial/Organizational (I/O) Psychology
    - Clinical Psychology
- Doctor of Philosophy in Addiction Neuroscience
- Doctor of Philosophy in Applied Social and Organizational Psychology
- Doctor of Philosophy in Clinical Psychology

Undergraduate Minors in the School of Science

- Astronomy
- Biology
- Chemistry
- Climate Resilience
- Environmental Science
- Forensic and Investigative Sciences
- Geochemistry
- Geology
- Health Psychology
- Mathematics
- Neuroscience
- Physics
- Psychology

Graduate (Doctoral) Minors in the School of Science

Biology

- Developmental Biology & Genetics
- Neurobiology
- Physiology
- Scientific Foundations

Chemistry

- Forensic Science

Earth and Environmental Sciences
- Applied Techniques & Data Analysis in Geoscience
- Climate Change
- Geospatial Technology
- Humans and the Environment
- Science Education

Mathematical Sciences
- Geometry and Topology
- Mathematical Analysis
- Mathematical Sciences
- Statistics

Physics
- Mathematical Physics
- Molecular Physics
- Quantum Science

Psychology
- Psychology of Teaching
- Statistics for Social & Behavioral Sciences
- Diversity Science and Health Equity

Contact Information

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Academic Policies & Procedures

- Academic Regulations
- Academic Standing

Academic Regulations

See the Office of the Registrar's website for general information about grades. The following policies apply to the School of Science.

Pass/Fail Option During the four years of their undergraduate program, all undergraduates in good standing (with an overall GPA of 2.00 or higher) may enroll in up to eight elective courses to be taken with a grade of P or F. 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 Pass/Fail option can be discussed with an academic advisor or with staff in the School of Science Dean's Office, LD 222.

The course selected for Pass/Fail grading 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 major. If the course is at the 300-level or higher, with a grade of P, the course may apply to the 32 credit hour School of Science residency requirement. After the form is submitted to the Office of the Registrar, a grade of P cannot be subsequently changed to a grade of A, B, C, or D.

For additional information, visit the Student Central website here.

Withdrawal for Undergraduate and Graduate Students

Students may officially withdraw from classes without penalty during the first half of a semester or session if they secure the approval of their advisor; a grade of W (Withdrawal) is recorded on the final grade report. Students may withdraw from classes during the second half of a semester or session only under extraordinary

circumstances. In such cases, the student must secure the approval of their advisor, the instructor of the course, and the dean of their school; the instructor may assign a grade of W or F. A written justification from a doctor, member of the clergy, advisor, etc., must be presented indicating that the student could not have withdrawn earlier. The grade so assigned is recorded on the final grade report. To maintain integrity as to how students are accountable in this area, the policy for School of Science students is considered to be the policy for all students served by the School, regardless of academic unit or school through which the student is enrolled.

Students who alter their schedules, whether by personal incentive or by departmental directive, must follow correct 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 they risk not receiving credit for work done in a course that has not been properly added.

This policy applies to students in both undergraduate and graduate programs.

Grade Replacement Policy for Undergraduate Students Only (this policy is not available to graduate students)

The Grade Replacement Policy is available only to undergraduate students pursuing their first bachelor's degree. It may be exercised for a maximum of 15 credit hours, no more than two times for a given course, with each replacement counting toward the 15 credit hour limit.

Grade replacements must be made in sequential order. The repeated course grade must be the same as or higher than the grade in the previous attempt in the course.

Replaced grades completed prior to the Fall 2021 semester will remain on the student's transcript with an X placed beside the grade to note that the grade was excluded. Replaced grades completed in the Fall 2021 semester or later will not be listed on the student's transcript but will be noted with an X.

Once a grade replacement has been processed, it cannot be reversed.

Grade replacement is available only for courses taken at any Indiana University campus.

A science major interested in the Grade Replacement Policy should speak with their academic advisor.

For more information about the policy, click here.

Fresh Start through Academic Renewal (Fresh Start) (this policy is not available to graduate students)

For students whose first attempt at an undergraduate degree from IU did not go well, Fresh Start may be the key to successfully returning to IU Indianapolis. The policy allows students to start over with a cumulative GPA of 0.00
Students who are eligible for Fresh Start:

- Undergraduate students
- Students pursuing their first bachelor's degree from IU
- Students who have not enrolled at any IU campus for 36 or more consecutive months (3 years)

Application for Fresh Start must be made by the last day of classes in the second (major) term of enrollment after returning from the 36+ month hiatus. Students apply through their school of enrollment by speaking with their academic advisor. The school completes the initial review. Applications that meet the eligibility criteria are forwarded to the Registrar's Office for review and approval.

For courses in which the student received a P, an S, or a grade of C or better, the credit hours will count toward the degree but won't be factored into the GPA. In courses where the student received a grade lower than a C, the credit hours will not be counted toward the degree and will not be factored into the GPA.

The Fine Print

The policy is available for courses taken on any IU campus.

The policy will apply to all terms of IU enrollment, regardless of the campus on which the courses were completed, for the purposes of determining the IU Indianapolis degree progress and completion.

Students receiving Fresh Start at IU Indianapolis who subsequently become degree-seeking students on another IU campus are subject to the policies in effect for the IU campus from which they receive their degree. Students receiving a similar academic forgiveness or academic Fresh Start on another IU campus are not eligible for IU Indianapolis Fresh Start.

Application for Fresh Start may be made only once.

Grades awarded based on violation of the IU Code of Student Rights, Responsibility, and Conduct will not be removed from the cumulative GPA by application of Fresh Start.

Students who are approved for Fresh Start will restart with a cumulative GPA of 0.00. These students must complete a minimum of 30 hours on the IU Indianapolis campus after their return in order to meet the graduation residency requirement.

For more information about this policy click here.

Special Credit

Special credit by examination, by credentials, and/or by experience may be awarded in order to help qualified students earn their degrees more quickly. Each instructional department determines which of its courses are available for special credit and establishes procedures to determine student eligibility, administer evaluations for special credit, and grade students. The evaluations are as comprehensive as those given in the course. 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. An S (passing) grade is considered to be equivalent to performance at a minimum grade level of C.

Responsibility for initiating a request for special credit in a specific course normally rests with the student. To find out if special credit is warranted, the student should consider meeting first with the department chair, advisor, or course instructor.

For additional information, refer to the front part of this bulletin under “Special Credit" or click here.

Auditing Courses

University policy permits the auditing of courses, but audited courses may not be retaken later for academic credit. Written permission from the instructor to audit a class must be obtained before the student attempts to register. See the Student Central website for general information about auditing courses.

Incomplete Grade Process for Undergraduate and Graduate Students

You can ask your instructor for a grade of Incomplete if you satisfactorily competed a substantial portion of your coursework, but extenuating circumstances during the term prevented you from completing all coursework as of the end of the semester.

Your instructor has the right to set a specific date, up to one year, by which you must complete all unfinished work

In some cases, your instructor may recommend or require you to attend another term (or portion of a term) of a course to remove your "I" grade. In this case, don't register for the course a second time. Instead, make arrangements with your instructor to sit in on the course as required. Note that sitting in on a course does not count as part of your full-time or part-time load for financial aid purposes or for loan deferments. If your original instructor isn't available or is no longer with IU Indianapolis, contact the chair of the school or department that offers the course for assistance.

Once you've completed the work the instructor will change your "I" to the appropriate letter grade. You can track the progress of your request or check your academic record for grade information.

If you fail to complete the coursework and turn it in to your instructor in the time allowed, your "I" will automatically become an F.

See the IU Indianapolis Student Central website for information here.

This policy applies to students in both undergraduate and graduate programs.

Review of Final Grade in a Course

A student has the right to request and receive a review of the student's final grade in a course. However, the request for such a review must be made in a timely manner; that is, within one year of the completion of the course. This policy applies to students in both undergraduate and graduate programs.

Petition for Grade Change

Faculty Petition A faculty member may request a change of grade for a student. This request can be honored only after approval of the department chair and the School of Science Executive Director for Academic and Student Affairs.

Student Petition In certain cases, a student may request a change of grade. Students should contact the School of Science, LD 222, for information about procedures and time limits for applicable cases. This option is primarily used by undergraduate students and is generally not available for graduate students. Information is available at here.

Residency Requirements

For undergraduate students: Residence at IU Indianapolis for at least two semesters and completion, while at IU Indianapolis, of at least 32 credit hours of work in courses at the 300-level or higher are required.

At least four courses totaling a minimum of 12 credit hours in the major subject must be completed at IU Indianapolis.

With the approval of the executive Director of Academic and Student Affairs or the Associate Dean for Academic Affairs, students who have had at least four semesters of resident study may complete up to 15 credit hours of the senior year at another approved college or university. In order to transfer back to IU Indianapolis, a transfer course must be a grade of C or higher. Students should be aware that completing coursework at another college or university may result in a postponement of their graduation for at least one semester due to the timing of processing and reviewing transfer credit.

For graduate students: At least 30 academic credits are required for the master's degree and at least 90 academic credits are required for the Ph.D. Some programs may require more credits. The maximum number of didactic transfer credits allowed is 12 hours, but some programs may allow fewer. The student's major department and the Office of the Associate Dean for Research and Graduate Education determine acceptability of transfer credits from another college or university. No work may be transferred from another institution unless the grade is a B or higher.

Students must meet graduate school resident study requirements. At least 30 credit hours of IU graduate work must be completed while enrolled on a campus of Indiana University to satisfy the master's degree. At least one-third of the total credit hours used to satisfy degree requirements must be earned (while registered for doctoral study) in continuous residence on the IU Indianapolis campus. The major department should be consulted for other more specific rules.

Candidates for Baccalaureate Degrees

Students are considered to be candidates in good standing for baccalaureate degrees awarded by the School of Science when they have been admitted as regular students by the Undergraduate Admissions Center, when their last semester's grade point average is not below a 2.00, and when their cumulative grade point average is not below this same level (2.00).

Degree Grade Point Average

The School of Science computes a school grade point average, which is the basis for recommending the awarding of a degree. This grade point average is computed at the completion of the degree program. Only the most recent grade in repeated courses counts in computing the school grade point average for the purpose of graduation. Remedial courses and courses that overlap are also excluded. Other course exclusions may apply.

Double Major

A double major is awarded to students who complete the requirements for two Bachelor of Arts degree programs or two Bachelor of Science degree programs in the School

of Science. Students who plan to double major must have their programs approved by both major departments and the academic dean or director. A student declaring a double major must satisfy the departmental requirements for the second major as stated in the School of Science bulletin in effect when the second major is approved.

Double Degree

A student may be awarded two degrees by completing bachelor's degree programs from two different schools at IU Indianapolis or by simultaneously completing two baccalaureate major programs from the School of Science, one leading to a Bachelor of Arts degree and the other leading to a Bachelor of Science 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 student who declares a double degree, and who is accepted by a department in the School of Science for the additional degree program, must satisfy the requirements for that program as stated in the School of Science bulletin in effect when the additional degree program is approved.

Updating a Major, Adding a Second Major, Adding a Minor, or Adding a Preprofessional Designation within the School of Science

A student who desires to change or add majors within the School of Science, or add a minor or preprofessional designation, should apply the School of Science by completing the Internal Admissions Application. If the application is approved, the student may be placed under the bulletin in effect during the time of admission into the new major.

Second Baccalaureate Degree

Normally the holder of a bachelor's degree who wishes to pursue a further educational goal is encouraged to consider a graduate degree program. However, a student interested in pursuing a second degree should apply through the IU Indianapolis Undergraduate Admissions Center, Campus Center Room 255, 420 University Boulevard, Indianapolis, IN 46202. Further information and application forms may be obtained at this address, by calling (317) 274-4591, or online here.

In order to be admitted to the degree program, the applicant must meet admission requirements of the School of Science and of the department. If admitted, the candidate will be placed under the bulletin in effect during the time of admission into the second-degree program.

Degrees Awarded with Distinction

IU Indianapolis recognizes outstanding performance in course work by awarding bachelor's degrees with distinction. Indiana University degrees are awarded with distinction, high distinction, and highest distinction.

To award graduation with distinction for baccalaureate degrees, there must be at least 20 students in the respective pool of Spring semester candidates.

To be eligible for graduation with distinction, candidates must complete all the requirements of their degree programs. Additionally, the following conditions apply:

- A candidate for a baccalaureate degree with distinction must have a minimum of 65 credit hours of course work from Indiana University applicable to the graduation index (degree grade point average) on record.
- The minimum graduation index for distinction shall be no less than the 90th percentile of the graduation indexes of all the graduates in the school for the Spring semester, provided that the index is at least 3.30;
- Of those who qualify for distinction under these rules for the Spring semester, the six-tenths of the baccalaureate graduates having the highest graduation indexes shall be designated as graduating with high distinction;
- Of those who qualify for distinction under these rules for the Spring semester, the three-tenths of the baccalaureate graduates having the highest graduation indexes shall be designated as graduating with highest distinction;
- The minimum graduation indexes determined for the Spring semester for graduation with distinction, high distinction, and highest distinction shall be applied for graduation with those respective levels of distinction for the subsequent Summer sessions and Fall semester.

Academic Standing

Science Scholars List and Dean's Honor List (Undergraduate Only)

The School of Science recognizes exceptional academic performance in baccalaureate and associate degree programs before graduation from the university by periodically publishing the Science Scholars List. This recognition does not apply to students pursuing graduate level degrees.

Science Scholars List eligibility includes:

- Full-time enrolled student (between 12 or more credit hours) who has completed at least 26 credit hours of course work at IU Indianapolis and who has a semester and IU cumulative grade point average (GPA) of 3.75 or higher.
- Part-time enrolled student (between 5 and 11 credit hours) who has completed at least 26 credit hours of course work at IU Indianapolis and who has a semester and IU cumulative grade point average (GPA) of 3.75 or higher.

Courses assigned a deferred grade (R) will count toward the 12 credit hour minimum required of full-time students. Courses taken on a Pass/Fail basis will not count toward the 12 credit hour minimum. Students who received an Incomplete (I) will not be placed on the Science Scholars List. No Science Scholars List is published for the summer sessions.

The University also publishes a Dean's List. More information can be found here.

Academic Warning (Undergraduate Only)

A student whose IU semester grade point average (GPA) falls below a 2.00, but whose IU cumulative GPA is a 2.00 or higher will be placed on academic warning. Students on academic warning will be required to meet with their academic advisor before being able to register for classes. A student will be advised of academic warning status by

letter from the Associate Dean for Academic Affairs. This policy does not apply to students pursuing graduate level degrees.

Academic Review (Undergraduate Only)

A student whose IU cumulative grade point average (GPA) falls below a 2.00 will be placed on academic review. The student may continue studies provided the student achieves an IU GPA of at least 2.00 for each semester while on review. Once the IU cumulative GPA is at least 2.00, the student will be removed from academic review status. A student will be advised of academic review status by letter from the Associate Dean for Academic Affairs. This policy does not apply to students pursuing graduate level degrees.

Academic Dismissal (Undergraduate Only)

A student on academic review who has completed a minimum of 12 IU cumulative grade point average (GPA) hours is subject to dismissal if the student fails to attain an IU semester GPA of at least 2.00 in any two consecutive IU Indianapolis semesters (Fall and Spring), including the semester that the student was first placed on academic review and when the student's IU cumulative GPA is below a 2.00. This portion of the policy does not apply to students pursuing graduate level degrees.

(Graduate and Undergraduate)

A student can also be dismissed from the university when, in the opinion of the Associate Dean for Academic Affairs of the School of Science, the student has ceased making progress in the degree program. This policy may be applied to students at either the undergraduate or graduate level.

Readmission (Undergraduate Only)

A student dismissed for the first time must remain out of school at least one regular (Fall or Spring) semester. During the semester out of school, the student may petition the School of Science for readmission. A student dismissed for the second time must remain out of school at least two regular semesters (Fall and Spring), but may petition for readmission during the second semester out of school. Readmission after a second dismissal is extremely rare.

In order to allow sufficient time for considering a petition for readmission, a student eligible to submit a petition should do so before June 15 for the Fall semester, October 15 for the Spring semester, or March 15 for either Summer session.

A student readmitted will be so informed by letter from the Associate Dean for Academic Affairs. The letter will indicate any conditions and restrictions affecting readmission and continuance in the degree program.

Area Requirements

Area Requirements for Baccalaureate Degrees

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 that are in effect when they enter the School of Science, or they may choose new requirements that become effective after that date.

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 advisors in planning their courses of study.

- Bachelor of Arts Degree and Bachelor of Science Degree Requirements

Bachelor of Arts Degree and Bachelor of Science Degree Requirements

The requirements for these bachelor's degree programs include the common general education core approved by the faculties IU Indianapolis, baccalaureate degree requirements within the School of Science, and courses within the major.

First-Year Experience Course

Each beginning freshman and transfer student (with less than 19 credit hours) in both the Bachelor of Arts and Bachelor of Science programs in the School of Science is required to take either SCI-I120 Windows on Science (1 cr.) or an equivalent freshman experience course that may be offered by a department in which the student is a major.

Area I English Composition and Communication Competency

Both Bachelor of Arts and Bachelor of Science students are required to take two courses in English composition worth at least 3 credit hours each and COMM-R110 Fundamentals of Speech Communication (3 cr.). The English composition requirement is partially satisfied by completing ENG-W131 (or ENG-W140 Honors). The second composition course must have ENG-W131 (or ENG-W140) as a prerequisite. An appropriate course in technical or research writing may be used to complete the second composition course requirement. Consult departmental guidelines. A grade of C or higher must be obtained in both English composition courses.

Area II World Language Competency

1. A first-year proficiency in a world language is required for the Bachelor of Arts degree program. Note that American Sign Language may be used to satisfy this requirement. This requirement may be satisfied in one of the following ways:

- by completing first-year courses (8-10 credit hours) in a single language with passing grades;
- by completing a second-year or third-year course with a grade of C or higher;
- by taking a placement test and placing into the 200 level or higher. See the School of Liberal Arts Department of World Languages and Culture for items related to the placement test, nonnative speakers, and credit for lower division language courses.

2. Check the department section of the bulletin for any reference to a language proficiency requirement for a Bachelor of Science degree program (e.g. Mathematical Sciences).

Area III

IIIA Arts and Humanities, Social Sciences, and Cultural Understanding Competencies

Four courses totaling 12 credit hours are required. The courses are to cover each of four areas:

1. One course in arts and humanities from List H

2. One course in social sciences from List S

3. One additional course from either List H or List S

4. One course in cultural understanding from List C

Courses taken from lists H, S, and C must be outside the student's major. For example, psychology majors cannot take a PSY-B course to satisfy one of the List H, S, or C requirements below.

It is recommended that the student see an academic advisor for updated lists.

Note that some courses may appear on more than one list. A cross-listed course may apply to only one of the required areas specified by the lists.

- CLAS-C101 Ancient Greek Culture (3 cr.)
- CLAS-C102 Roman Culture (3 cr.)
- CLAS-C205 Classical Mythology (3 cr.)
- COMM-T130 Introduction to Theatre (3 cr.)
- ENG-L105 Appreciation of Literature (3 cr.)
- ENG-L115 Literature for Today (3 cr.)
- ENG-L202 Literary Interpretation (3 cr.)
- ENG-L203 Introduction to Drama (3 cr.)
- ENG-L204 Introduction to Fiction (3 cr.)
- ENG-L205 Introduction to Poetry (3 cr.)
- ENG-L207 Women and Literature (3 cr.)
- ENG-L213 Literary Masterpieces I (3 cr.)
- ENG-W206 Introduction to Creative Writing (3 cr.)
- ENG-W207 Introduction to Fiction Writing (3 cr.)
- ENG-W208 Introduction to Poetry Writing (3 cr.)
- ENG-W210 Literacy and Public Life (3 cr.)
- ENG-W260 Writing of Film Criticism (3 cr.)
- FILM-C292 Introduction to Film (3 cr.)
- HER-E101 Beginning Drawing I (3 cr.)
- HER-E105 Beginning Painting I (3 cr.)
- HER-E109 Color and Design for Non-Art Majors (3 cr.)
- HER-E111 Metalsmithing and Jewelry Design (3 cr.)
- HER-E201 Photography I (3 cr.)
- HER-E209 Drawing of Interior Environments (3 cr.)
- HER-H100 Art in Culture (was Art Appreciation) (3 cr.)
- HER-H101 History of Art 1 (3 cr.)
- HER-H102 History of Art 2 (3 cr.)
- HER-H200 Understanding Contemporary Art (3 cr.)
- HER-H221 Art Past and Present (3 cr.)
- HIST-H195 Introduction to Digital Humanities (3 cr.)
- MHHS-M201 Introduction to Medical Humanities and Health Studies (3 cr.)
- MUS-E241 Introduction to Music Fundamentals (3 cr.)
- MUS-L100 Guitar Elect/Secondary (2 cr.)
- MUS-L101 Beginning Guitar Class (2 cr.)
- MUS-M174 Music for the Listener (3 cr.)
- MUS-V100 Voice Elective and Secondary (1 - 4 cr.)
- MUS-Z111 Introduction to Music Theory (3 cr.)
- MUS-Z201 History of Rock and Roll Music (3 cr.)
- NELC-N157 Introduction to Islam (3 cr.)
- NEWM-N100 Foundations of New Media (3 cr.)
- NEWM-N102 Digital Media Imagery (3 cr.)
- NEWM-N131 Game On! A History of Video Games
- NEWM-N201 Design Issues in Digital Media (3 cr.)
- NEWM-N260 Scriptwriting (3 cr.)
- PHIL-P110 Introduction to Philosophy (3 cr.)
- PHIL-P120 Ethics (3 cr.)
- PHIL-P162 Logic (3 cr.)
- PHST-P105 Giving & Volunteering in America (3 cr.)
- PHST-P211 Philanthropy and the Humanities (3 cr.)
- REL-R133 Introduction to Religion (3 cr.)
- REL-R173 American Religion (3 cr.)
- REL-R180 Introduction to Christianity (3 cr.)
- REL-R212 Comparative Religions (3 cr.)
- REL-R243 Introduction to New Testament (3 cr.)

- BUS-F151 Personal Finances of the College Student (1 cr.)
- BUS-F152 Basic Financial Planning and Investment (1 cr.)
- BUS-F251 Managing Personal and Financial Risk (1 cr.)
- BUS-F260 Personal Finance (3 cr.) (NOTE: BUS-F260 is equivalent to F-151, F-152 and F-251 combined)
- BUS-W200 Introduction to Business & Management (3 cr.)
- BUS-X100 Business Administration: Introduction (3 cr.)
- COMM-C180 Introduction to Interpersonal Communication (3 cr.)
- COMM-M150 Mass Media & Contemporary Society (3 cr.)
- ECON-E101 Survey of Economic Issues & Problems (3 cr.)
- ECON-E201 Introduction to Microeconomics (3 cr.)
- ECON-E202 Introduction to Macroeconomics (3 cr.)
- EDUC-P251 Educational Psychology for Elementary Teachers (3 cr.)
- FOLK-F101 Introduction to Folklore (3 cr.)
- GEOG-G110 Human Geography in a Changing World (3 cr.)
- GEOG-G130 World Geography (3 cr.)
- HER-V101 Design Thinking (3 cr.) (previously HER-U101)
- HIST-H105 American History I (3 cr.)
- HIST-H106 American History II (3 cr.)
- HIST-H108 Perspectives: World to 1800 (3 cr.)
- HIST-H109 Perspectives: World 1800 to Present (3 cr.)
- HIST-H113 History of Western Civilization I (3 cr.)
- HIST-H114 History of Western Civilization II (3 cr.)
- HLSC-H200 Survey of U.S. Health Care System Services (3 cr.)
- HLSC-H 220 Aging and the Older Person (3 cr.)
- HPER-F255 Human Sexuality (3 cr.)
- HPER-F258 Marriage and Family Interaction (3 cr.)
- HPER-H195 Principles and Applications of Lifestyle Wellness (3 cr.)

- INFO-I202 Social Informatics (3 cr.)
- INFO-I270 Intro to Human-Computer Interaction Principles and Practices (3 cr.)
- INFO-I275 Intro to Human-Computer Interaction Theory (3 cr.)
- JOUR-J110 Foundations of Journalism and Mass Communication (3 cr.)
- MSPT-Z100 Motorsports Studies (3 cr.)
- NEWM-N132 Game Design Psychology: Theory and Prototyping (3 cr.)
- PBHL-A140 Preparing for Disasters (3 cr.)
- PBHL-H101 Influencing the Public's Health (3 cr.)
- PBHL-P109 Introduction to Public Health (3 cr.)
- PBHL-S120 Introduction to Community Health (3 cr.)
- PHST-P210 Philanthropy and the Social Sciences (3 cr.)
- PHST-P212 Philanthropy and Civic Engagement (3 cr.)
- POLS-Y101 Introduction to Political Science (3 cr.)
- POLS-Y103 Introduction to American Politics (3 cr.)
- POLS-Y217 Introduction to Comparative Politics (3 cr.)
- POLS-Y219 Introduction to International Relations (3 cr.)
- PSY-B110 Introduction to Psychology (3 cr.) (NOTE: Course does not count for List S for psychology majors.)
- SOC-R100 Introduction to Sociology (3 cr.)
- SOC-R121 Social Problems (3 cr.)
- SPEA-J101 American Criminal Justice System (3 cr.)
- SPEA-J150 Public Safety in America (3 cr.)
- SPEA-V170 Introduction to Public Affairs (3 cr.)
- SPEA-V221 Nonprofit & Voluntary Sector (3 cr.)
- SPEA-V222 Principles of Sustainability (3 cr.)
- SWK-S221 Human Growth and Development in the Social Environment (3 cr.)
- SWK-S251 History and Analysis of Social Welfare Policy (3 cr.)
- WGSS-W105 Introduction to Women's, Gender, and Sexuality Studies (3 cr.)

- AFRO-A140 Introduction to African American and African Diaspora Studies (3 cr.)
- AFRO-A150 Survey of the Culture of Black Americans (3 cr.)
- AFRO-A152 Introduction to African Studies (3 cr.)
- AMST-A101 Introduction to American Studies (3 cr.)
- AMST-A102 Asian-American Culture (3 cr.)
- ANTH-A104 Cultural Anthropology (3 cr.)
- ASL-A131 First Year ASL I (4 cr.)
- ASL-A132 First Year ASL II (4 cr.)
- ASL-A211 Second Year ASL I (3 cr.)
- ASL-A212 Second Year ASL II (3 cr.)
- CLAS-C213 Sport & Competition in the Ancient World (3 cr.)
- CLAS-L131 Beginning Latin I (4 cr.)
- CLAS-L132 Beginning Latin II (4 cr.)
- COMM-C282 Let's Talk: Communicating Across Social Identities (3 cr.)
- COMM-C299 Communicating Queer Identity (3 cr.)
- EALC-C131 Beginning Chinese I (4 cr.)
- EALC-C132 Beginning Chinese II (4 cr.)
- EALC-C201 Second Year Chinese I (3 cr.)
- EALC-C202 Second Year Chinese II (3 cr.)
- EALC-J131 Beginning Japanese I (4 cr.)
- EALC-J132 Beginning Japanese II (4 cr.)
- EALC-J201 Second Year Japanese I (3 cr.)
- EALC-J202 Second Year Japanese II (3 cr.)
- EDUC-E201 Multicultural Education and Global Awareness (3 cr.)
- ENG-L245 Introduction to Caribbean Literature (3 cr.)
- FREN-F131 First Year French I (4 cr.)
- FREN-F132 First Year French II (4 cr.)
- FREN-F203 Second Year French I (3 cr.)
- FREN-F204 Second Year French II (3 cr.)
- GER-G131 First Year German I (4 cr.)
- GER-G132 First Year German II (4 cr.)
- GER-G203 Second Year German I (3 cr.)
- GER-G204 Second Year German II (3 cr.)
- HIST-H100 Introduction to History (3 cr.)
- INTL-I100 Introduction to International Studies (3 cr.)
- LATS-L101 Introduction to Latino Studies (3 cr.)
- LATS-L228 An Interdisciplinary Look at U.S. Latino/a Identities (3 cr.)
- MUS-M394 Survey of African American Music (3 cr.)
- MUS-Z105 Traditions in World Music (3 cr.)
- NAIS-N101 Introduction to Native American and Indigenous Studies (3 cr.)
- NELC-A131 Basic Arabic I (4 cr.)
- NELC-A132 Basic Arabic II (4 cr.)
- NELC-A200 Intermediate Arabic I (3 cr.)
- NELC-A250 Intermediate Arabic II (3 cr.)
- PBHL-A120 Culture, Health, and Happiness (3 cr.)
- PSY-B203 Ethics and Diversity in Psychology (3 cr.) (NOTE: PSY-B203 does not count for List C for psychology majors.)
- REL-R101 Religion and Culture (3 cr.)
- REL-R103 The Bible and Culture (3 cr.)
- SPAN-S131 First Year Spanish I (4 cr.)
- SPAN-S132 First Year Spanish II (4 cr.)
- SPAN-S203 Second Year Spanish I (3 cr.)
- SPAN-S204 Second Year Spanish II (3 cr.)
- SWK-S102 Understanding Diversity in a Pluralistic Society (1-4 cr.)
- TSEM-T208 Tourism Geography (3 cr.)
- TSEM-T234 Cultural Heritage Tourism (3 cr.)

For the most current list of courses in the areas of Arts and Humanities, Social Sciences and Cultural Understanding, please refer to the IU Indianapolis General Education Curriculum.

IIIC Life and Physical Sciences Competency

Both Bachelor of Arts and Bachelor of Science students are required to complete at least four science lectures courses totaling a minimum of 12 credit hours outside the major department. At least one of the courses must have a laboratory component.

Courses that do not count in Area IIIC include AST-A130; BIOL-N100, BIOL-N200, CHEM-C100, FIS-N courses,

GEOL-G130, PHYS-I100, PHYS-I140, PHYS-I200, and all agriculture courses.

NOTE: This is not a complete list. If you have a question about whether a course is applicable or not, please speak with your academic advisor prior to registering to confirm.

Topics or variable credit hour courses (e.g., BIOL-N222) must receive approval from the School of Science Academic Dean's Office. Consult with your major department or the School of Science Academic Dean's Office for additional course restrictions.

Courses that do not count for any credit toward any degree program in the School of Science include, but are not limited to, BIOL-N120 and PHYS-I010.

Except for laboratory courses combined with corresponding lecture courses, 1 credit hour and, in general, 2 credit hour courses do not apply to this area. In addition, students must obtain grades of C- or higher in their Area IIIC courses. However, a single grade of D+ or D will be allowed for one course only. Check with the major department for additional restrictions or requirements. Some majors may require a minimum grade of C or higher in this Area.

Note that GEOG-G107 Physical Systems of the Environment (3 cr.)/GEOG-G108 Physical Systems of the Environment: Laboratory (2 cr.) may apply to Area IIIC with approval of the student's major department. Also, GEOG-G185 Global Environmental Change (3 cr.) is an acceptable substitute for GEOL-G185 Global Environmental Change (3 cr.).

IIID Analytical Reasoning Competency

Bachelor of Arts students must have at least one course of at least 3 credit hours in mathematics and one course of at least 3 credit hours in computer programming.

Bachelor of Science students must have at least two courses beyond college algebra and trigonometry, totaling minimally 6 credit hours. In addition, one course of at least 3 credit hours in computer programming is required. Courses in applied statistics are not acceptable.

MATH-M010, MATH-I001, MATH-M001, MATH-I002, MATH-I110, MATH-I111, MATH-I123, MATH-I130, MATH-I132, MATH-I136; BUS-K201, BUS-K204, and CSCI-N100-level courses do not count for any credit toward any degree in the School of Science. Computer Science CSCI-N241 and CSCI-N299 do not count in this area as computer programming, but may count as general electives.

Students must obtain grades of C- or higher in their Area IIID courses. However, a single grade of D+ or D will be allowed for one course only. Check with the major department for additional restrictions or requirements. Some majors may require a minimum grade of C or higher.

Area IV

Major Department

Consult the listing of the major department for courses required within the major subject, as well as courses required by the major department in the other areas (e.g. Biotechnology, Environmental Science, Forensic & Investigative Sciences, and Neuroscience).

Capstone Experience Course

Each undergraduate major in the School of Science is to be provided a Capstone Experience (research, independent study/project, practicum, seminar, or field experience). The capstone, required of all majors, is to be an independent, creative effort of the student that is integrative and builds on the student's previous work in the major. See departmental sections of the bulletin for specific information about capstone courses.

Undergraduate Programs

The IU Indianapolis School of Science offers the following undergraduate degree programs:

Baccalaureate Degrees

- Biology (B.A.)
- Biology (B.S.)
- Biology Secondary School Teaching (B.A.)
- Biotechnology (B.S.)
- Chemistry (B.A.)
- Chemistry (B.S., ACS certified)
- Chemistry Secondary School Teaching (B.A.)
- Earth Science Secondary School Teaching
- Environmental Science (B.S.)
- Forensic and Investigative Sciences (B.S. FEPAC accredited)
- Geology (B.A.)
- Geology (B.S.)
- Interdisciplinary Studies (B.S.)
- Mathematics (B.S.)
- Mathematics Teaching B.S.
- Neuroscience (B.S.)
- Physics (B.S.)
- Physics Secondary School Teaching (B.S.)
- Psychology (B.A. and B.S.)

General Requirements

School of Science requirements are the minimal requirements in various areas, and individual departments/programs may require more, as stated in their degree descriptions. Students should consult with departmental/program advisors in planning their courses of study.

1. A minimum of 120 credit hours for all programs must be completed. Approval must be obtained from the School of Science to use as credit toward graduation any course that was completed 10 or more years previously.
2. A minimum grade point average of 2.00 is required.
3. A minimum of 24 credit hours must be taken in a major subject (see program requirements) with a minimum grade point average of 2.00. No grade below C- is acceptable in the major subject. Some majors may have higher minimum grade requirements (see program requirements).
4. At least four courses totaling a minimum of 12 credit hours in the major subject must be completed

at IU Indianapolis (see departmental/program requirements).

5. Residence at IU Indianapolis for at least two semesters and completion, while at IU Indianapolis, of at least 32 credit hours of work in courses at the 300 level or higher are required.

6. With the approval of the Executive Director of Academic and Student Affairs or the Associate Dean for Academic Affairs, students who have had at least four semesters of resident study may complete up to 15 credit hours of the senior year at another approved college or university. In order to transfer back to IU Indianapolis, a transfer course must be a grade of C or higher.

7. Courses taken on the Pass/Fail option may be applied only as general electives and not toward degree AREA requirements of the school or department/program. Courses taken on the Pass/Fail option may apply to the 32 credit hours residency requirement listed in item 5 if the course is at the 300-level or higher.

8. No more than 64 credit hours earned in accredited junior or community colleges can be applied toward a degree. (Per IU Policy ACA-56)

9. Students may enroll in independent study (correspondence) courses for general electives up to a maximum of 12 credit hours with permission of the Executive Director of Academic and Student Affairs or the Associate Dean for Academic Affairs. Independent study (correspondence) courses may not apply to the 32 credit hours residency requirement listed in item 5. Independent study (correspondence) courses may not apply to course requirements in minors or certificates.

10. With permission of the appropriate department or program, credit may be earned through special credit examination. Credits earned by special credit examination may be used toward the total credit hours required and to satisfy AREA requirements for a degree.

11. The following courses do not count for any credit toward any degree program in the School of Science: AGR 10100; BIOL-N120; BUS-K201, BUS-K204; CSCI-N100-level courses; CIT 10600; all remedial and developmental courses; EDUC-U205, EDUC-W200, EDUC-W201, EDUC-X100, EDUC-X150, EDUC-X151, EDUC-X152; ENG-G010, ENG-G011, ENG-G012, ENG-W001, ENG-W031; MATH-M010, MATH 00100, MATH-M001, MATH 00200, MATH 11000, MATH-I110, MATH 11100, MATH-I111, MATH 12300, MATH-I123, MATH 13000, MATH-I130, MATH 13200, MATH-I132, MATH 13600, MATH-I136; PHYS 01000; UCOL-U112, UCOL-U210.

    NOTE: This is not a complete list. The School and department/program reserve the right to exclude course credit when it is deemed as overlapping with other earned credit or it is determined to be remedial in nature.

    - Note that CHEM-C100 may count for general elective credit only if the student has not already established credit in CHEM-C101 or CHEM-C105/CHEM-C106, or equivalent courses. Otherwise, CHEM-C100 does not count for credit in any given degree program.

- No more than 6 credit hours of studio, clinical, athletic, or performing arts course work will be approved unless the additional credit hours are required to complete a (or were previously applied to an earned) certificate, minor, or second degree. Verification of academic intent or program completion of a certificate, minor, or second degree is required. Also, any athletic or performance-type credit earned through military service that is eligible for transfer to IU Indianapolis will count and not be considered as part of the 6-credit hour minimum. Consult a school or departmental/program advisor with questions.
- No more than 15 credit hours of military credit for basic training can apply towards the degree program. For coursework taken as part of a military occupation or position beyond basic training, military personnel will receive distributed or undistributed credit. (Per IU Policy ACA-78)

- An online application for a degree or certificate graduation must be completed by the following deadlines. Applications must be submitted by January 15 for August graduation; May 15 for December graduation; and October 15 for May graduation.
    - Indiana University degree candidates for December, May, or August graduation of a particular academic year may participate in the May Commencement (e.g. students having graduated in December 2024, May 2025, or August 2025 will participate in the May 2025 Commencement Exercises).
    - Purdue University has a commencement ceremony three times a year, December, May, and August. Degree candidates participate in their corresponding graduation term at Purdue University West Lafayette.
    - Students completing a certificate program do not participate in Commencement Exercises.

12. In general, credit is not allowed for both of two overlapping courses. Examples of course overlaps include **(NOTE: This is not a complete list.)**:

    - BIOL-N100 and BIOL-K101/BIOL-K103
    - BIOL-N100 and BIOL-K102/BIOL-K104
    - BIOL-N100 and BIOL-N107 and BIOL-K101
    - BIOL-N212/BIOL-N213 and BIOL-N217
    - BIOL-N214/BIOL-N215 and BIOL-N261
    - BIOL-N212 and BIOL-N207
    - BIOL-N214 and BIOL-N211
    - CHEM-C101/CHEM-121 and CHEM-C105 and/or CHEM-C106
    - CHEM-C102 and CHEM-C341/CHEM-C343
    - CHEM-C110 and CHEM-C341

- CHEM-C110/CHEM-C115 and CHEM-C341/CHEM-C343
- CHEM-C360 and CHEM-C361
- CHEM-C325/CHEM-C326 and CHEM-C410/CHEM-C411
- GEOL-G185 and GEOG-G185
- GEOL-G221 and GEOL-G306
- GEOL-G222 and GEOL-G306
- MATH-M119 and MATH 22100 (MATH-I221) or MATH 23100 (MATH-I231) or MATH 24100 (MATH-I241) or MATH 16300 or MATH 16500 (MATH-I165)
- MATH 15100 or 15900 (MATH-I159) and MATH 15300/15400 (MATH-I153/MATH-I154)
- MATH 15100 and MATH 15900 (MATH-I159)
- MATH 22100/MATH 22200 (MATH-I221/MATH-I222) and MATH 23100/MATH 23200 (MATH-I231/MATH-I232)
- MATH 22100/MATH 22200 (MATH-I221/MATH-I222) and MATH 24100/MATH 24200 (MATH-I241/MATH-I242)
- MATH 23100/MATH 23200 (MATH-I231/MATH-I232) and MATH 24100/MATH 24200 (MATH-I241/MATH-I242)
- MATH 22100/MATH 22200 (MATH-I221/MATH-I222) and MATH 16300/MATH 16400 or MATH 16500/MATH 16600 (MATH-I165/MATH-I166)
- MATH 23100/MATH 23200 (MATH-I231/MATH-I232) and MATH 16300/MATH 16400 or MATH 16500/MATH 16600 (MATH-I165/MATH-I166)
- MATH 24100/MATH 24200 (MATH-I241/MATH-I242) and MATH 16300/MATH 16400 or MATH 16500/MATH 16600 (MATH-I165/MATH-I166)
- MATH 16300 and MATH 16500 (MATH-I165)
- MATH 16400 and MATH 16600 (MATH-I166)
- PHYS-P201/PHYS-P202 or PHYS 21800/PHYS 21900 (PHYS-I218/PHYS-I219) and PHYS 15200/PHYS 25100 (PHYS-I152/PHYS-I251)
- PSY-B320 and BIOL-L391 Addictions (IU East)
- PSY-B320 and NSCI-N301
- SCI-I120 and UCOL-U110
- STAT 30100 (STAT-I301) and PSY-B305

In addition, any course that is retaken is considered an overlap. Consult with your academic advisor regarding other overlapping courses.

See statements about required First-Year Experience Course and Senior Capstone Experience in the description of the Bachelor of Arts degree and the Bachelor of Science degree programs.

Minors

Minors

Minors are often awarded with the completion of a bachelor's degree, but may be awarded earlier.

Independent Study (correspondence) courses may not be used to fulfill course requirements in a minor program.

A minimum of 6 credit hours in the minor must be completed at IU Indianapolis.

Check with the department or program offering the minor for additional minimum courses to be completed at IU Indianapolis, and other restrictions or requirements.

- Astronomy
- Biology
- Chemistry
- Climate Resilience
- Environmental Science
- Forensic and Investigative Sciences
- Geology
- Geochemistry
- Health Psychology
- Mathematics
- Neuroscience
- Physics
- Psychology

Student Learning Outcomes

- Biology
- Biotechnology
- Chemistry
- Environmental Science
- Forensic and Investigative Sciences
- Geology
- Interdisciplinary Studies
- Mathematics
- Neuroscience
- Physics
- Psychology

Bachelor of Arts & Bachelor of Science in Biology

Students who graduate with a B.A. or B.S. in Biology will be able to:

1. Demonstrate knowledge of how biological molecules such as DNA, RNA, proteins, lipids, and carbohydrates contribute to the structure and function of prokaryotic and eukaryotic cells.
2. Integrate the cellular, molecular and physiological basis of how organisms develop structure, carry out functions, sense and control their environment, and respond to external change.
3. Describe how genetic principles associated with natural selection contribute to the functioning of an organism and the evolutionary diversity of life on earth.
4. Access, evaluate, and communicate information relevant to the study of biological sciences.
5. Work safely and effectively with basic laboratory techniques and instrumentation.

6. Exhibit problem solving and critical thinking skills needed to design and implement laboratory projects, and gather, analyze and draw conclusions from data.
7. Apply basic principles of chemistry, math, and other disciplines to the functioning of living systems.
8. Successfully complete a laboratory or literature-based research project with supervision from a faculty sponsor.

Bachelor of Arts in Biology - Secondary School Teaching

Students who graduate with a B.A. in Biology - Secondary School Teaching will be able to:

1. Demonstrate knowledge of how biological molecules such as DNA, RNA, proteins, lipids, and carbohydrates contribute to the structure and function of prokaryotic and eukaryotic cells.
2. Integrate the cellular, molecular and physiological basis of how organisms develop structure, carry out functions, sense and control their environment, and respond to external change.
3. Describe how genetic principles associated with natural selection contribute to the functioning of an organism and the evolutionary diversity of life on earth.
4. Access, evaluate, and communicate information relevant to the study of biological sciences.
5. Work safely and effectively with basic laboratory techniques and instrumentation.
6. Exhibit problem solving and critical thinking skills needed to design and implement laboratory projects, and gather, analyze and draw conclusions from data.
7. Apply basic principles of chemistry, math, and other disciplines to the functioning of living systems.
8. Successfully complete a laboratory or literature-based research project with supervision from a faculty sponsor.
9. Satisfy the learning outcomes specified by the School of Education for undergraduate students.

Biotechnology

Students who graduate with a B.S. degree in Biotechnology (B.S.B.):

1. Enter IU Indianapolis with the ***Skills And Knowledge Standards For Associate Degree In Biotechnology Programs In Indiana*** (Indiana Commission for Higher Education) as an outcome of prior completion of an Associate Degree in Biotechnology from Ivy Tech Community College.

2. Demonstrate knowledge of how biological molecules such as DNA, RNA, proteins, lipids, and carbohydrates contribute to the structure and function of prokaryotic and eukaryotic cells.

3. Integrate the cellular, molecular, genetic, and biochemical basis of how organisms carry out functions, sense and control their environment, and respond to external change.

4. Access, evaluate, and communicate information relevant to the study of biological sciences.

5. Work safely and effectively with basic laboratory techniques and instrumentation.

6. Exhibit problem solving and critical thinking skills needed to design and implement laboratory projects, and gather, analyze and draw conclusions from data.

7. Apply basic principles of chemistry, math, and other disciplines to the functioning of living systems.

8. Successfully complete a biotechnology-based internship or research project prior to attending IU Indianapolis.

Chemistry

Bachelor of Arts in Chemistry (B.A.)

Students who graduate with a B.A. in Chemistry will be expected to:

1. Understand major concepts and theoretical principles in organic chemistry, analytical chemistry, and physical chemistry.
2. Exhibit problem solving and critical thinking skills relevant to the field of chemistry.
3. Access, retrieve, and interpret accurate and meaningful information from the chemical literature.
4. Communicate scientific information effectively, in both oral and written formats.
5. Work effectively in teams in both classroom and laboratory.
6. Design, carry out, record, analyze the results and draw conclusions from chemical experiments.
7. Use instrumentation for chemical analysis and separation.
8. Use computers in experiments, data analysis, and in communication.
9. Understand and follow safety guidelines in chemical labs.
10. Be aware of and abide by ethical standards in chemical discipline.
11. Integrate knowledge from mathematics, physics, and other disciplines in support of chemistry.

Bachelor of Science in Chemistry (B.S.)

Students who graduate with a B.S. in Chemistry will be expected to:

1. Understand major concepts, theoretical principles, and experimental findings in organic chemistry, analytical chemistry, inorganic chemistry, physical chemistry and biochemistry.
2. Exhibit problem solving and critical thinking skills relevant to the field of chemistry.
3. Access, retrieve, and interpret accurate and meaningful information from the chemical literature.
4. Communicate scientific information effectively, in both oral and written formats.
5. Work effectively in teams in both classroom and laboratory.
6. Design, carry out, record and analyze the results of chemical experiments.
7. Use instrumentation for chemical analysis and separation.
8. Use computers in experiments, data analysis, and in communication.
9. Understand and follow safety guidelines in chemical labs.

10. Be aware of and abide by ethical standards in chemical discipline.
11. Integrate knowledge from mathematics, physics and other disciplines in support of chemistry.
12. Conduct research projects with supervision.

Bachelor of Arts in Chemistry Secondary School Teaching (B.A.)

Students who graduate with a B.A. in Chemistry will be expected to:

1. Understand major concepts and theoretical principles in organic chemistry, analytical chemistry, and physical chemistry.
2. Exhibit problem solving and critical thinking skills relevant to the field of chemistry.
3. Access, retrieve, and interpret accurate and meaningful information from the chemical literature.
4. Communicate scientific information effectively, in both oral and written formats.
5. Work effectively in teams in both classroom and laboratory.
6. Design, carry out, record, analyze the results and draw conclusions from chemical experiments.
7. Use instrumentation for chemical analysis and separation.
8. Use computers in experiments, data analysis, and in communication.
9. Understand and follow safety guidelines in chemical labs.
10. Be aware of and abide by ethical standards in chemical discipline.
11. Integrate knowledge from mathematics, physics, and other disciplines in support of chemistry.
12. Satisfy the learning outcomes specified by the School of Education for undergraduate students.

NOTE: The Bachelor of Arts Chemistry Secondary School Teaching degree completion time is currently more than 4 years. Please contact the chemistry undergraduate advisor for details.

Bachelor of Science in Environmental Science (B.S.)

Broad Earth Sciences Undergraduate Program Goals

Upon graduating, students with an undergraduate degree in Environmental Science (BSES) will:

- gain access to employment in professions of their choosing related to Earth Science, Science Education, and/or Environmental Science.
- gain acceptance to reputable graduate programs in the Earth Sciences, Environmental Sciences, or a program of their choosing.
- successfully complete state and/or national professional competency examinations in Earth Sciences.

Student Learning Outcomes for BS degree in Environmental Science (BSES)

Students who graduate with a BSES degree will achieve the following objectives:

1. Solve environmental science problems using the scientific method and critical thinking.
2. Evaluate physical, chemical and biological cycles related to surficial earth processes and how they operate to describe integrated earth systems from a local to global scale.
3. Demonstrate competence in communicating environmental science problems to a broad audience through written, oral, and visual means.
4. Describe the structure and function of major environmental systems.
5. Effectively apply analytical skills, including basic measurement and monitoring skills, and use of appropriate technology.
6. Understand current thinking and research on the nature, causes, and solutions of environmental problems as they affect human health and the environment.
7. Develop knowledge in advanced disciplines of environmental sciences and evaluate inter-relationships between disciplines.

Specialization leading to an advanced understanding of one of the three component areas that are central to the BSES program:

Earth and Water Resources

1. Understand interactions between land, soil, and water and quantitatively assess processes in soils, hydrogeology, and biogeochemistry.
2. Describe physical, chemical, and biological interactions and processes affecting soil and water resources.
3. Apply advanced analytical techniques related to environmental quality assessments.

Environmental Remote Sensing and Spatial Analysis

1. Develop spatial analytical techniques using remote sensing (satellite and airborne sensors), geographic information system (GIS), and global positioning system (GPS) technologies.
2. Integrate technologies of remote sensing and spatial analysis to problems of environmental modeling and analysis.

Environmental Management

1. Apply skills needed to characterize hazards, track the fate and transport of pollutants.
2. Identify health and environmental effects of pollutants and plan and manage programs to control environmental hazards.
3. Identify and solve problems in solid and hazardous waste, water quality and wastewater treatment, and air quality.

Forensic and Investigative Sciences

Undergraduate

Student Learning Outcomes

FIS BS SLOs

Students who graduate from the Forensic and Investigative Sciences program will learn:

Program Level Student Learning Outcomes

Aligned with

1. Generalize the forensic science system in the United States including crime scene investigation, crime laboratories and organization, specialized disciplines, and preparation for a career in forensic science
    1. Communicator: Evaluates Information and Conveys Ideas Effectively
    2. Community Contributor: Builds Community and Behaves Ethically
2. Identify common pattern evidence in forensic science and describe the appropriate analytical techniques used to examine patterned evidence, such as fingerprints, tool marks, physical matches, and firearms
    1. Problem Solver: Thinks Critically and Analyzes, Synthesizes, and Evaluates
    2. Innovator: Investigate and Creates/Designs
3. Interpret the use of chemical and instrumental techniques in forensic analysis and examine common chemical evidence, such as illicit drugs, fire residue, explosives, inks, and paint
    1. Problem Solver: Thinks Critically and Analyzes, Synthesizes, and Evaluates
    2. Innovator: Investigate and Creates/Designs
4. Identify and analyze forensic biological evidence, such as bodily fluids, blood spatter, DNA and interpret profiles using population genetics
    1. Problem Solver: Thinks Critically and Analyzes, Synthesizes, and Evaluates
    2. Innovator: Investigate and Creates/Designs
5. Summarize and demonstrate the use of ethics, bias, criminal and civil laws, rules of evidence, and expert testimony in the practice of forensic science
    1. Community Contributor: Behaves Ethically and Anticipates Consequences
    2. Innovator: Confronts Challenges and Makes Decisions
6. Demonstrate the use of common microscopes used in analysis of trace evidence and identify common trace evidence with microscopes such as fibers, hairs, glass, biological and chemical materials
    1. Problem Solver: Thinks Critically and Analyzes, Synthesizes, and Evaluates
    2. Innovator: Investigate and Creates/Design
7. Conduct a literature review of a current forensic science topic and present findings professionally
    1. Communicator: Evaluates Information and Conveys Ideas Effectively
    2. Innovator: Investigate and Creates/Designs

Bachelor of Arts & Bachelor Science in Geology

Broad Earth Sciences Undergraduate Program Goals

Upon graduating, students with an undergraduate degree in Geology (B.A. and B.S.) will:

- gain access to employment in professions of their choosing related to Earth Science, Science Education, and/or Environmental Science.
- gain acceptance to reputable graduate programs in the Earth Sciences, Environmental Sciences, or a program of their choosing.
- successfully complete state and/or national professional competency examinations in Earth Sciences.

Student Learning Outcomes for B.A. and B.S. in Geology

Students who graduate with a B.A. or B.S. Degree will achieve the following objectives:

1. Solve earth science problems using the scientific method and critical thinking.
2. Describe spatial and temporal variations in Earth processes through modeling, mapping, observation and measurement.
3. Understand the evolution of physical Earth and life as reflected in the geologic time scale.
4. Understand the structural and chemical controls on the physical properties and behavior of Earth materials.
5. Evaluate how physical, chemical and biological cycles are integrated into Earth systems from the local to global scale.
6. Understand how events of the geologic past control the current distribution of resources.
7. Assess the impact of physical and chemical cycles on human health and welfare.
8. Evaluate impacts and potential mitigation strategies for natural hazards, resource utilization, climate and environmental change.
9. Demonstrate competence in communicating Earth science problems to a broad audience through written, oral and visual means.
10. Understand the interdependence of the diverse sub-disciplines of Earth science.

Student Learning Outcomes for B.A. in Earth Sciences Secondary School Teaching

Upon graduating, students with an undergraduate degree in Earth Science Secondary School Teaching will:

- gain access to employment in professions of their choosing related to Earth Science, Science Education, and/or Environmental Science.
- gain acceptance to reputable graduate programs in the Earth Sciences, Environmental Sciences, or a program of their choosing.
- successfully complete state and/or national professional competency examinations in Earth Sciences.
- satisfy the learning outcomes specified by the School of Education for undergraduate students.

Bachelor of Science in Interdisciplinary Studies (B.S.)

The purpose of the Bachelor of Science (B.S.) in Interdisciplinary Studies Program is to provide an opportunity for IU Indianapolis students to construct individual majors that are science-based, interdisciplinary, and not represented by an existing major program. Interdisciplinary Studies Majors create individualized courses of study; each student, in consultation with his or her faculty mentor, will individually develop student

learning outcomes. The following SLOs, however, are common for all Interdisciplinary Studies Majors:

1. Create and develop an individualized plan of study for the proposed major, the interdisciplinary nature between science and at least one other discipline.
2. Design, in consultation with a faculty mentor, 4-6 individualized Student Learning Outcomes that specify an action or outcome of the plan of study that is *observable, measurable, and capable of being demonstrated.*
3. Successfully design, present, and defend an experimental or literature-based research project or internship experience, culminating with a written report or presentation of the findings.

Bachelor of Science in Mathematics and Mathematics Education (B.S.)

The Department of Mathematical Sciences synthesized the IU Indianapolis' Principles of Undergraduate Learning (now IU Indianapolis Profiles of Learning for Undergraduate Student Success), the National Council of Teachers of Mathematics Standards, and the Mathematics Association of America's competencies for undergraduate mathematics majors to create the following 10 Student Learning Outcomes for the undergraduate mathematics programs. Students will be able to:

1. Understand and critically analyze mathematical arguments.
2. Understand, appreciate, and identify connections between different areas of mathematics.
3. Understand, appreciate, and solve some applications of mathematics to other subjects.
4. Develop a deeper knowledge and competence of at least one area of mathematics.
5. Develop and demonstrate abstract reasoning in a mathematical context.
6. Develop and demonstrate the principle modes of discovery in mathematics.
7. Develop and demonstrate careful and ethical analysis of data.
8. Develop and demonstrate problem-solving skills.
9. Demonstrate effective communication skills of mathematical ideas precisely and clearly, both orally and in writing.
10. Utilize a variety of technological tools (CAS, statistical packages, programming languages, etc.) in analyzing and solving mathematical problems.

Concentrations include: Applied Mathematics, Pure Mathematics, Actuarial Science, Applied Statistics, and Secondary School Teaching

All majors should work on a senior-level project that requires them to analyze and create mathematical arguments and leads to a written and oral report (capstone).

Bachelor of Science in Neuroscience (B.S.)

Profiles of Learning

Upon successful completion of the neuroscience major, students will have developed the capacity to perform tasks related to each of the IU Indianapolis' Profiles of Learning, including:

Communicator Profile:
- Be able to research and evaluate questions relating to Neuroscience and related topics
- Be prepared to discuss different topics in Neuroscience from multiple levels of organization
- Communicate Neuroscientific information in a clear, reasoned manner, both verbally and in writing

Problem Solver Profile:
- Integrate knowledge of nervous system function to explain complex processes underlying behavior
- Connect curricular and extracurricular experiences to potential future careers
- Identify various career options in neuroscience to prepare for and pursue one's chosen profession

Innovator Profile:
- Synthesize theoretical and empirical neuroscience information sufficient to then formulate hypotheses, design experiments, and engage in scientific research
- Understand, appreciate and utilize the development, organization, and function of the nervous system to provide new and inventive solutions to community health challenges
- Create new therapeutic treatments based on interpretation of quantitative scientific data

Community Contributor:
- Help build and connect local and global neuroscience communities
- Be able to adjust behaviors and help others adjust behaviors based on new scientific information
- Connect curricular and extracurricular experiences to potential future careers

Bachelor of Science in Physics (B.S.)

Students who graduate with a B.S. in Physics will achieve the following objectives:

1. Know and understand the basic and advanced concepts of classical and modern physics.
2. Master the mathematical skills relevant to the study of physics.
3. Apply the knowledge of physics and mathematics to solve physical problems.
4. Design and perform laboratory experiments in physics.
5. Use computers and software to solve physics problems and to obtain and analyze experimental data.
6. Successfully collaborate with peers, attain the necessary skills, and develop the work ethic to perform and complete physics research.
7. Prepare a written technical document and deliver an oral presentation relevant to physics.
8. Apply skills to other areas or problems.

Bachelor of Science in Physics Teaching (B.S.)

Students who graduate with a B.S. in Physics Teaching will achieve the following objectives:

1. Know and understand the concepts of classical and quantum physics at an intermediate level.

2. Master the mathematical skills relevant to the study of physics.
3. Apply the knowledge of physics and mathematics to solve physical problems.
4. Design and perform laboratory experiments in physics.
5. Use computers and software to solve physics problems and to obtain and analyze experimental data.
6. Prepare a written technical document and deliver an oral presentation relevant to physics.
7. Satisfy the learning outcomes specified by the School of Education for undergraduate students.

Bachelor of Arts and Bachelor of Science in Psychology

Student graduating with a B.A. or B.S. in Psychology will demonstrate the following learning outcomes.

Goal 1: Knowledge Base in Psychology

Student Learning Outcomes

1.1 Describe key concepts, principles, and overarching themes in psychology

1.2 Demonstrate working knowledge of psychology's content domains (biological, developmental, cognitive, social)

1.3 Describe how concepts, principles, and themes in psychology are applied to individual, social, and organizational issues

Goal 2: Scientific Inquiry

Student Learning Outcomes

2.1 Use scientific reasoning to interpret psychological phenomena

2.2 Demonstrate psychology information literacy

2.3 Interpret, design, and gain experience in conducting basic psychological research

Goal 3: Critical Thinking

Student Learning Outcomes

3.1 Generate essential questions to solve problems

3.2 Gather and assess relevant information to come to well-reasoned conclusions

3.3 Recognize and assess assumptions and biases of self and others

Goal 4: Ethical and Social Responsibility in a Diverse World

Student Learning Outcomes

4.1 Apply ethical standards to evaluate psychological science and practice

4.2 Build and enhance interpersonal relationships

4.3 Exhibit respect for members of diverse groups

Goal 5: Communication

Student Learning Outcomes

5.1 Demonstrate effective writing for different purposes

5.2 Exhibit effective presentation skills for different purposes

5.3 Demonstrate professionalism in formal and informal communication with others

Goal 6: Professional Development

Student Learning Outcomes

6.1 Apply psychological content and skills to career goals

6.2 Exhibit self-efficacy and self-regulation

6.3 Develop meaningful professional direction for life after graduation

General Requirements for Graduate Degrees

Students must be seeking graduate degrees and meet the general requirements of the Indiana University Graduate School Indianapolis, depending on the degree. Specific requirements of the individual department in which the student enrolls must also be met. Special departmental requirements are listed under the major department.

At least 30 academic credits are required for the master's degree and at least 90 academic credits are required for the Ph.D. Some programs may require more credits. The maximum number of didactic transfer credits allowed is 12 hours, but some programs may allow fewer. The student's major department and the Office of the Associate Dean for Research and Graduate Education determine acceptability of transfer credits from another college or university. No work may be transferred from another institution unless the grade is a B or higher.

Students must meet graduate school resident study requirements. At least 30 credit hours of IU graduate work must be completed while enrolled on a campus of Indiana University to satisfy the master's degree. At least one-third of the total credit hours used to satisfy degree requirements must be earned (while registered for doctoral study) in continuous residence on the IU Indianapolis campus. The major department should be consulted for other more specific rules.

All non-native speakers of English must submit results of the Test of English as a Foreign Language (TOEFL). Information about this test is available from the Office of International Affairs here.

Each student must file a plan of study that conforms to the departmental and disciplinary requirements. This is normally done in consultation with a faculty advisory committee. A tentative plan of study should be drawn up in advance of registration for the first semester of graduate work. The student and the graduate advisor should do this. Students and advisors should pay careful attention to the deadlines established by the graduate schools for filing plans of study.

Students must meet the grade and grade point average requirements. Only grades of A, B, or C are acceptable in fulfilling graduate school requirements in any plan of study. An advisory committee or department may require higher performance than C in certain courses. Grades of

Pass (P) are not acceptable. Specific cumulative grade point average requirements, if any, are determined by the individual departments.

Students must fulfill departmental requirements regarding oral and written examinations. These requirements vary by program and students should consult the major department. The graduate school has no general requirement for oral and written examinations for the non-thesis master's degree.

Graduate Non-Degree Study

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 graduate non-degree student is, however, required and may be obtained through the Graduate School Indianapolis at the Web site here.

Additional information can be obtained at the Graduate School Indianapolis, University Library, Room UL 1170, 755 West Michigan Street, Indianapolis, IN 46202; phone (317) 274-1577. Students should consult the major department to determine how many credits earned in a non-degree status may be transferred into a graduate degree program.

Contact Information

Department of Biology

723 West Michigan Street, SL 306
Indianapolis, IN 46202-5132
Phone: (317) 274-0577; fax: (317) 274-2846
Web: click here

Department of Chemistry and Chemical Biology

Science Building, LD 326
402 North Blackford Street
Indianapolis, IN 46202-3274
Phone: (317) 274-6872, fax: (317) 274-4701
Web: click here

Department of Earth and Environmental Sciences

Engineering, Science, and Technology Building, SL 118
723 West Michigan Street
Indianapolis, IN 46202-5132
(317) 274-7484; fax (317) 274-7966
Web: click here

Forensic and Investigative Sciences Program

Science Building, LD 326
402 North Blackford Street
Indianapolis, IN 46202-3274
Phone: (317) 274-8969; fax: (317) 274-4701
Web: click here

Department of Mathematical Sciences

Science Building, LD 270
402 North Blackford Street
Indianapolis, IN 46202-3216
Phone: (317) 274-6918; fax: (317) 274-3460
Web: click here

Department of Physics

Science Building, LD 154
402 North Blackford Street
Indianapolis, IN 46202-3273
Phone: (317) 274-6900; fax: (317) 274-2393
Web: click here

Department of Psychology

Science Building, LD 124
402 North Blackford Street
Indianapolis, IN 46202-3275
Phone: (317) 274-6947; fax: (317) 274-6756
Web: click here

Degree Programs

Master of Science Degrees

Indiana University Master of Science degrees are offered in all School of Science departments. All departments award either a thesis or nonthesis option.

- Actuarial Science
- Applied Social and Organizational Psychology
- Applied Statistics
- Biology
- Chemistry
- Computational Data Science (Mathematical Sciences)
- Forensic and Investigative Sciences (Thesis Track FEPAC Accredited)
- Geology
- Industrial Organizational Psychology
- Mathematics
- Mathematics Education
- Physics
- Psychology

Doctor of Philosophy Degrees

Indiana University Ph.D. degrees are offered are offered in all School of Science departments.

- Addiction Neuroscience
- Applied Earth Sciences
- Applied Social and Organizational Psychology
- Biology
- Chemistry
- Clinical Psychology
- Mathematics
- Physics

Graduate (Doctoral) Minors in the School of Science

Biology
- Developmental Biology & Genetics
- Neurobiology
- Physiology
- Scientific Foundations

Chemistry
- Forensic Science

Earth and Environmental Sciences
- Applied Techniques & Data Analysis in Geoscience
- Climate Change
- Geospatial Technology
- Humans and the Environment
- Science Education

Mathematical Sciences
- Geometry and Topology
- Mathematical Analysis
- Mathematical Sciences

- Statistics

Physics
- Mathematical Physics
- Molecular Physics
- Quantum Science

Psychology
- Psychology of Teaching
- Statistics for Social & Behavioral Sciences
- Diversity Science and Health Equity

Graduate Program Admissions

- Biology
- Chemistry
- Earth and Environmental Sciences
- Forensic and Investigative Sciences
- Mathematics
- Physics
- Psychology

Biology, M.S. and Ph.D.

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, and Mathematics.

A minimum graduation grade-point index of 3.00 or equivalent is required for unconditional admission. An undergraduate GPA of 3.00 or higher does not guarantee admission. Applicants with GPAs of 3.00 or slightly above will be expected to have a science course GPA of 3.00.

Transfer Students

Transfer credits from other institutions of higher learning cannot be used to replace the minimum of 9 hours of Biology Department course work required for the M.S. thesis degree. Up to 12 hours of Biology graduate credits taken at IU Indianapolis by graduate non-degree students may be transferred to the non-thesis option. At least half of the coursework hours in a Ph.D. program of study must be taken while enrolled at IU Indianapolis.

Application Process

REMEMBER: ALL MATERIALS MUST BE SUMBITTED TO THE DEPARTMENT BEFORE THE GRADUATE COMMITTEE WILL REVIEW THE APPLICATION FILE.

Online Application

In the online application, please make sure you complete all sections. This includes the Personal Statement, Departmental Question, and Recommendations sections. It is helpful to include your name on all typed, uploaded documents.

In the Educational Objective Section, you must select: **Academic Objectives: Biology**

For the **Personal Statement:** Provide a statement (approximately 750 words) that identifies your academic goals, career objectives, why you are applying to this specific program, and the qualifications you have that make you a strong candidate for this program. For M.S. Thesis and Ph.D. applicants, identify at least one faculty member with whom you would be interested in working.

In the **Departmental Question** section, you must specify which program you are pursuing. The choices are as follows: Pre-Professional Non-Thesis, M.S. Non-Thesis, M.S. Thesis, and Ph.D. Simply write a sentence saying "I am applying for the .... program." and upload it.

The last step before submitting an on-line application is the application fee. ***You must pay this fee in order to submit your application.***

IMPORTANT NOTE: An email will be sent to you when our department receives your complete application. If you do not receive an application submission email within 3-4 weeks, please email or call to verify that we have it. We have several students who mistakenly select the wrong Academic Objective and their application goes to another department. It is important to check your email to verify we received your application. If your application is misdirected, it can be easily switched over to our department.

Letters of Recommendation

At least 2 letters should come from professors in previous science courses and should address the applicant's aptitude and potential in a science program at the graduate level.

The preferred method is using the online section within the application. If you have a person who does not wish to fill out the recommendation online, that individual may write a standard letter and mail it to the department. They can also include an optional recommendation form, but it is NOT required. You may call the Department of Biology at (317) 274-0577, or e-mail biograd@iu.edu, with your address to have the optional form mailed to you. We also accept "committee packets" that universities put together for their students.

Official Transcripts

Send two (2) official copies of transcripts from all attended institutions (including any IU campus) directly to the Biology Department:

IU Indianapolis Biology Department

ATTN: Graduate Secretary

723 West Michigan Street, SL 306
Indianapolis, IN 46202

Official GRE and TOEFL Scores

(TOEFL scores are for international students only)*

The GRE and/or subject tests are not required for Ph.D. and Thesis M.S. applicants. However, if submitted, the results are added to the applicant's file for consideration.

Only non-thesis M.S. applicants are required to take the Graduate Record Examination** (GRE) General test. Minimal score requirements for new GRE tests are as follows:

A combined GRE score of 295 for the verbal and quantitative sections

- Verbal score of 146 or greater
- Quantitative score of 145 or greater
- 5 score on the analytical portion of the test

MCAT or DAT scores will be considered ONLY for the Pre-Professional Non-Thesis M.S. program. An MCAT combined total score of 497 or greater (new test) taken within the last 3 years can be submitted or a DAT total

score of 17 or greater, taken within the last 3 years can be submitted.

GRE and TOEFL codes: IU Indianapolis = 1325, Biology Department = 0203

*Test of English as a Foreign Language (TOEFL) with a minimum score of 80 (out of 120) is required. Moreover, minimum scores for specific sections are as follows: Writing – 18; Speaking – 22; Listening – 16; Reading – 19. **To find testing sites or to find scores, visit the ETS website here.

Application Deadlines

Ph.D.: Priority deadline is December 15, although applications may be submitted through January 31. After January, please contact the Director of Graduate Studies (Dr. Lata Balakrishnan or email biograd@iu.edu).

M.S. Thesis (full time with support): March 1 for Fall entry or October 1 for Spring entry

Pre-Professional Non-Thesis and M.S. Non-Thesis: August 1 for Fall entry or December 1 for Spring entry

Chemistry, M.S. and Ph.D.

Applications for full-time study should be completed by January 15th for entry the following fall semester to ensure complete consideration for fellowships and other financial support.

Late applications will be considered only if full-time positions are available. Applications for part-time graduate admission may be submitted up to two months prior to the intended starting date.

University Code: 1325

Application Process

Graduate Application Form: Complete the application online using the Online University Application.

Letters of Recommendation: We require three letters of recommendation from people familiar with you and your student and/or professional career. Your references will receive an automatic notification of a request for a letter of recommendation when you submit your application. Letters on letterhead are also acceptable and should be addressed to Graduate Admissions, c/o Department of Chemistry and Chemical Biology.

Transcripts: One original copy of the official transcript(s) of all previous university work is required. All degrees awarded should be documented. A list of university courses and their titles that do not appear on the transcript(s) should also be sent to us.

GRE: All students are required to take the Graduate Record Examination general test. Please have the documentation of your score mailed directly to us from Educational Testing Service.

TOEFL: Foreign students must take the TOEFL or IELTS. The minimum scores required for admission are 80 (with subscores of 19-reading, 16-listening, 22-speaking, and 18-writing) for the TOEFL internet-based test. or 6.5 (ELTS),

Application Fee: An application fee will be charged which may be paid by credit or debit card.

Fellowships & Assistantships: Fall semester deadline to be considered for a Fellowship or a Teaching Assistantship is January 15th. In addition, University Fellowships are available.

Letters of recommendation and transcripts should be mailed to:

Graduate Admissions Committee

Department of Chemistry and Chemical Biology

Indiana University Indianapolis

402 North Blackford Street, LD 326
Indianapolis, IN 46202-3274

Graduate Continuing Non-Degree (GND) Students

Graduate Continuing Non-Degree (GND) students who wish to enroll in courses, though not necessarily in a degree program, should contact the IU Graduate School Indianapolis. Students should be aware that no more than 12 credit hours earned as a non-degree student may be counted toward a degree program.

Earth and Environmental Sciences

Ph.D. in Applied Earth Sciences

The Ph.D. program prepares students for academic positions or research and leadership positions in local, state, national, or private environmental organizations. The goal of the program is to prepare future researchers and leaders who assess complex environmental systems and assist in providing sound options and solutions for optimizing human-environment interactions.

To apply, fill out the Online Application Form provided by the IU Graduate School Indianapolis.

NOTE: The suggested application submission date is January 15th. Submission in mid-January maximizes the prospective student's opportunity to receive financial aid.

Master of Science in Geology

The IU Indianapolis graduate program in Geology leads to a Master of Science degree from Indiana University. We offer a thesis and non-thesis option; however, typically only thesis-option students are considered for funding. Our thesis option requires 21 - 24 credit hours of graduate level courses and 6 - 9 credit hours of a research thesis. Our non-thesis option requires 33 credit hours of graduate level coursework and 3 credit hours of a research project. See Requirements of MS Degree for more details.

To apply, fill out the Online Application Form provided by the IU Graduate School Indianapolis.

NOTE: The suggested application submission date is January 15th. Submission in mid-January maximizes the prospective student's opportunity to receive financial aid. However, the Department of Earth and Environmental Sciences will consider applications for admission throughout the year.

FIS MS Program Details

The M.S. Program in Forensic Science, which awards an Indiana University degree, requires 30 credit hours of study beyond the baccalaureate level. It is designed for students seeking careers as professional forensic scientists who desire employment in the criminal justice field or a related area. There are two ways to complete the

M.S., the thesis M.S. or the non-thesis, accelerated MS. The M.S. Thesis Program is FEPAC-accredited.

The **admission requirements** are as follows:

- A Bachelor's degree from an accredited institution in the physical or life sciences including chemistry, biology, forensic science, pharmacology/toxicology, or a related science
- A minimum GPA of 3.00 for all undergraduate work

The program will serve full-time students who meet the above requirements. The non-thesis program can accommodate part-time students as well.

Students must apply in one of the following concentrations: forensic biology or forensic chemistry. All students take a core of required courses which include an overview of crime scene investigation, professional issues course, and a law course. Each concentration contains specific required courses taken by students in that concentration.

The full-time thesis M.S. program consists of 30 semester credit hours. It is anticipated that the program will be completed within two years. The thesis program requires 18 credit hours of course work and 12 credit hours of thesis completion and defense (research). Students who desire a non-thesis M.S. degree (full- or part-time) must complete 30 credit hours of coursework approved by the department and it is expected the program will be completed within 12 calendar months for full-time students. This may include up to six credits of internship.

How to Apply for the Full-Time Thesis M.S.

Application to the program can be done completely online. Information about the online application can be found here.

You will be directed to create an account to begin your application. The application can be filled out in stages and saved along the way so you can return to it later. The eApp has provisions for uploading your personal statement, supplemental questions, and listing contact names for two letters of recommendation. These people will automatically be emailed and asked to input their letters of recommendation. These people will automatically be emailed and asked to input their letters of recommendation.

Please arrange for your previous academic institutions to send official, sealed transcripts to FIS Graduate Admissions, 402 N. Blackford St., LD 326, Indianapolis, IN 46202. International applicants will need to provide transcripts in both native language and English, as well as a certificate of diploma. The Forensic and Investigative Sciences Program accepts applications once a year for beginning matriculation in the Fall semester. The deadline for applying to the program is **December 15** of the year you wish to start. Applications must be complete by **December 15** or they will not be considered. Applicants must submit the following:

1. The completed application which will also require
    - Two letters of recommendation. These would normally be from professors who can evaluate your ability to successfully complete graduate work in forensic science
    - A personal statement that discusses your educational and work background, interest and experience (if any) in forensic science, and research interests if you are full time. Supplemental questions requests information about which degree (thesis or non-thesis) and track (forensic biology or forensic chemistry) is applied for along with requiring a list of relevant coursework.
2. Official final transcripts from all higher education institutions that you attended.

Applications are not normally considered on a rolling basis. They are generally considered en masse after the December 15th deadline. You will be notified within a few weeks after the decision is made. If your application is not successful for the thesis program, it will be automatically considered for the non-thesis program.

How to Apply for the Non-Thesis M.S.

Application to the program can be done completely online. Information about the online application can be found here.

You will be directed to create an account to begin your application. The application can be filled out in stages and saved along the way so you can return to it later. The CAS system has provisions for uploading your personal statement, supplemental questions for, and listing contact names for two letters of recommendation. These people will automatically be emailed and asked to input their letters of recommendation.

The Forensic and Investigative Sciences Program review of applications will begin in late February and will continue on a rolling basis until the **March 15** deadline. Applications received after March 15 will be considered if positions are available. Applications will also be considered for the Spring term if there is availability (completed applications by October 1).

Applicants must submit the following:

1. The completed application which will also require
    - Two letters of recommendation. These would normally be from professors who can evaluate your ability to successfully complete graduate work in forensic science.
    - A personal statement that discusses your educational and work background, interest and experience (if any) in forensic science, and research interests if you are full time. Supplemental questions requests information about which degree (thesis or non-thesis) and track (forensic biology or forensic chemistry) is applied for along with requiring a list of relevant coursework.
2. Official final transcripts from all higher education institutions that you attended.

Mathematics

Master of Science in Mathematics (M.S.)

Master of Science in Computational Data Science (M.S.)

Doctor of Philosophy in Biostatistics (Ph.D.)
Doctor of Philosophy in Mathematics (Ph.D.)

MS in Mathematics
Application Process

1. IU Indianapolis online application
2. A statement of personal and professional goals (300-500 words) should be submitted as part of the online application.
3. A resume or CV should be submitted as part of the online application.
4. Three letters of recommendation should be submitted through the online application.
5. Unofficial transcripts and evidence of degrees awarded from each post-secondary school attended are suitable for admission purposes. Following admission to IU Indianapolis, official documents must be submitted for verification. If the original documents are not in English, you must submit a certified translation of each official transcript and degree certificate. Notarized copies are NOT acceptable.
6. Demonstration of English proficiency*. All international applicants must demonstrate English proficiency for admission into IU Indianapolis graduate programs. Non-native English speaking domestic applicants may also be required to complete standardized testing depending on their English proficiency. English proficiency for admission purposes can be satisfied by one of the following options:
    1. TOEFL score report not more than two years old with the following minimum scores: TOEFL iBT Special Home Edition: Total score of **79,** or TOEFL Essentials: Total score of **8.**
    2. IELTS (International English Language Testing System) Indicator -Online: Overall Band Score of at least **6.5**.
    3. Duolingo English Test (DET): Minimum score of **110.**
    4. Complete Bachelor's degree or higher from the U.S. or other country where English is an official language or the predominant native language..
    5. Graduate from the IU Indianapolis Program for Intensive English: at least Level 7.
7. Non-waivable, non-refundable application fee for domestic and international applicants.
8. International Student Financial Information Form (For international students only)
9. Supplemental Question Form should be submitted as part of the online application.

*All English proficiency exams must be submitted before admission. Once a student is admitted, English proficiency exams or updated scores will not be accepted.

NOTE: All documents submitted become the property of IU Indianapolis. After one year of **no** enrollment, hard copies will be discarded.

Upon admission, send official transcripts and degree certifications to the following address:

Graduate Admissions Committee
IU Indianapolis Department of Mathematical Sciences
402 N. Blackford Street, LD 270
Indianapolis IN 46202-3216

Email: mathgrad@iu.edu
Phone: 1-317-274-6918
Fax: 1-317-274-3460

Admission Deadlines
Fall Semester

- International applicants: March 1
- Domestic applicants: May 1*

Spring Semester

- International applicants: October 1
- Domestic applicants: November 15*

Due to the schedule of course offerings, it is not always feasible to begin the program in Spring semesters. Email mathgrad@iu.edu for more information before applying for Spring admission.

- April 1**

*If you cannot provide all application materials by the date indicated above, we encourage you to apply to the Graduate Non-Degree program through the IU Graduate School Indianapolis. This program will allow you to take courses towards your intended degree program, and you may transfer up to 12 credit hours into the M.S. program, subject to graduate committee approval. Email mathgrad@iu.edu for more information.

**This deadline applies for an M.S. Math Education major only. Due to schedule of course offerings, it is not always feasible to begin the program in the Summer semester (with the exception of math education). Email mathgrad@iu.edu for more information before applying for Summer admission (unless you are math education).

MS in Computational Data Science

Prerequisite coursework and/or degrees: Qualified applicants must have a 4-year Bachelor's degree in Computer Science, Mathematics, Data Science, Statistics, Engineering, or related fields. Applicants with a 4-year Bachelor's degree in any other area of study will be evaluated on a case-by-case basis, based on the coursework and corresponding grades in the applicant's transcripts, as well as on the overall potential of successfully completing this program.

Generally, applicants are expected to have completed, with at least a grade of B, the following prerequisite courses: Calculus sequence including Multivariate Calculus, Linear Algebra, Probability, Statistics, and Data Structures. An applicant who has not taken one of these advanced courses may be considered for conditional admission and be required to enroll in the prerequisite course in their first semester of the program.

GPA: Applicants are expected to have a minimum cumulative grade point average (GPA) equivalent to at least 3.00 on a 4.00 scale.

International applicants are required to demonstrate proof of English proficiency as described below.

Application Process

1. IU Indianapolis online application

2. A statement of personal and professional goals (300-500 words) should be submitted as part of the online application.
3. A resume or CV should be submitted as part of the online application.
4. Three letters of recommendation should be submitted through the online application.
5. Unofficial transcripts and evidence of degrees awarded from each post-secondary school attended are suitable for admissions purposes. Following admission to IU Indianapolis, official documents must be submitted for verification. If the original documents are not in English, you must submit a certified translation of each official transcript and degree certificate. Notarized copies are NOT acceptable.
6. Demonstration of English proficiency*: All international applicants must demonstrate English proficiency for admission into IU Indianapolis graduate programs. Non-native English-speaking domestic applicants may also be required to complete standardized testing depend on their English proficiency. English proficiency for admission purposes can be satisfied by one of the following options:
    1. TOEFL score report not more than two years old with the following minimum scores: TOEFL iBT Special Home Edition: Total score of **79,** or TOEFL Essentials: Total score of **8.**
    2. IELTS (International English Language Testing System) Indicator -Online: Overall Band Score of at least **6.5**.
    3. Duolingo English Test (DET): Minimum score of **110.**
    4. Completed Bachelor's degree or higher from the U.S. or other country where English is an official language or the predominant native language.
    5. Graduate from the IU Indianapolis Program for Intensive English: at least Level 7.
7. Non-waivable, non-refundable application fee for domestic and international applicants.
8. International Student Financial Information Form (for international students only).
9. Supplemental Question Form should be submitted as part of the online application.

*All English proficiency exams must be submitted before admissions. Once a student is admitted, English proficiency exams or updated scores will not be accepted.

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Upon admission, send official transcripts and degree certifications to the following address:

Graduate Admissions Committee
IU Indianapolis Department of Mathematical Sciences
402 N. Blackford Street, LD 270
Indianapolis IN 46202-3216

Email: mathgrad@iu.edu
Phone: 1-317-274-6918
Fax: 1-317-274-3460

Admission Deadlines

Fall Semester

- International applicants: March 1
- Domestic applicants: May 1*

Spring Semester

- International applicants: October 1
- Domestic applicants: November 15*

Due to schedule of course offerings, it is not always feasible to begin the program in the Spring semester. Email mathgrad@iu.edu for more information before applying for Spring admission.

*If you cannot provide all application materials by the date indicated above, we encourage you to apply to the Graduate Non-Degree program through the IU Graduate School Indianapolis. This program will allow you to take courses towards your intended degree program, and you may transfer up to 12 credit hours into the M.S. program, subject to graduate committee approval. Email mathgrad@iu.edu for more information.

Ph.D. in Biostatistics

The Ph.D. in Biostatistics is offered jointly with the Department of Biostatistics and Health Data Science of the Indiana University Fairbanks School of Public Health (FSPB), which administrate this program. It combines the statistical theory and modeling strengths of our Department of Mathematical Sciences with the exceptional biostatistical methods research, health sciences applications, and public health experience of the FSPB's department of biostatistics.

Admission Requirements

Applications are invited from individuals with strong quantitative and analytical skills and a strong interest in biological, medical and/or health related sciences. Any applicant who has a bachelor's or master's degree from an accredited institution and shows promise for successfully completing all the degree requirements will be considered for admission to this PhD program.

This program requires completion of at least 90 credit hours of graduate work and can be completed on either a full-time or part-time basis. A maximum of 30 credit hours completed in either a previous degree program, or in graduate non-degree status, may contribute towards this requirement, subject to program approval. However, transfer of credit hours completed in graduate non-degree status is limited to no more than 12. All course grades must be a B or higher in order to be considered for transfer into the program.

In addition to satisfying general Indiana University Graduate School requirements for admission, applicants must have at least a B (3.00 GPA) average in courses taken during the last two years of their earlier degree studies, and a grade of B+ (3.50 GPA) in courses required as prerequisites for the program.

Students entering this program should have a minimal mathematics background consisting of an undergraduate course sequence in univariate and multivariate calculus (equivalent to MATH-I 165, MATH-I 166 and MATH-I 261 at IU Indianapolis) and a course in linear algebra (including matrix theory). In addition, applicants should have had a calculus-based undergraduate level course in probability or statistics. Prospective applicants who do not

have this background must acquire it prior to admission to the program.

Those whose native language is not English must also take the Test of English as a Foreign Language (TOEFL) and achieve a score of 570 (or 230 on the computer version of the test, or 79 on the internet-based test). Final admission decisions will be made by the faculty admission committee.

Application Process

All application should be submitted though the Centralized Application Service of the Association of Schools and Programs of Public Health (ASPPH). A statement of personal and professional goals (approximately 750 words). This can be submitted as part of the online application or sent directly to the department.

A resume or CV.

GRE scores are not required for admission unless you are applying to the program as a full-time **funded** student, in which case you are strongly encourage to submit your current GRE scores.

Three letters of recommendation.

Official transcripts and evidence of degrees awarded from each post-secondary school attended.

Non-native speakers of English must provide proof of English proficiency. See the IUI Office of International Affairs English Language Requirements for details.

For additional information click here.

NOTE: All documents submitted become property of IU Indianapolis. After one year of **no** enrollment, hard copies will be discarded.

Admission Deadlines

Fall Semester

- Priority Application: December 15
- All Applications: February 1

Applications are considered for Fall entry only; application entries for Spring (January) and Summer (June) will not be considered. However, any prospective applicant who would like to start taking classes during a Spring or Summer session is welcome to do so as a graduate non-degree student. A separate application is required see here for additional information.

Ph.D. in Mathematics

Admission Requirements

Applications are invited from individuals with a strong background in mathematics who either have an M.S. in mathematics or have been admitted to our combined M.S.-Ph.D. program. The Ph.D. in Mathematics requires completion of at least 90 credit hours of graduate work. An awarded M.S. degree from an accredited university may contribute up to 30 credit hours toward this requirement, subject to approval. If an applicant does not hold an awarded M.S. degree, up to 12 credit hours of graduate work from an accredited university may be transferred toward the Ph.D. degree.

Application Process

1. IU Indianapolis online application
2. A statement of personal and professional goals (300-500 words) should be submitted as part of the online application.
3. A resume or CV should be submitted as part of the online application.
4. Three letters of recommendation should be submitted through the online application.
5. Unofficial transcripts and evidence of degrees awarded from each post-secondary school attended are suitable for admissions purposes. Following admission to IU Indianapolis, official documents must be submitted for verification. If the original documents are not in English, you must submit a certified translation of each official transcript and degree certificate. Notarized copies are NOT acceptable.
6. Demonstration of English proficiency*: All international applicants must demonstrate English proficiency for admission into IU Indianapolis graduate programs.#Non-native English-speaking domestic applicants may also be required to complete standardized testing depend on their English proficiency.
   English proficiency for admission purposes can be satisfied by one of the following options:
   1. TOEFL score report not more than two years old with the following minimum scores: TOEFL iBT Special Home Edition: Total score of **79,** or TOEFL Essentials: Total score of **8.**
   2. IELTS (International English Language Testing System) Indicator-Online: Overall Band Score of at least **5**.
   3. Duolingo English Test (DET): Minimum score of **110.**
   4. Completed Bachelor's degree or higher from the U.S. or other country where English is an official language or the predominant native language.
   5. Graduate from the IU Indianapolis Program for Intensive English: at least Level 7.
7. Non-waivable, non-refundable application fee for domestic and international applicants.
8. International Student Financial Information Form (For international students only; review all required forms: click here).
9. Supplemental Question Form should be submitted as part of the online application.

*All English proficiency exams must be submitted before admissions. Once a student is admitted, English proficiency exams or updated scores will not be accepted.

NOTE: All documents submitted become the property of IU Indianapolis. After one year of **no** enrollment, hard copies will be discarded.

Upon admission, send official transcripts and degree certifications to the following address:

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Indianapolis IN 46202-3216

Email: mathgrad@iu.edu
Phone: 1-317-274-6918
Fax: 1-317-274-3460

Admission Deadlines

Fall Semester

- Domestic and International applicants: February 1

Spring Semester

- International applicants: October 1
- Domestic applicants: November 15

Due to schedule of course offerings, it is not always feasible to begin the program in the Spring semester. Email mathgrad@iu.edu for more information before applying for Spring admission.

Physics, M.S. and Ph.D.

Students seeking to enroll in the physics graduate programs should have a background in the usual undergraduate courses in physics, mathematics and other sciences. Graduates from related fields of study in pure and applied sciences, and engineering, may be accepted on a probationary basis until they have completed any necessary undergraduate courses in physics.

Letters of Recommendation: We require three letters of recommendation from people familiar with the applicant's academic and/or professional performance. (See Letters of recommendation.)

Transcripts: An original copy of the official transcript(s) from all previously attended university programs is required. All degrees awarded should be documented. A list of university courses and their titles that do not appear on the transcript(s) should also be sent to us.

GRE: The Graduate Record Examination general test and physics subject tests are not required but they are strongly encouraged. The documentation of your official GRE score(s) must be sent directly to us by the Educational Testing Service.

TOEFL: International students must take the TOEFL or IELTS. The minimum scores required for admission are 79 (TOEFL internet-based test, (with partial minima of 18 in speaking, 18 in writing, 14 in listening, and 19 in reading)); 213 (TOEFL computer-based test); or 6.5 (IELTS).

Physics Placement Test: A placement test will be given to all new students in the week before the start of their first semester in our program. The purpose of the test is to identify problem areas in physics and mathematics and to decide a plan of study for each student. A second test might be given in the second semester on a case-by-case basis.

Online Application: Please be sure to complete the Supplemental Questions section by answering the questions about your motivation, skills, and interest in physics and physics research. Also note the specific area of Physics that interests you. Apply now.

Application Fee: An application fee will be charged which may be paid by credit or debit card.

Fellowships & Assistantship: Please make sure you submit the application package in a timely manner to be considered for Fellowships and Assistantships offered at the Department and Campus level. If you have any doubt about the timing, please contact physics@iu.edu.

Note: The application deadline to receive full consideration for Financial Aid is January 15 for the fall semester and July 15 for the spring semester.

Director of Graduate Programs

Department of Physics

IU Indianapolis School of Science

402 N. Blackford St., LD 154
Indianapolis IN 46202-3273

Psychology

All applicants must have a bachelor's degree from an accredited institution. A master's degree is not required for admission into the Ph.D. programs.

Applicants must:

- submit three (3) letters of recommendation,
- submit a personal statement, and
- provide official transcripts (2 copies) of past academic work.

The Graduate Record Examination (GRE) is optional for applicants to the Addiction Neuroscience, Applied Social and Organizational Psychology, Industrial/Organizational Psychology, and Clinical Psychology programs.

Application Deadlines

- Clinical Psychology Ph.D.: December 1
- Addiction Neuroscience Ph.D.: December 1
- Applied Social and Organizational Psychology, Ph.D.: December 15
- Industrial/Organizational Psychology M.S.: February 1

Online Applications

Applications are completed online, and additional information is available on the Department of Psychology website. Call **317-274-6945** or email gradpsy@iu.edu for additional information.

Apply to the Graduate Program

Addiction Neuroscience Ph.D.

Admission Requirements

Addiction Neuroscience Ph.D.

All application materials must be submitted by December 1.

Admitted Students enter the program beginning in the Fall semester. The Addiction Neuroscience (AN) program is designed for full-time students only.

Application Materials

1. Apply online
2. A minimum undergraduate GPA (grade point average) of 3.20*
3. A personal statement expressing interest in addiction neuroscience and detailing any relevant research experience.
4. Three (3) letters of recommendation ideally from faculty or others who can speak to the applicant's preparation for graduate level work in addiction neuroscience.

5. Two (2) official transcripts of all undergraduate and graduate coursework.
6. International students must submit TOEFL (Test of English as a Foreign Language) scores unless the student has a bachelor's degree from a predominantly English-speaking country (check here for the official list).
7. Verbal and Quantitative Graduate Record Examination (GRE) scores are optional.

*Majors in the life sciences (psychology, biology, or chemistry) are particularly encouraged to apply, but other degrees will be given full consideration with appropriate course work. Academic preparation and performance in the life sciences (e.g., experimental psychology and behavioral neuroscience, cell and systems biology, or chemistry) are given high priority in considering candidates for admission. Note that the candidate's entire application package will be reviewed as a comprehensive and holistic representation of the likelihood for success in graduate studies; no one part of the application materials is deemed "most important."

Women and/or minority applicants are strongly encouraged to apply.

Financial support is typically provided to all students in good standing.

For more information about the program, contact Dr. Cristine Czachowski (cczachow@iu.edu@.

Applied Social and Organizational Psychology Ph.D.

PROGRAM Hiatus: The ASOP program is currently on hiatus and will not be admitting students for the next cycle.

Admission Requirements

Applied Social and Organizational Psychology Ph.D.

Admitted students enter the program beginning in the Fall semester. The Applied Social and Organizational Psychology (ASOP) program is designed for full-time students only.

All application materials must be submitted by December 15.

Application Materials

1. A graduate school application that can be electronically submitted
2. A full set of undergraduate and graduate transcripts
3. Three (3) letters of recommendation
4. International students must submit TOEFL (Test of English as a Foreign Language) scores *unless* the student has a bachelor's degree from a predominantly English-speaking country (check here for the official list).
5. A personal statement
6. Departmental questions

Admission Requirements

- A bachelor's degree in psychology from an accredited institution is highly desirable, but applicants with a bachelor's degree in a similar area with coursework in social science statistics and research methods will be considered. Applicants with graduate degrees (preferably in psychology or a related social science field) will also be considered.
- An undergraduate and graduate GPA (grade point average) of 3.20 or higher on a 4-point scale.
- Three (3) favorable letters of recommendation, ideally from faculty or others who can speak to the applicant's preparation for graduate level work in psychology. The recommendation form must be attached to all reference letters and may be submitted by the recommenders through the online application.
- A personal statement expressing an interest in applied social and organizational psychology.
- Relevant research experience, preferably in psychology or a related social science.

Clinical Psychology Ph.D.

Students will be admitted to the program only at the beginning of the Fall Semester. The Clinical Psychology program is designed for full#time students only.

All application materials must be submitted by December 1.

Application Materials

1. A graduate school application
2. A full set of undergraduate and graduate transcripts
3. Three (3) letters of recommendation
4. Personal statement
5. Departmental questions
6. Curriculum vitae
7. GRE (Graduate Record Examination) scores optional
8. International applicants must submit TOEFL (Test of English as a Foreign Language) scores *unless* the applicant has a bachelor's degree from a predominantly English-speaking country (check here for the official list).

Admission Requirements

- Bachelor’s degree from an accredited institution
- An undergraduate and graduate GPA (grade point average) of 3.20 or higher on a 4-point scale
- At least 15 credit hours in psychology
- Three (3) favorable letters of recommendation. The recommendation form must be attached to all reference letters and may be submitted by the recommenders through the online application.
- A personal statement displaying an interest in the field of clinical psychology with a focus in clinical health psychology, diversity science, and/or dual diagnosis (i.e., severe mental illness/psychiatric rehabilitation and substance use)

Undergraduate Prerequisites

Except in unusual circumstances, students admitted to the program are expected to have completed at least 15 credit hours in psychology. Although there are no specific undergraduate course prerequisites for program entry, students without coursework in research methods, statistics, and abnormal psychology will likely be at a disadvantage when taking some of the required courses and may be asked by their instructors to complete some remedial activity prior to enrolling in the graduate course (e.g., reading an undergraduate text or taking an undergraduate course).

Industrial/Organizational Psychology M.S. Admission Requirements

All applicants must have a bachelor's degree from an accredited institution. Admitted students enter the program beginning in the Fall semester. The Industrial/Organizational (I/O) Psychology program is designed for full-time students only.

All application materials must be submitted by February 1.

1. Apply online
2. Students must have an undergraduate GPA (grade point average) of at least 3.00 on a 4-point scale
3. Three (3) strong letters of recommendation ideally from faculty or others who can speak to the applicant's preparation for graduate level work in psychology.
4. A personal statement expressing an interest in industrial/organizational psychology.
5. Two (2) official transcripts of all undergraduate and graduate coursework.
6. International students must submit TOEFL (Test of English as a Foreign Language) scores unless the student has a bachelor's degree from a predominantly English-speaking country (check here for the official list).
7. Relevant research experience, preferably in psychology or a related social science.

Student Learning Outcomes

- Addiction Neuroscience
- Applied Social and Organizational Psychology
- Biology
- Chemistry
- Clinical Psychology
- Computer and Information Science
- Forensic and Investigative Sciences
- Geology
- Industrial Organizational Psychology
- Mathematics
- Physics

Biology

Master of Science in Biology (M.S.)

Students pursuing the Biology Pre-Professional M.S. will be able to:

1. Integrate biological knowledge and information incorporating cellular, molecular, genetic, physiological, and biochemical approaches.
2. Use critical thinking to access, analyze and evaluate information relevant to the study of biological sciences.
3. Develop proficiency in reading, interpreting, and evaluating primary scientific literature.
4. Summarize and present scientific ideas and biological information in a formal setting, in writing and orally, to faculty or fellow students.

Students pursuing the Biology Thesis M.S. will be able to:

1. Conduct independent research under the supervision of a research advisor to design, test, and analyze original laboratory and/or field experiments.
2. Demonstrate the ability to read, interpret, and incorporate the results of primary literature into the research design.
3. Employ rigorous approaches to data collection, replication of experimental results, set up of experimental controls and sampling design, and organization of raw data.
4. Summarize, describe and analyze patterns in data, interpret results and draw conclusions from data to defend an argument.
5. Present and communicate research results to peers through a poster presentation, research seminar and/or publication of results.
6. Write and defend a thesis that demonstrates mastery in at least one discipline of biological sciences.

Master of Arts for Teachers (MAT) (M.S.)

Students pursuing the Biology M.S. for Teachers will:

1. Gain the ability to break down and analyze biological concepts for an undergraduate audience
2. Gain the ability to develop and analyze hypotheses and experiments
3. Gain a fluency with scientific literature
4. Gain a richer understanding of biology in the natural world around us

Doctor of Philosophy in Biology (Ph.D.)

In addition to the above outcomes, students completing the Ph.D. in Biology will be able to:

1. Demonstrate a comprehensive knowledge in biological sciences through successful completion of a qualifying and preliminary examination.
2. Document an original contribution to biology through independent experimental design, peer-reviewed publication of results, and presentation and defense of a thesis.

Graduate Certificate in Biology

Students pursuing the Graduate Certificate in Biology will:

1. Gain the ability to break down and analyze biological concepts for an undergraduate audience
2. Gain the ability to develop and analyze hypotheses and experiments
3. Gain a fluency with scientific literature
4. Gain a richer understanding of biology in the natural world around us

Chemistry

Master of Science in Chemistry (M.S.)

In addition to the stated SLOs for B.A. and B.S. students, those who graduate with a M.S. in Chemistry will be expected to:

1. Demonstrate increased depth of understanding in most sub-disciplines of chemistry.
2. Integrate sub-disciplines of chemistry and other disciplines as applicable in problem solving and research.
3. Read and understand peer-reviewed chemical literature and apply in field of study.

4. Present and communicate results to peers through poster, seminar, and/or publishing.
5. Identify chemical problems and design experiments to solve these problems.
6. Teach effectively in labs or recitations in lower-level undergraduate chemistry courses.
7. For thesis MS, propose major area of research and conduct independent research under the mentoring of a research advisor.
8. For thesis MS, write and defend the thesis.

Doctor of Philosophy in Chemistry (Ph.D.)

In addition to the above learning outcomes for the M.S. degree, Chemistry Ph.D. students upon graduation will be expected to:

1. Think critically and creatively.
2. Propose original research project and conduct this research independently, including project design, analysis, and conclusion.
3. Demonstrate mastery of chemistry in at least one discipline of chemistry.
4. Communicate and defend scholarly works.

FIS MS Program SLOs

Master of Science in Forensic and Investigative Sciences (M.S.)

After completing the MS in Forensic and Investigative Sciences, students will be able to:

1. Generalize the forensic science system in the United States:
    - Students will be proficient in analyzing and integrating the multifaceted components of the forensic science system in the United States, spanning crime scene investigation, crime laboratories, organizational structures, specialized disciplines, and the preparation required for a career in forensic science.
2. Identify common pattern evidence in forensic science:
    - Students will deconstruct and model the examination of patterned evidence, such as fingerprints, tool marks, physical matches, and firearms, showcasing a deep understanding of the appropriate analytical techniques used for these types of evidence.
3. Summarize and demonstrate the use of ethics, bias, criminal and civil laws, rules of evidence, and expert testimony:
    - Students will evaluate and relate the application of ethics, bias considerations, criminal and civil laws, rules of evidence, and expert testimony in the practice of forensic science, demonstrating their critical understanding of these crucial elements.
4. Interpret the use of chemical and instrumental techniques in forensic analysis:
    - Students will critically critique and defend the application of chemical and instrumental techniques in forensic analysis, specifically examining common chemical evidence like illicit drugs, fire residue, explosives, inks, and paint.
5. Identify and analyze forensic biological evidence:
    - Students will engage in a discriminative analysis of diverse biological evidence types, including bodily fluids and blood spatter, and then synthesize and integrate these analyses, culminating in the interpretation of DNA profiles by applying advanced principles of population genetics.
6. Conduct a literature review of a current forensic science topic:
    - Students will generate and structure a comprehensive literature review on a contemporary forensic science topic and present their findings professionally.

Geology

Broad Earth and Environmental Sciences Graduate Program Goals

Upon graduating, students with a graduate degree (M.S. in Geology or Ph.D. in Applied Earth Sciences) will:

- Broadly understand and explain the significance of major research questions in one or more areas of earth sciences.
- Formulate testable scientific hypotheses.
- Carry out independent research in one or more subfields of earth sciences, using appropriate field, experimental, analytical, and/or computational methods.
- Describe, synthesize, and interpret the results of a scientific investigation orally and in writing.

Student Learning Outcomes for the M.S. Degree Program

Students who graduate with an M.S. degree* will achieve the following objectives:

1. Demonstrate the ability to synthesize current research questions and approaches in one or more subfields of Earth Sciences by critical evaluation of primary scientific literature.
2. Write a research proposal that presents a testable hypothesis, outlines the types of data needed to test the hypothesis, and describes how the collected data will be used to test the hypothesis.
3. Devise and implement a field, experimental, analytical, and/or computational plan aimed at collecting and analyzing the data necessary to address a specific scientific question.
4. Communicate research results to peers via poster or oral presentation, or publication in peer-reviewed journals, meeting abstracts, and/or technical reports.
5. Write and defend their research results (orally or in poster format) to demonstrate mastery of the material and an ability to communicate the results and significance of their work.

**numbers 1-5 apply to thesis-option M.S. graduates. Number 1 applies to non-thesis option M.S. graduates.*

Student Learning Outcomes for the Ph.D. in Applied Earth Sciences

Students who graduate with a Ph.D. in Applied Earth Science will achieve the following objectives:

1. Conduct independent research under the supervision of a research advisor to design, test, and analyze the results of original laboratory and/or field experiments.
2. Demonstrate the ability to read, interpret, and incorporate the results of primary literature into the research design.
3. Employ rigorous approaches to sampling design and data collection, replication of experimental results, set up of experimental controls, and organization of raw data.
4. Summarize, describe and analyze patterns in data, interpret results and draw conclusions from data to defend or refute a hypothesis.
5. Demonstrate a comprehensive knowledge of applied earth sciences through successful completion of preliminary and qualifying examinations.
6. Document an original contribution to applied earth sciences through publication of peer-reviewed results, and presentation and defense of an original dissertation.

Mathematical Sciences

Master of Science in Mathematics (M.S.)

Degree concentrations include Applied Mathematics, Pure Mathematics, Applied Statistics, and Math Education. In addition to the Student Learning Outcomes for the B.S. degree, those who graduate with a M.S. degree in Mathematics will be able to:

1. Demonstrate increased depth of understanding in most sub-disciplines of mathematics.
2. Integrate sub-disciplines of mathematics and other disciplines as applicable in problem solving.
3. Read and understand peer-reviewed mathematical literature.
4. Identify mathematical problems and design solutions to solve these problems.

Master of Science in Mathematics - Applied Statistics Concentration (M.S.)

1. Demonstrate increased depth of understanding in most sub-disciplines of mathematics.
2. Integrate sub-disciplines of mathematics and other disciplines as applicable in problem solving.
3. Read and understand peer-reviewed mathematical literature.
4. Identify mathematical problems and design solutions to solve these problems.
5. Develop a deeper knowledge and competence in the area of applied statistics.

Master of Science in Mathematics Teaching (M.S.)

1. Develop an increased appreciation for higher mathematics
2. Learn about the sources and history of secondary mathematics
3. Learn about how abstract algebra forms the foundation for high school algebra and solving for the roots of an equation
4. Learn a deeper appreciation for mathematical analysis in order to be able to teach calculus effectively in the high school
5. Study alternate forms of geometry, including projective or hyperbolic geometry, in order to inform their teaching of proofs in high school geometry
6. Learn the art of probabilistic and statistical thinking
7. Depending on the students' interests, learn more about solving differential equations and applied mathematics
8. Study the logical foundations of mathematics in set theory or through construction and development of the number systems

Master of Science in Computational Data Science (M.S.)

1. Synthesize data analysis principles across the statistical and computer sciences in topics such as pattern analysis, prediction, and big data processing.
2. Construct data science algorithms, including derivation and programming implementation in a variety of languages and platforms (C++, Python, Java, SAS, R, Matlab).
3. Be able to assess new programming language trends in industry, by gaining solid background in computing and algorithmic thinking.
4. Differentiate the processes from "raw data to outcome," which spans from considering the domain-specific constraints and characteristics (e.g., static vs. sequence, sparsity, dimensionality, etc.) to efficient method implementation, as software with desired specifications.
5. Integrate advanced knowledge in a broad range of related topics, such as survival analysis in Computer Science.
6. Assess different solutions to specific data-specific problems.
7. Summarize state-of-the-art data science methods and applications in scientific project reports and software documentation.

Doctor of Philosophy in Mathematics (Ph.D.)

In addition to the Student Learning Outcomes for the M.S. degree, those who graduate with a Ph.D. degree in Mathematics will be able to:

1. Demonstrate a basic understanding of the fundamental ideas underlying the basic mathematical disciplines.
2. Demonstrate the ability to recognize significant research problems.
3. Demonstrate the ability to analyze problems, reach research solutions, and transmit the fundamental ideas to others.
4. Demonstrate a comprehensive knowledge in mathematical sciences through successful completion of a qualifying and preliminary examination.
5. Document an original contribution to mathematics through independent experimental design, peer-

reviewed publication of results, and presentation and defense of an original thesis.

Doctor of Philosophy in Biostatistics (Ph.D.)

In addition to the Student Learning Outcomes for the M.S. degree, those who graduate with a Ph.D. degree in Biostatistics will be able to:

1. Demonstrate a basic understanding of the fundamental ideas underlying the basic mathematical disciplines.
2. Demonstrate the ability to recognize significant research problems.
3. Demonstrate the ability to analyze problems, reach research solutions, and transmit the fundamental ideas to others.
4. Demonstrate a comprehensive knowledge in biostatistics through successful completion of a qualifying and preliminary examination.
5. Document an original contribution to biostatistics through independent experimental design, peer-reviewed publication of results, and presentation and defense of an original thesis.

Physics

Master of Science in Physics (M.S.)

Student will demonstrate the following learning outcomes:

1. Students demonstrate proficiency in the core areas of physics (Classical Mechanics, Electromagnetism, Thermal Physics and Quantum Physics), and have knowledge of math sufficient to perform the calculations needed to apply their knowledge (Linear Algebra, Ordinary and Partial Differential Equations, Vector Calculus).
2. The most important outcome of their Masters is an ability to carry out a research project under the supervision of a faculty member. Research includes written and verbal communication. The written portion is demonstrated in a thesis or report. The ability to communicate verbally is demonstrated during the first part of the defense, which is open to the public. It is not required but expected that students will present their research at scientific conferences.

The students' progress towards their M.S. degree is evaluated by their advisors and advisory committee.

Doctor of Philosophy in Physics (Ph.D.)

Students will demonstrate the following learning outcomes:

1. Students demonstrate expertise in core areas of physics (Electromagnetism, Thermal Physics and Quantum Physics), as well as in other areas associated specifically with their research and the area of their selected minor.
2. They demonstrate proficiency in widely used areas of mathematics (Linear Algebra, Ordinary and Partial Differential Equations, Vector Calculus) and in the use of advanced mathematical tools needed in their physics courses and their research.
3. The most important outcome of their Ph.D. is an ability to perform substantial independent research in collaboration with a faculty member. Their research culminates in an original project, written as a Thesis and defended in an examination, which has a public part and a meeting with the examination committee. It is also expected that the student's research findings are published in scientific journals.
4. Communication skills are emphasized throughout the Ph.D. program. During the program, students write reports as part of their graduate courses and need to demonstrate English proficiency as Teaching Assistants in recitations and instructional laboratories. In addition, Ph.D. students are required to present their research results at scientific conferences either in the form of oral or poster presentations. At the end of the program, the student's Ph.D. Thesis and examination establish the student’s ability to communicate verbally and in scientific writing at a high level. Students also write reports in their courses, they have to present their research results at conferences, and it is expected that they will publish their results in scientific journals.
5. Their ability of Ph.D. students to plan and design a research plan is evaluated at a Preliminary exam when, if successful, they are fully admitted into the Ph.D. program. Students in the Ph.D. program meet at least once a year with their advisory committee to report on their progress.

Doctor of Philosophy in Addiction Neuroscience (Ph.D.)

Graduate students earning an Indiana University Ph.D. in Addiction Neuroscience on the IU Indianapolis campus will demonstrate the following abilities related to the research focus of the degree:

1. Demonstrate knowledge of key concepts in the psychological and brain sciences, including the methods, history, and theoretical and empirical foundations, with special emphasis on the neuroscience of addiction.
2. Demonstrate the knowledge and skills necessary to conduct, analyze, interpret, and communicate original research and scholarship in behavioral neuroscience, particularly in addiction neuroscience.
3. Demonstrate understanding of the neural mechanisms and processes associated with the causes and consequences of substance abuse, including integration across genetic, neurobiological, developmental, and behavioral levels.
4. Think critically and creatively to solve problems and generate new knowledge in behavioral neuroscience in general, with focus on and application to problems of drug abuse and addiction.
5. Conduct research in the behavioral and addiction neurosciences in an ethical and responsible manner.

Master of Science (M.S.) and Doctor of Philosophy (Ph.D.) in Applied Social and Organizational Psychology

Students graduating with an Indiana University degree majoring in Applied Social and Organizational Psychology will be able to:

1. Demonstrate mastery of knowledge of the core content areas of *organizational psychology* (e.g., staffing, human resources and organizational development, work motivation, leadership, and group/team performance) and *applied social psychology* (e.g., attitudes and social cognition, social stigma, and managing a diverse workforce).
2. Apply the theory, methodologies, and data analytic procedures to conduct research on topics relevant to organizations and society.
3. Synthesize and critically evaluate psychological theory and research as they relate to human cognition, emotion, and behavior in social and organizational settings.
4. Apply skills related to the conceptualization, implementation, and evaluation of scientifically-based interventions intended to improve organizational functioning and provide evidence-based solutions to societal problems.
5. Communicate effectively to members of the field and to the general public.
6. Demonstrate awareness of, appreciation for, and interpersonal skills regarding human diversity.
7. Behave ethically and professionally in accordance with the American Psychological Association's Ethics Code in the conduct of research and in personal and professional settings.

Master of Science (M.S.) and Doctor of Philosophy (Ph.D.) in Clinical Psychology

Graduate students earning an Indiana University degree majoring in Clinical Psychology on the IU Indianapolis campus will demonstrate the following abilities:

1. Students will demonstrate knowledge in the breadth of scientific psychology, including historical perspectives of its foundations and development.
2. Students will demonstrate knowledge in the theory, methodology, and data analytic skills related to psychological research.
3. Students will demonstrate the ability to generate new scientific knowledge and theory related to the field of psychology.
4. Students will acquire knowledge and skills in the assessment of individual strengths and weaknesses, as well as the diagnosis of psychological problems and disorders.
5. Students will acquire knowledge and skills in the conceptualization, design, implementation, delivery, supervision, consultation, and evaluation of evidence-based psychological interventions for psychological problems and disorders.
6. Students will demonstrate sensitivity, knowledge, and skills in regard to the role of human diversity in the research and practice of clinical psychology.
7. Students will demonstrate a working knowledge of the APA Ethics Code and will demonstrate their ability to apply ethical principles in practical contexts.

Master of Science in Industrial/ Organizational Psychology (M.S.)

Students graduating with a M.S. in Industrial/ Organizational (I/O) Psychology will be able to:

1. Demonstrate mastery of knowledge of the historical foundations of I/O psychology and its core content areas: *personnel psychology* (e.g., selection, training, and performance management) and *organizational psychology* (e.g., motivation, leadership, job attitudes, and group/team performance).
2. Apply the theory, methodologies, and data analytic procedures to conduct research in organizational settings or on topics relevant to organizations.
3. Synthesize and critically evaluate psychological theory and research as they relate to human cognition, emotion, and behavior in organizations.
4. Apply skills related to the conceptualization, implementation, and evaluation of scientifically-based interventions intended to improve organizational functioning.
5. Communicate effectively to members of the field and to the general public.
6. Demonstrate awareness of, appreciation for, and interpersonal skills regarding human diversity.
7. Behave ethically and professionally in accordance with the American Psychological Association's Ethics Code in the conduct of research and in personal and professional settings.

Admission

All students entering the School of Science must have been officially admitted to the university by the IU Indianapolis Undergraduate Admissions Center, Campus Center, Room 255, 420 University Blvd., Indianapolis, IN 46202. Further information and application forms may be obtained at this address, by calling (317) 274-4591, or on the Web here.

Applicants should be aware that, under Indiana law, criminal convictions might result in ineligibility for admission to certain programs at IU Indianapolis. For the School of Science, criminal convictions may also result in ineligibility for enrollment in certain courses or participation in certain projects. Questions regarding school policy on such matters should be addressed to the Executive Director of Academic and Student Affairs or the Associate Dean for Academic Affairs.

International Students

International students seeking admission to the School of Science at IU Indianapolis must submit the international application for admission, which is available online from the IU Indianapolis Office of International Affairs. Additional information can be obtained at IU Indianapolis Office of International Affairs, 902 W. New York St., ES 2126 46202; phone (317) 274-7000; fax (317) 278-2213; email: oia@iu.edu.

Undergraduate Requirements

Beginning Students

Students entering IU Indianapolis directly from high school should file their applications for admission early in their senior year.

Acceptance to the university as a new student is influenced by several factors. The Undergraduate Admissions Center is guided by the following:

- The applicant should be a high school graduate or be scheduled to graduate before enrolling at IU Indianapolis.
- The extent to which the student meets or exceeds the minimum subject requirements indicated below is considered. For admission to the School of Science, the student's record should include the following course work:

Subjects	Semesters
English	8
History and Social Science	6
Algebra	4
Geometry	2
Trigonometry	1-2
Laboratory Science	6 (including biology and chemistry)
Combination of foreign language, additional mathematics, laboratory science, social science, or computer science courses	6-7

Applicants to the School of Science are strongly encouraged to complete AP science and mathematics courses if available at their high school. Applicants considering majors in chemistry, mathematics, or physics are encouraged to complete a calculus course in high school.

In planning high school electives, the curricula of the various departments of the School of Science contained in this bulletin should be reviewed. Departmental advisors will be glad to help with planning for admission.

There are two paths to direct admission for incoming high school students:

1. You have a high school GPA of 3.3 and can provide evidence of readiness for the first math course in your respective major.
2. You have a high school GPA of 3.0 with minimum SAT scores of 1080 (530 math) OR minimum ACT scores of 21 composite and 21 math.*

*Physics applicants need minimum SAT scores (for tests completed prior to March 2016) of 550 math and 480 verbal/critical reading math OR minimum ACT scores of 24 math and 20 verbal. Completion of the writing section is required. For comparable SAT scores for an SAT exam completed after March 2016, admission is based on minimum SAT scores of 570 math and a combined reading/math score of 1110.

The Undergraduate Admissions Center will examine the applicant's high school transcript and standardized test scores to determine both admission to the university and acceptance to the School of Science.

Students should declare a major when applying for admission so a departmental advisor can be assigned.

Transfer Students

From IU Indianapolis Schools and Indiana University Campuses

Prospective transfer students should have a minimum grade point average of 2.00 on a 4.00 scale, meet the requirements of the department or program they wish to enter, and be in good disciplinary standing. In order to be accepted for admission to the School of Science, students must first provide the materials indicated below.

- An IU Indianapolis campus student should file a record change online form. The form and information about the process may be found here.
- A student from another Indiana University campus, must make an official application through the IU Indianapolis Undergraduate Admissions Center using the Intercampus Transfer Application. Additional information is available here.

From Other Colleges and Universities

Students who have earned transfer credit for 12 credit hours and have a minimum cumulative grade point average of 2.00 on a 4.00 scale from other institutions may be considered for admission to the School of Science. Admittance to the school is contingent upon acceptance into a departmental program. Students should submit the following with their application for admission to the IU Indianapolis Undergraduate Admissions Center:

- a copy of their high school record showing satisfactory completion of entrance requirements; students with less than 26 hours of transfer work must present SAT or ACT scores.
- an official transcript of work completed in all institutions previously attended
- an official record of any AP test credit, military credit, PLTW credit, IB credit,or other college level credit earned while in high school
- evidence of good academic and disciplinary standing at the institution last attended

The Undergraduate Admissions Center evaluates credit from other institutions, and the major department and the School of Science determine its applicability toward degree requirements in the School of Science.

A marginal applicant may be granted admission, admitted on probation, or have admission denied.

From IU Indianapolis to Other Indiana University Campuses

Students transferring from IU Indianapolis to another Indiana University campus should consult the appropriate departments at that campus about equivalence of courses.

Transfer Credit Evaluation

The student's major department and the School of Science determine acceptability of transfer credits from another college or university to the School of Science. Often, a course description and/or a course syllabus are required to be reviewed by the corresponding IU Indianapolis department for consideration of applicability to a degree requirement.

Graduate and Doctoral Requirements

For Admission requirements please refer to the IU Graduate School Indianapolis.

Non-Degree Students

Undergraduate Non-Degree Program

Students who hold a bachelor's degree from IU Indianapolis or another university may register at IU Indianapolis as Undergraduate Non-Degree students. This enrollment status is desirable for students who need to take a small number of undergraduate courses in order to apply for medical school or other professional programs in, for example, dentistry, occupational therapy, optometry, pharmacy, physical therapy, and veterinary medicine. Students enrolled as undergraduate non-degree pay undergraduate tuition and fees, but may only register for undergraduate courses.

Undergraduate non-degree students who enroll in graduate courses may be administratively withdrawn from these courses and may forfeit tuition and associated fees. Undergraduate non-degree students may seek academic advising through the School of Science. Students enrolled as undergraduate non-degree are eligible for student loans only, provided they have not used up their undergraduate financial aid eligibility. They may also seek loans or support through banks or other financial institutions. Students enrolled as undergraduate non-degree are not eligible for other forms of financial aid through IU Indianapolis.

Graduate Non-Degree Program

Students who normally select the graduate non-degree classification are those whose intent is to take course work for personal enrichment. 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 graduate non-degree student. The major department will advise applicants of the procedure for obtaining status as a degree-seeking student. An application to become a graduate non-degree student is obtained through the IU Graduate School of Indianapolis here. Additional information can be obtained at the IU Graduate School of Indianapolis, University Library, Room UL 1170, 755 W. Michigan Street, Indianapolis, IN 46202; telephone (317) 274-1577.

No more than 9 hours of credit earned under this classification may be used in a plan of study for an Indiana University degree program without approval of the major department.

Departments & Programs

- Biology
- Biotechnology
- Chemistry and Chemical Biology
- Earth Sciences
- Environmental Science
- FIS Programs
- Interdisciplinary Studies
- Mathematical Sciences
- Neuroscience
- Physics
- Psychology
- Special Programs

Department of Biology

723 W. Michigan Street, SL 306
Indianapolis, IN 46202-5132
Phone: (317) 274-0577; fax: (317) 274-2846
Web: click here

Department Chair: Teri Belecky-Adams, Ph.D.

Undergraduate Program Advisor: School of Science Advising Group

Graduate Program Advisors:

- James A. Marrs, Ph.D. (Pre-Professional Non-Thesis)
- Lata Balakrishnan, Ph.D.

The Department of Biology offers undergraduate instructional programs leading to the Bachelor of Arts (B.A.), Bachelor of Science (B.S.) and Biotechnology B.S. 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 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 advisor.

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 non-thesis option. Among the non-thesis options is the M.S. degree in the teaching of biology, which is designed primarily for secondary school teachers, and a one-year preprofessional option for those seeking admission to medical or dental schools. The Doctor of Philosophy (Ph.D.) degree can be pursued in a variety of areas through the IU Graduate School Indianapolis.

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, neurobiology, plant cell and molecular biology, recombinant DNA, cell biology, developmental biology, regenerative biology, microbiology, oncology, plant and animal tissue culture, and forensic biology.

- Bachelor of Arts Degree Requirements
- Bachelor of Science Degree Requirements
- Minor in Biology
- Biology Plans of Study
- Master of Science
- Doctor of Philosophy

Bachelor of Arts Degree Requirements

Degree Requirements

First-Year Experience Course Beginning freshmen and transfer students with fewer than 19 credit hours are

required to take SCI-I 120 Windows on Science (1 cr.) or an equivalent first-year experience course.

Area Requirements

Area I English Composition and Communication Competency

See the School of Science requirements under "Undergraduate Programs" in this bulletin.

Written Communication (6 cr.)

ENG-W 131 Reading, Writing and Inquiry (3 cr.)

A second writing course with ENG-W 131 as a prerequisite, e.g. ENG-W 150, ENG-W 230, ENG-W 231, ENG-W 270, ENG-W 320, or ENG-W 350.

Oral communication

COMM-R 110 Fundamentals of Speech Communication (3 cr.)

Area II World Language Competency

See School of Science requirements under "Undergraduate Programs." Students must have first-year proficiency in a world language [first year sequence (131 & 132) or a 200-level world language course or 200 level world language proficiency].

Area IIIA Arts and Humanities, Social Sciences, and Cultural Understanding Competencies (12 cr.)

- List H course: Choose one course (3 cr.) from this list. The list of course choices is located under the School of Science requirements "Undergraduate Programs" in this bulletin.
- List S course: Choose one course (3 cr.) from this list. The list of course choices is located under the School of Science requirements "Undergraduate Programs" in this bulletin.
- One additional course from either List H or List S
- List C course: Choose one course (3 cr.) from this list. The list of course choices is located under the School of Science requirements "Undergraduate Programs" in this bulletin.

For the most current list of courses in the areas of Arts and Humanities, Social Sciences and Cultural Understanding, please refer to the IU Indianapolis General Education Curriculum.

Area IIIC Life and Physical Sciences Competency

Physics Two semesters of basic physics (PHYS-P 201 / PHYS-P 202 or PHYS-I 152 / PHYS-I 251).

Chemistry Two semesters of Principles of Chemistry with laboratories (CHEM-C 105/CHEM-C 125 3/2 cr.; CHEM-C 106/CHEM-C 126 3/2 cr.), two semesters of organic chemistry lecture and one semester of laboratory (CHEM-C 341/CHEM-C 343, CHEM-C 342), plus prerequisite basic sequence or background to enter sequence above. The second laboratory in organic chemistry (CHEM-C 344) is required for admission to some medical schools and is strongly recommended for students in most other programs. Consult a PREPs or departmental advisor.

Area IIID Analytical Reasoning Competency

MATH-I 159 or MATH-I 153 / MATH-I 154. (Starting point for mathematics courses should be worked out with a departmental advisor based on the math placement test and/or background of the student.) The computer programming requirement may be satisfied with CSCI-N 200, CSCI-N 201, CSCI-N 207, or CSCI-N 211 (other 300+ level courses may be used with permission).

Note: Computer Science CSCI-N 241 and CSCI-N 299 do not count in Area IIID, but may count as general electives.

Area IV Biology Major Requirements

Required Core Sequence

- BIOL-K 101 / BIOL-K 103 Concepts of Biology I and II (BIOL-K 102/BIOL-K 104 Honors)
- BIOL-K 322 Genetics and Molecular Biology
- BIOL-K 324 Cell Biology
- BIOL-K 341 Principles of Ecology and Evolution

Upper-Level Courses

- Complete at least one lecture course or in cases where a lecture is less than 3 credit hours, complete additional courses to reach a minimum of 3 credit hours from each of areas I-II listed below. Special topics may be available vary year-to-year. Check with the biology advisor and obtain approval before registering to determine if the course will be acceptable and under which Area.
- Minimally three laboratory courses beyond BIOL-K 101 / BIOL-K 103 selected from Areas below. To receive credit for a laboratory, an accompanying pre- or co-requisite lecture must be completed with a minimum grade of C-. BIOL-K 493 will count as one laboratory course when 2 credit hours are completed (in one semester or across two semesters) and only if BIOL-K 490 is also taken where BIOL-K 490 satisfying the capstone requirement.
- Capstone Experience. This requirement is met by taking either BIOL-K 493 Independent Research (1 cr.) or BIOL-K 490 Capstone (1 cr.) in the senior year. BIOL-K 493 cannot be used as both a third laboratory *and* as a capstone. BIOL-K 490 addresses the integration of knowledge in the principles of undergraduate education as well as values and ethics as they relate to the student's major. The capstone is an independent, creative effort by the student that is integrative and builds on the student's previous work in the major; it may include research projects, independent study and projects, a practicum, a seminar, and/or a field experience.
- Electives consisting of sufficient lecture and laboratory course work to total 30 credit hours (including core sequence credit hours). These credits may be selected from any of the Areas listed below.
- Residency Credits. In order to graduate students must have a minimum of 32 credit hours at the 300-level or above at IU Indianapolis. B.A. students usually need at least one 300-level course in addition to their required biology and chemistry courses to meet this requirement.

A maximum of 15 credit hours of biology earned previously at other institutions is applicable toward the major for the B.A. degree.

A minimum 2.00 GPA must be earned in BIOL-K courses. No grade lower than a C-.

Once admitted, students are expected to fulfill their course requirements within the major at IU Indianapolis.

Areas/Electives

I. Molecular/Cellular Area

- Undergraduate Level
  - BIOL-K 338 Introductory Immunology (3 cr.)
  - BIOL-K 360 Computational Biology (1 cr.)
  - BIOL-K 384 Biochemistry (3 cr.)
  - BIOL-K 416 Cellular and Molecular Neuroscience (3 cr.)
  - BIOL-K 451 Neuropharmacology (3 cr.)
  - BIOL-K 484 Cellular Biochemistry (3 cr.)
  - BIOL-K 488 Endocrinology in Health and Disease (3 cr.)
- Undergraduate and Graduate Level
  - BIOL-I 507 Principles of Molecular Biology (3 cr.)
  - BIOL-I 512 Advanced Cell Biology (3 cr.)
  - BIOL-I 516 Molecular Biology of Cancer (3 cr.)
  - BIOL-I 544 Sensory Systems (3 cr.)
  - BIOL-I 559 Endocrinology (3 cr.)
  - BIOL-I 560 Neurodegenerative Diseases (3 cr.)
  - BIOL-I 561 Immunology (3 cr.)
  - BIOL-I 564 Molecular Genetics of Development (3 cr.)
  - BIOL-I 574 Molecular and Cell Bone Biology (3 cr.)

II. Organismal Area

(minimally 1 course required for a total of 3 credit hours; additional credits will count as electives to reach the required 30 credit hours of approved biology course work)

- Undergraduate Level
  - BIOL-K 331 Developmental Biology (3 cr.)
  - BIOL-K 350 Comparative Animal Physiology (3 cr.)
  - BIOL-K 356 Microbiology (3 cr.)
  - BIOL-K 370 Avian Form, Function and Evolution (1 cr.)
  - BIOL-K 372 Avian Ecology and Conservation (1 cr.)
  - BIOL-K 411 Global Change Biology (3 cr.)
  - BIOL-K 432 Animal Ecophysiology in Changing Environments (3 cr.)
  - BIOL-K 480 General Entomology (3 cr.)
  - FIS-I 440 Population Genetics (3 cr.)
- Undergraduate and Graduate Level
  - BIOL-I 556 Physiology I (3 cr.)
  - BIOL-I 557 Physiology II (3 cr.)

III. Laboratory Courses

(minimally 3 courses required for a total of 6 credit hours for which the corresponding lecture is concurrently enrolled or previously completed; additional credits will count as electives to reach the required 30 credit hours of approved biology course work)

- BIOL-K 323 Genetics and Molecular Biology Lab (BIOL-S 323 Honors) (2 cr.)
- BIOL-K 325 Cell Biology Lab (BIOL-S 325 Honors) (2 cr.)
- BIOL-K 333 Developmental Biology Lab (2 cr.)
- BIOL-K 339 Immunology Lab (2 cr.)
- BIOL-K 342 Principles of Ecology and Evolution Lab (2 cr.)
- BIOL-K 357 Microbiology Lab (BIOL-S 357 Honors) (2 cr.)
- BIOL-K 361 Computational Biology Lab (2 cr.)
- BIOL-K 371 Avian Form, Function and Evolution Laboratory (1 cr.)
- BIOL-K 373 Avian Ecology and Conservation Laboratory (1 cr.)
- BIOL-K 461 Cadaveric Human Anatomy (only 2 cr. count towards lab degree requirements) (2 cr.)

Bachelor of Science Degree Requirements

Degree Requirements

First-Year Experience Course

Beginning freshmen and transfer students with fewer than 19 credit hours are required to take SCI-I 120 Windows on Science (1 cr.) or an equivalent first-year experience course.

Area Requirements

Area I English Composition and Communication Competency

See the School of Science requirements under “Undergraduate Programs” in this bulletin.

Written Communication (6 cr.)

ENG-W 131 or ENG-W 140 Reading, Writing and Inquiry (3 cr.)

The second semester of English composition may be satisfied with ENG-W 150, ENG-W 230, ENG-W 231, ENG-W 270, ENG-W 320, or ENG-W 350.

Oral Communication (3 cr.)

COMM-R 110 Fundamentals of Speech Communication (3 cr.)

Area II World Language Competency

No world language proficiency is required for a Bachelor of Science degree. However, knowledge of a world language is strongly recommended for any student planning to attend graduate school.

Area IIIA Arts and Humanities, Social Sciences, and Cultural Understanding Competencies (12 cr.)

- List H course: Choose one course (3 cr.) from this list. The list of course choices is located under the School of Science requirements “Undergraduate Programs” in this bulletin.
- List S course: Choose one course (3 cr.) from this list. The list of course choices is located under the School of Science requirements “Undergraduate Programs” in this bulletin.

- One additional course from either List H or List S.
- List C course: Choose one course (3 cr.) from this list. The list of course choices is located under the School of Science requirements “Undergraduate Programs” in this bulletin.

For the most current list of courses in the areas of Arts and Humanities, Social Sciences and Cultural Understanding, please refer to the IU Indianapolis General Education Curriculum.

Area IIIC Life and Physical Sciences Competency

Physics Two semesters of basic physics (PHYS-P 201 / PHYS-P 202 or PHYS-I 152 / PHYS-I 251).

Chemistry Two semesters of Principles of Chemistry with laboratories (CHEM-C 105/CHEM-C 125 3/2 cr.; CHEM-C 106/CHEM-C 126 3/2 cr.), two semesters of organic chemistry with laboratories (CHEM-C 341/CHEM-C 343 3/2 cr.; CHEM-C 342/CHEM-C 344 3/2 cr.), plus prerequisite basic sequence or background to enter sequence above. (A course in analytical chemistry or biochemistry is also strongly recommended; determination should be made in consultation with a PREPs or departmental advisor.)

Area IIID Analytical Reasoning Competency

Course work through two semesters of calculus (MATH-I 231 / MATH-I 232 or MATH-I 165 / MATH-I 166). Starting point to be worked out with departmental advisor based on the math placement test and/or background of the student. The computer programming requirement may be satisfied with CSCI-N 200, CSCI-N 201, CSCI-N 207, or CSCI-N 211 (other 300+ level courses may be used with approval).

Note: Computer Science CSCI-N 241 and CSCI-N 299 do not count in Area IIID, but may count as general electives.

Area IV Biology Requirements

Required Core Sequence

- BIOL-K 101 / BIOL-K 103 Concepts of Biology I and II (BIOL-K 102/BIOL-K 104 Honors)
- BIOL-K 322 Genetics and Molecular Biology
- BIOL-K 324 Cell Biology
- BIOL-K 341 Principles of Ecology and Evolution

Upper-Level Courses

- Complete at least one lecture course or in cases where a lecture is less than 3 credit hours, complete additional courses to reach a minimum of 3 credit hours from each of areas I-II listed below. Special topics may be available vary year-to-year. Check with the biology advisor and obtain approval before registering to determine if the course will be acceptable and under which Area.
- Minimally four laboratory courses beyond BIOL-K 101 / BIOL-K 103 selected from Areas listed below. To receive credit for a laboratory course, an accompanying pre- or co-requisite lecture course must be completed with a minimum grade of C-. BIOL-K 493 will count as one laboratory course when 2 credit hours are completed (in one semester or across two semesters) and only if BIOL-K 490 is also taken where BIOL-K 490 satisfying the capstone requirement.
- Capstone for the BS may be met with BIOL-K 493 Independent Research (2 to 3 credit hours) and BIOL-K 494 Senior Research Thesis (1 credit hour) or by taking the BIOL-K 490 Capstone (1 credit hour). The BIOL-K 493 / BIOL-K 494 option will consist of the completion BIOL-K 493 (research) and the preparation of a written report (BIOL-K 494) on the results of the research project. The title and nature of the BIOL-K 493 / BIOL-K 494 sequence is to be determined in consultation with the department research sponsor. A student may complete BIOL-K 493 in lieu of one of the required labs. If the student uses BIOL-K 493 for a lab, they must complete BIOL-K 490 for the capstone requirement.
- Electives consisting of sufficient BIOL-K lecture and laboratory course work to total 40 credit hours (including core sequence credit hours). These credits may be selected from any of the Areas listed below.
- Residency Credits. In order to graduate students must have a minimum of 32 credit hours at the 300-level or above at IU Indianapolis. B.S. students usually fulfill the requirement with required biology and chemistry courses. Transfer students may need additional 300-level hours.

A maximum of 20 credit hours of biology earned previously at other institutions is applicable toward the major for the B.S. degree.

A minimum 2.00 GPA must be earned in BIOL-K courses. No grade lower than a C- allowed.

Once admitted, students are expected to complete their course requirements within the major at IU Indianapolis.

Areas/Electives

I. Molecular/Cellular Area

- Undergraduate Level
  - BIOL-K 338 Introductory Immunology (3 cr.)
  - BIOL-K 360 Computational Biology (1 cr.)
  - BIOL-K 384 Biochemistry (3 cr.)
  - BIOL-K 416 Cellular and Molecular Neuroscience (3 cr.)
  - BIOL-K 451 Neuropharmacology (3 cr.)
  - BIOL-K 484 Cellular Biochemistry (3 cr.)
  - BIOL-K 488 Endocrinology in Health and Disease (3 cr.)
- Undergraduate and Graduate Level
  - BIOL-I 507 Principles of Molecular Biology (3 cr.)
  - BIOL-I 512 Advanced Cell Biology (3 cr.)
  - BIOL-I 516 Molecular Biology of Cancer (3 cr.)
  - BIOL-I 544 Sensory Systems (3 cr.)
  - BIOL-I 559 Endocrinology (3 cr.)
  - BIOL-I 560 Neurodegenerative Diseases (3 cr.)
  - BIOL-I 561 Immunology (3 cr.)
  - BIOL-I 564 Molecular Genetics of Development (3 cr.)
  - BIOL-I 574 Molecular and Cell Bone Biology (3 cr.)

II. Organismal Area

(minimally 1 course required for a total of 3 credit hours; additional credits will count as electives

to reach the required 30 credit hours of approved biology course work)

- Undergraduate Level
  - BIOL-K 331 Developmental Biology (3 cr.)
  - BIOL-K 350 Comparative Animal Physiology (3 cr.)
  - BIOL-K 356 Microbiology (3 cr.)
  - BIOL-K 370 Avian Form, Function and Evolution (1 cr.)
  - BIOL-K 372 Avian Ecology and Conservation (1 cr.)
  - BIOL-K 411 Global Change Biology (3 cr.)
  - BIOL-K 432 Animal Ecophysiology in Changing Environments (3 cr.)
  - BIOL-K 480 General Entomology (3 cr.)
  - FIS-I 440 Population Genetics (3 cr.)
- Undergraduate and Graduate Level
  - BIOL-I 556 Physiology I (3 cr.)
  - BIOL-I 557 Physiology II (3 cr.)

III. Laboratory Courses
(minimally 3 courses required for a total of 6 credit hours for which the corresponding lecture is concurrently enrolled or previously completed; additional credits will count as electives to reach the required 30 credit hours of approved biology course work)

- BIOL-K 323 Genetics and Molecular Biology Lab (BIOL-S 323 Honors) (2 cr.)
- BIOL-K 325 Cell Biology Lab (BIOL-S 325 Honors) (2 cr.)
- BIOL-K 333 Developmental Biology Lab (2 cr.)
- BIOL-K 339 Immunology Lab (2 cr.)
- BIOL-K 342 Principles of Ecology and Evolution Lab (2 cr.)
- BIOL-K 357 Microbiology Lab (BIOL-S 357 Honors) (2 cr.)
- BIOL-K 361 Computational Biology Lab (2 cr.)
- BIOL-K 371 Avian Form, Function and Evolution Laboratory (1 cr.)
- BIOL-K 373 Avian Ecology and Conservation Laboratory (1 cr.)
- BIOL-K 461 Cadaveric Human Anatomy (only 2 cr. count towards lab degree requirements) (2 cr.)

Minor in Biology

The Department of Biology offers an undergraduate minor in biology with the following requirements:

- BIOL-K 101 Concepts of Biology I (5 cr.)
- BIOL-K 103 Concepts of Biology II (5 cr.) (P: BIOL-K 101 with a C- or better)
- BIOL-K 322 Genetics and Molecular Biology (3 cr.) (P: BIOL-K 103 and CHEM-C 106 with a C- or better)
- BIOL-K 324 Cell Biology (3 cr.) (P: BIOL-K 103 and CHEM-C 106 with a C- or better)
- BIOL-K 341 Principles of Ecology and Evolution (3 cr.) (P: BIOL-K 103 with a C- or better)

At least half of the minimum 19 credit hours required to minor in biology must be completed at IU Indianapolis. In cases where introductory biology was completed as AP test credit for which university credit was awarded or as an enrolled course at another institution and transferred to IU Indianapolis, residency for the biology minor will be satisfied with the three required upper-level courses (BIOL-K 322, BIOL-K 324, and BIOL-K 341), as long as all three are completed at IU Indianapolis.

The minor requires a minimum grade point average of 2.00, and all grades must be C- or higher. Correspondence courses may not be used to fulfill requirements for the minor.

Doctoral Minors

The Department of Biology offers four Ph.D. minor programs that require 6 credit hours of selected course work. The doctoral minors are restricted to School of Science Ph.D. students. Course requirements are as follows:

Minor in Developmental Biology & Genetics

Take any 2 of the following courses (6 credit hours total needed):

- BIOL-I 564 Molecular Genetics of Development (3 cr.)
- BIOL-I 566 Developmental Biology (3 cr.)
- BIOL-I 573 Stem Cell Biology (3 cr.)
- FIS-I 560 Population Genetics (3 cr.)
- MGEN-Q 580 Basic Human Genetics (3 cr.)
- NSCI-I 560 Behavioral Genetics (3 cr.)
- NSCI-I 571 Developmental Neurobiology (3 cr.)
- PSY-I 535 Developmental Neuroscience (3 cr.)

Minor in Neurobiology

Take any 2 of the following courses (6 credit hours total needed):

- BIOL-I 569 Cellular Neurobiology (3 cr.)
- NSCI-K 451 Neuropharmacology (3 cr.)
- NSCI-I 559 Endocrinology (3 cr.)
- NSCI-I 560 Behavioral Genetics (3 cr.)
- NSCI -I 561 Immunology (3 cr.)
- PSY-I 545 Psychopharmacology (3 cr.)
- PSY-I 570 Drugs of Abuse (3 cr.)

Minor in Physiology

Required course:

- BIOL-I 556 (3 cr) Physiology I

And one of the following electives (for a total of 6 cr hours):

- BIOL-I 559 Endocrinology (3 cr)
- BIOL-I 561 Immunology (3 cr)
- BIOL-I 571 Developmental Neurobiology (3 cr)

Minor in Scientific Foundations

Take any 6 credit hours total from among the following courses:

- BIOL-I 507 Principles of Molecular Biology (3 cr.)
- BIOL-I 516 Advanced Cell Biology (3 cr.)
- BIOL-I 609 Scientific Research Bootcamp (1 cr.)
- CHEM-I 533 Introductory Biochemistry (3 cr.)
- FIS-I 540 Forensic Biology I (3 cr.)
- FIS-I 560 Population Genetics (3 cr.)
- FIS-N 570 Laboratory Project Design (2 cr.)
- GEOL-G 567 GeoHealth: When our Health Collides with our Environment (3 cr.)
- GEOL-G 585 Environmental Geochemistry (3 cr.)
- GRDM-G 855 Experimental Design and Research Biostatistics (3 cr.)
- PBHL-B 561 Introduction to Biostatistics (3 cr.)
- PSY-I 518 Memory and Cognition (3 cr.)
- PSY-I 570 Drugs of Abuse (3 cr.)
- STAT-I 514 Design of Experiments (3 cr.)

Biology Plans of Study

No single semester-by-semester plan of study will guide all students through the degree options because of the flexibility encouraged within the programs. 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 advisor.

Bachelor of Arts Sample Program (120 cr. required)

Freshman Year

First Semester	
SCI-I 120 Windows on Science	1
BIOL-K 101 Concepts of Biology I	5
CHEM-C 105 Principles of Chemistry I	3
CHEM-C 125 Experimental Chemistry I	2
MATH-I 153 College Algebra	3
Total	**14**
Second Semester	
BIOL-K 103 Concepts of Biology II	5
CHEM-C 106 Principles of Chemistry II	3
CHEM-C 126 Experimental Chemistry II	2
MATH-I 154 Trigonometry	3
ENG-W 131 Reading, Writing and Inquiry I	3
Total	**16**

Sophomore Year

Third Semester	
BIOL-K 322 Genetics and Molecular Biology	3
BIOL-K 323 Genetics and Molecular Biology Lab	2
CHEM-C 341 Organic Chemistry I	3
CHEM-C 343 Organic Chemistry Laboratory I	2
World Language Course (Cultural Understanding)	4
Elective Course	1
Total	**15**
Fourth Semester	
BIOL-K 324 Cell Biology	3
BIOL-K 325 Cell Biology Laboratory	2
CHEM-C 342 Organic Chemistry II	3
2nd written communication course	3
World Language Course	4
Total	**15**

Junior Year

Fifth Semester	
Molecular/Cellular Biology Lecture	3
PHYS-P 201 General Physics I	5
Arts and Humanities/Social Sciences (choose from list)	3
Computer Programming Course (approved)	3
Total	**14**
Sixth Semester	
Organismal Biology Lecture/ Lab	5
PHYS-P 202 General Physics II	5
Social Sciences (choose from list)	3
Elective Course	3
Total	**16**

Senior Year

Seventh Semester	
BIOL-K 341 Principles of Ecology and Evolution	3
Arts and Humanities (choose from list)	3
Elective/Minor Course 300-level	3
Elective/Minor Course	6
Total	**15**
Eighth Semester	

BIOL-K 490 Capstone in Biology (or BIOL-K 493 Independent Research)	1
COMM-R 110 Fundamentals of Speech Comm	3
Elective/Minor Courses	11
Total	**15**

Bachelor of Science Sample Program (120 cr. required)

Freshman Year

First Semester	
SCI-I 120 Windows on Science	1
BIOL-K 101 Concepts of Biology I	5
CHEM-C 105 Principles of Chemistry I	3
CHEM-C 125 Experimental Chemistry I	2
MATH-I 231 Calculus for the Life Sciences I	3
Total	**14**
Second Semester	
BIOL-K 103 Concepts of Biology II	5
CHEM-C 106 Principles of Chemistry II	3
CHEM-C 126 Experimental Chemistry II	2
MATH-I 232 Calculus for the Life Sciences II	3
ENG-W 131 Reading, Writing and Inquiry I	3
Total	**16**

Sophomore Year

Third Semester	
BIOL-K 322 Genetics and Molecular Biology	3
BIOL-K 323 Genetics and Molecular Biology Laboratory	2
CHEM-C 341 Organic Chemistry I	3
CHEM-C 343 Organic Chemistry Laboratory I	2
Computer Programming (approved elective)	3
COMM-R 110 Fundamentals of Speech Comm	3
Total	**16**
Fourth Semester	
BIOL-K 324 Cell Biology	3
BIOL-K 325 Cell Biology Laboratory	2
CHEM-C 342 Organic Chemistry II	3
CHEM-C 344 Organic Chemistry Laboratory II	2
2nd written communication course	3
Elective Course	1
Total	**14**

Junior Year

Fifth Semester	
Molecular/Cellular Biology Lecture/Lab	5
PHYS-P 201 General Physics I	5
Social Sciences (choose from list)	3
Arts and Humanities (choose from list)	3
Total	**16**
Sixth Semester	
Organismal Biology Lecture/ Lab	5
PHYS-P 202 General Physics II	5
Arts and Humanities/Social Sciences (choose from list)	3
BIOL-K 493 Independent Research	1
Total	**14**

Senior Year

Seventh Semester	
BIOL-K 341 Principles of Ecology and Evolution	3
BIOL-K 493 Independent Research	1
Cultural Understanding (choose from list)	3
Elective/Minor Courses	9
Total	**16**
Eighth Semester	
BIOL-K 493 Independent Research	1
BIOL-K 494 Capstone in Biology	1
Biology Major Courses	3
Elective/Minor Courses	9
Total	**14**

Master of Science

Degree Options

M.S. Non-thesis in Interdisciplinary Biology

This program requires a minimum of 30 credit hours of registration, at least 21 of which must be in biology. For students who wish to combine biology training with work in a secondary area as a mechanism to meet career objectives, up to 9 credit hours can be taken in the

secondary area. Advanced-level undergraduate course work hours are limited to 6. Examples of secondary areas include, but are not limited to, chemistry, mathematics, public affairs, business, statistics, law, computer science, administration, and, for those interested in teaching, education. For those students with no secondary area of interest, all 30 credit hours may be taken in biology. The program requires registrations in BIOL-I 595 Special Assignments and BIOL-I 696 Seminar. The former consists of an independent, creative project done in association with a faculty member. Typical examples include a limited laboratory research experience or a library research assignment. The results of the project are reported both in writing and orally in BIOL-I 696.

M.S. Pre-professional Non-thesis

This program also consists of a minimum of 30 credit hours, all of which must be taken over two semesters. This challenging program is highly intensified and is open only to those students who meet a high admission standard based on undergraduate GPA and GRE or MCAT or DAT scores. The program is available to those students planning careers in medicine, dentistry, optometry, or other health-related fields and differs from the interdisciplinary non-thesis M.S. by having no requirement for the BIOL-I 595 and BIOL-I 696 registrations.

M.S. with Thesis

This 30 credit hour program requires a minimum of 9 credit hours of 500-level and 600-level course work in biology chosen in consultation with the student's graduate advisory committee, and intensive research leading to a thesis. Most full-time students should expect to spend at least two full years to complete this program. Areas in which research opportunities are available include: physiology, neuroscience, eye regeneration, biochemistry, developmental genetics, cell biology, membrane biochemistry and biophysics, plant physiological ecology, molecular biology, and genetics. The overall emphasis of the department's research program focuses on questions at the cellular, biochemical, and molecular levels. Many of the projects provide a foundation in biotechnology and an excellent preparation for biomedical and industrial applications.

Admission Requirements

- Students must hold a bachelor's degree from an accredited institution of higher learning and demonstrate good preparation in biological sciences, organic chemistry, physics, and mathematics.
- The GRE and/or subject tests are not required for Ph.D. and Thesis M.S. applicants; however, if submitted, the results are added to the applicant's file for consideration. Only non-thesis M.S. applicants are required to take the GRE General Test. In place of the GRE, non-thesis MS applicants can use MCAT or DAT test scores.
- Three letters of recommendation are required.
- A minimum graduation grade point average of 3.00 or its equivalent is required for unconditional admission.

Transfer of Credit

Transfer credit to be used in the non-thesis option may be given for up to 9 credit hours of graduate work completed elsewhere with a grade of B or higher. Such credit may be used only in the secondary area and will be accepted only after one semester of satisfactory work is completed in residence at IU Indianapolis. Transfer credit is not accepted in the thesis option. Up to 12 hours of biology graduate credit taken at IU Indianapolis undergraduate non-degree status may be transferred to the thesis or non-thesis options.

Requirements

Grades

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

Residence Requirements

Thirty (30) credit hours of registration are required for the M.S. degree. Students entering with advanced standing from another graduate school are given residence credit commensurate with the graduate work accomplished.

Final Examination

A comprehensive written or oral examination in the individual's primary area may be required of non-thesis students unless their cumulative GPA is 3.00 or higher. The final examination for thesis students will consist of a thesis defense, which will be done in conjunction with BIOL-I 696 Seminar.

All students (except for the pre-professional non-thesis students) are required to take BIOL-I 696 Seminar. The creative project required of all non-thesis students will provide the basis for the public presentation.

Financial Assistance

The Department of Biology has financial support available in the form of tuition-refund assistantships, associate faculty positions, fellowships, and stipends from local industry on a limited basis.

Biology, Master of Arts for Teachers (MAT)

The IU Online Master of Arts for Teachers in Biology combines coursework in education and biology to prepare students to be a dual-credit instructor at the high school and community college levels.

The educational component of the program covers instruction and curriculum, assessment, diversity and inclusive teaching, and research.

The biology component of the program covers the nature of living organisms at an advanced level. Students gain the ability to break down and analyze biological concepts for an undergraduate audience, the ability to develop and analyze hypotheses and experiments, a fluency with scientific literature, and a richer understanding of biology in the natural world around us.

Specific areas of focus include:

- Evolution
- Molecular and cellular biology, including biochemistry, cell biology, molecular and macromolecular biology, immunology, bioinformatics, and molecular genetics

- Organismal biology, including developmental biology, neurobiology, field zoology, marine community ecology, animal nutrition, ornithology, horticulture, and ecology

Of Special Interest for Teachers/Instructors Needing to Meet HLC Dual-Credit Standards

The stackable structure of the MAT in Biology is ideal for high school and community college educators wanting to teach dual-credit courses, or for high school educators wanting to teach at the community college level. This program is designed to help students meet Higher Learning Commission (HLC) dual-credit qualification standards. These standards require teachers wanting to teach dual-credit courses in biology to hold either a master's degree in biology or a master's degree in another discipline (such as education), plus at least 18 credit hours of discipline-specific graduate coursework.

- Students need both discipline-specific coursework and a master's degree, the MAT in Biology meets HLC standards.
- Those who already hold a master's degree in a discipline other than biology, can meet HLC standards by completing the Graduate Certificate in Biology (see below).

This 100% online, consortial program is taught by IU Bloomington, IU East, IU Indianapolis, IU Kokomo, IU Northwest, IU South Bend, and IU Southeast. This consortial model allows you to take coursework from several campuses and learn from a wide range of faculty.

Graduate Certificate in Biology

The graduate certificate in Biology is offered 100% online through IU Bloomington, IU East, IU Indianapolis, IU Kokomo, IU Northwest, IU South Bend, and IU Southeast. This consortial model allows students to take coursework from several campuses and learn from a wide range of faculty.

Students in the IU Online Graduate Certificate in Biology, analyze and explore the nature of life and living organisms at an advanced level and gain the ability to break down and analyze biological concepts for an undergraduate audience, the ability to develop and analyze hypotheses and experiments, a fluency with scientific literature, and a richer understanding of biology in the natural world around us.

Specific areas of focus include:

- Evolution
- Ecology and environmental biology
- Organismal biology
- Cell and molecular biology, and biochemistry
- Genetics, bioinformatics, and genomics
- Anatomy and physiology
- Developmental biology

For Dual-credit and Community College Instructors needing to meet HLC standards

The Higher Learning Commission (HLC) requires all high school teachers who teach dual-credit or other college-level courses to hold a master's degree in the field, or to have a master's degree in another area (such as education), plus at least 18 credit hours of graduate coursework in the discipline. The Graduate Certificate in Biology provides these 18 discipline-specific credit hours.

The IU Online Graduate Certificate in Biology prepares students for such careers as:

- Biology dual-credit teacher (high school)
- Biology instructor (community college)

Understanding the requirements

To earn the Graduate Certificate in Biology, students must complete 18 credit hours. Requirements are broken down as follows:

- Core course (3 cr.)
- Molecular-cellular-level electives (6 cr.)
- Organismal-level electives (6 cr.)
- Capstone course (3 cr.)

Doctor of Philosophy

Doctor of Philosophy—Indiana University

The degree of Doctor of Philosophy (Ph.D.), the highest earned degree conferred by Indiana University, can be pursued in the Department of Biology at IU Indianapolis. The doctoral degree is restricted to those scholars who have demonstrated superior ability in a recognized academic discipline. The Ph.D. degree is not awarded on the basis of time spent in residence or following the completion of any specific number of formal courses, nor is the degree granted on the basis of miscellaneous course studies and research effort. The entire Ph.D. program must be rationally related, should be highly research oriented, and should culminate in a thesis of scholarly merit indicative of the candidate’s ability to conduct original research in a recognized field of specialization.

Ph.D. programs are directed by professors who work in close association with selected graduate students. In practice, doctoral programs are composed of formal courses, guided individual study in a chosen field or discipline, study in such cognate subjects as may be required by the candidate’s advisory committee, and original research that serves as the basis of a scholarly thesis.

As part of their graduate training, all Ph.D. candidates are expected to teach at least quarter time for one year.

Ninety (90) credit hours of registration are required for the Ph.D. degree. Students entering with advanced standing from another graduate school are given residence credit commensurate with the graduate work accomplished.

Fields of Study

Ph.D. degrees are offered in most of the fields described for the M.S. degree. Until a major professor is named, a student is counseled by a temporary advisor. In order to help familiarize students with the department and to assist the student in the selection of a major professor, a series of laboratory rotations is available.

Admission and First Year Review

To enter the Ph.D. program, a student must satisfy the admission requirements for the M.S. with thesis option and also submit a critical review at the end of the first year of

graduate study. In their second semester students write a critical review paper detailing a problem/knowledge gap in their area of research, along with an assessment of this literature to propose a specific answer to this problem. In the fall of their second year the students present the review to their graduate committee. For this first committee meeting, the student will prepare a presentation to recap the review for the committee. In addition, they may incorporate some of their preliminary data from the laboratory either linked to, or separate from, the review. As with other committee meetings, the committee will vote to pass or fail. If the student fails the committee meeting, the student will have to re-write the critical review and pass a committee meeting prior to taking the preliminary examination.

Plan of Study

Each prospective candidate for the doctoral degree, with the approval of the head of the Department of Biology, shall select a major professor from the department who will act as the chairperson of the student's advisory committee and who will direct the research. The student, in consultation with the major professor, will arrange an advisory committee of at least four faculty members (including the major professor) who have been approved to guide graduate students.

The plan of study shall include required core Biology courses and may include additional courses in the primary area of study. The plan will be appropriate to meet the needs of the student in a chosen field as determined by the advisory committee. All Ph.D. students must also complete a minor which is composed of at least 6 credit hours of coursework in a related area. The minor is chosen in consultation with the research committee. The plan will include the core and minor courses that the student is expected to complete, additional specific courses relevant to the field of research, language (if any) requirements, and 2 credit hours of BIOL-I 696 Seminar.

The department head and the Dean of the IU Graduate School Indianapolis, must approve the plan of study.

Qualifying Examination

After the student has completed most of the formal study to the satisfaction of the advisory committee and met any language requirement(s), the student becomes eligible to take the qualifying examination in order to advance to candidacy. The qualifying examination must be taken within one year of, and at least six months after passing the first committee meeting. The examination requires a research proposal to be written by the student in consultation with their major professor. The results of these written and oral examinations will be reported to the graduate school by the examining committee with an appropriate recommendation for the student's admission to candidacy, continued preparatory study, or discontinuation. The graduate school associate dean reserves the right to appoint additional members to the qualifying examining committee. No examining committee shall have fewer than three faculty members.

If the student does not pass the qualifying examination, a second meeting must be convened within 6 months. Should the qualifying examinations be failed twice, the student may not be given a third examination, except upon the recommendation of the examining committee and with special approval of the Graduate Council.

Ph.D. Dissertation

After admission to candidacy, the candidate must devote at least two semesters to research before the final examination.

The special research carried on as part of the doctoral work is expected to make a definite contribution to the candidate's chosen field of knowledge–a contribution of sufficient importance to merit publication. Each candidate must, therefore, prepare a dissertation showing the research results.

After the research has been completed and the dissertation written, the candidate shall be given a final examination in which the candidate defends the dissertation and demonstrates to the examining committee all of the capabilities for which the Doctor of Philosophy degree is awarded. The examining committee shall consist of no fewer than four members. The dean of the graduate school reserves the right to appoint additional committee members and must be informed of the place and time of the final examination at least two weeks in advance.

Biotechnology Program

IU Indianapolis
723 W. Michigan Street, SL 306
Indianapolis, IN 46202-5132
Phone: (317) 274-0577; fax: (317) 274-2846

- **Department Chair:** Teri Belecky-Adams, Ph.D.

This program is available only to students who have an earned Associate of Applied Science (AAS) degree in Biotechnology from Ivy Tech Community College (ITCC). NOTE: Coursework associated with an Associate of Science (AS) degree in biotechnology from ITCC will not be sufficient for admission into this program.

What has become known as the biotechnology industry has been going through some transforming changes that mandate more sophisticated workforce training at many levels. In order to place central Indiana at the forefront in the preparation of a suitable workforce for existing industry as well as a flexible training program that may be attractive to biotechnology industries considering a move to Indiana, IU Indianapolis has partnered with ITCC in central Indiana to provide an integrated training and theoretical framework for future biotechnology industry requirements.

The curriculum of the bachelor's degree also allows sufficient flexibility within the major and with electives to meet basic requirements for application to most graduate and professional programs.

No more than 64 applicable credits may transfer from a two-year or community college.

Degree Characteristics

Bachelor of Science in Biotechnology

- 120 credit hour Indiana University degree
- additional courses in the major and flexibility to add areas of specialization

- full general-education course work in the humanities and social sciences
- flexibility to become eligible for most graduate and professional degree programs

Bachelor of Science in Biotechnology (B.S.)

Degree Requirements

(ITCC: indicates course completed at Ivy Tech Indianapolis)

Area I English Composition and Communication Competency See the School of Science requirements under "Undergraduate Programs" in this bulletin.

Written Communication (6 cr.)

- ENG-W 131 Reading, Writing and Inquiry (3 cr.) *(ENG 111 ITCC)*
- Second composition course (3 cr.)

Speech Communication (3 cr.)

- COMM-R 110 Fundamentals of Speech Communication (3 cr.) *(COMM 101 ITCC)*

Area II World Language Competency No world language is required for a Bachelor of Science degree. However, knowledge of a world language is strongly recommended for any student planning to attend graduate school.

Area IIIA Arts and Humanities, Social Sciences, and Cultural Understanding Competencies

- List H course: Choose one course (3 cr.) from this list. The list of course choices is located under the School of Science requirements "Undergraduate Programs" in this bulletin.
- List S course: Choose one course (3 cr.) from this list. The list of course choices is located under the School of Science requirements "Undergraduate Programs" in this bulletin.
- One additional course from either List H or List S.
- List C course: Choose one course (3 cr.) from this list. The list of course choices is located under the School of Science requirements "Undergraduate Programs" in this bulletin.

For the most current list of courses in the areas of Arts and Humanities, Social Sciences and Cultural Understanding, please refer to the IU Indianapolis General Education Curriculum.

Area IIIC Life and Physical Sciences Competency

Chemistry

Two semesters of Principles of Chemistry with laboratory:

- CHEM-C 105 / CHEM-C 125 Principles of Chemistry I with lab *(CHEM 105 ITCC)*
- CHEM-C 106 / CHEM-C 126 Principles of Chemistry II with lab *(CHEM 106 ITCC)*

Two semesters of organic chemistry lecture:

- CHEM-C 341/CHEM-C 343 Organic Chemistry Lecture/Lab I
- CHEM-C 342 Organic Chemistry Lecture II

Physics One semester of basic physics

- PHYS 101, ITCC **or** PHYS-P 201, IU Indianapolis

Area IIID Analytical Reasoning Competency

Course work through two semesters of calculus:

- MATH-I 231 / MATH-I 232 **or**
- MATH-I 165 / MATH-I 166

NOTE: Students may need to complete MATH 136 College Algebra and MATH 137 Trigonometry with Analytic Geometry at ITCC.

The starting point for mathematics courses should be worked out with a departmental advisor based on the math placement test and/or background of the student.

The computer programming requirement may be satisfied with CSCI-N 200, CSCI-N 201, CSCI-N 207 or CSCI-N 211.
A statistics course is required: STAT-I 301.

Area IV Biotechnology Requirements

Required courses

- BIOL-K 101 Concepts of Biology I (5 cr.)
- BIOL-K 384 Biological Chemistry (3 cr.) **or** CHEM-C 384 Biological Chemistry (3 cr.) **or** BIOL-K 484 Cellular Biochemistry (3 cr.)
- BIOL-K 322, BIOL-K 323, BIOL-K 324, BIOL-K 356, BIOL-K 338
- BIOL-K 357 or BIOL-K 339

Specialized courses in biotechnology, including the internship, are to be taken at Ivy Tech Community College, Indianapolis. This program is available only to students who have an earned Associate Degree in Biotechnology from Ivy Tech Community College. See departmental advisor for additional information.

Elective courses in area of specialization.

Electives chosen with advisor to total at least 40 credits.

No grade below a C- will be accepted toward the degree program in any biology, biotechnology and chemistry course.

To receive credit for a laboratory for which there is an accompanying pre- or corequisite lecture, the lecture must be completed with a minimum grade of C-.

Department of Chemistry and Chemical Biology

IU Indianapolis
Science Building, LD 326
402 N. Blackford Street
Indianapolis, IN 46202-3274
Phone: (317) 274-6872, fax: (317) 274-4701
Web: click here

Department Chair: Partha Basu, Ph.D.

Department Advisors:

- Undergraduate Advisor: Rebecca Burris, MSW
- School of Science Advising Group
- Graduate Programs: Jingzhi Pu, Ph.D.

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

The Department of Chemistry and Chemical Biology offers the Bachelor of Arts (B.A.) degree, the Bachelor of Science American Chemical Society (A.C.S.) certified degree in Chemistry (B.S.) degree with a chemistry option , a biochemistry option, and a medicinal chemistry option, the Bachelor of Science non-A.C.S. certified degree in Environmental Chemistry, and the Master of Science (M.S.) degree. All degrees carry the general requirements of the School of Science, which are described elsewhere in this bulletin. An undergraduate minor in chemistry is also offered. The Bachelor of Science degrees in Chemistry (with chemistry option, biochemistry option, or medicinal chemistry option) carry certification by the American Chemical Society (A.C.S.) 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 Doctor of Philosophy (Ph.D.) degree in chemistry in the areas of analytical, biological, inorganic, organic, or physical chemistry. Contact the Department for details or visit the Web site here.

To enter the undergraduate 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 advisor.

Courses for Nonmajors

Students in programs that require only one semester of chemistry should take CHEM-C 100, CHEM-C 101, or CHEM-C 110, depending on their specific degree program. CHEM-C 100 and CHEM-C 110 are both nonmathematical introductions to chemistry, while CHEM-C 101 requires one semester of high school algebra. Students in programs that require two semesters of chemistry take either CHEM-C 101 / CHEM-C 121 with CHEM-C 110 / CHEM-C 115 or the CHEM-C 105 / CHEM-C 125 with CHEM-C 106 / CHEM-C 126 sequence. (See specific program for degree major.) The CHEM-C 105 / CHEM-C 125 with CHEM-C 106 / CHEM-C 126 sequence is designed for students pursuing advanced work in scientific fields (e.g., biology, chemistry, geology, medicine, and physics). Students with an insufficient background in high school chemistry for CHEM-C 105 should take CHEM-C 101 as a preparatory course. Credit for CHEM-C 101 cannot count toward the total credit hours needed for graduation if either of the following courses is taken: CHEM-C 105 or CHEM-C 106. Completion of CHEM-C 101 does not qualify a student for admission to CHEM-C 106.

Academic Advising in Chemistry

Academic success requires frequent and regular interaction between students and faculty in the classroom as well as outside it. In keeping with this departmental philosophy, chemistry majors are required to meet with their advisor at least once a year, preferably in the first half of the Fall semester.

Course Prerequisites

The Department enforces all prerequisites for chemistry courses as indicated in the course listing of this bulletin. For course equivalency of prerequisites, consult the instructor.

- Bachelor of Arts Preprofessional Chemistry Major
- Bachelor of Science in Chemistry, Professional Chemistry Major, A.C.S. Certified
- Bachelor of Science in Environmental Chemistry, non-A.C.S. Certified
- Graduate Programs (M.S. and Ph.D. Degrees)
- Minor

Bachelor of Arts Preprofessional Chemistry Major

For students who require a knowledge of chemistry as a basis for work in other fields such as business, dentistry, environmental science and policy, law, medicine, or other allied health fields. Recommended for pre-medical and pre-dentistry students.

Degree Requirements

First-Year Experience Course Beginning freshmen and transfer students with fewer than 19 credit hours are required to take SCI-I 120 Windows on Science (1 cr.) or an equivalent first-year experience course.

Area I English Composition and Communication Competency See the School of Science requirements under “Undergraduate Programs” in this bulletin. The second semester of English composition may be satisfied only by ENG-W 150, ENG-W 230, ENG-W 231, ENG-W 270, ENG-W 320, or ENG-W 350.

Area II World Language Competency See the School of Science requirements under “Undergraduate Programs” in this bulletin.

Area IIIA Arts and Humanities, Social Sciences, and Cultural Understanding Competencies See the School of Science requirements under "Undergraduate Programs" in this bulletin.

For the most current list of courses in the areas of Arts and Humanities, Social Sciences and Cultural Understanding, please refer to the IU Indianapolis General Education Curriculum.

Area IIIC Life and Physical Sciences Competency PHYS-P 201 and PHYS-P 202 (recommended PHYS-I 152 and PHYS-I 251). Also, at least two additional courses outside chemistry having a laboratory component, which may be chosen from, for example, biology, geology, or physics.

Area IIID Analytical Reasoning Competency MATH-I 231 and MATH-I 232 (recommended MATH-I 165 and MATH-I 166). One computer programming course is also required.

Note: Computer Science CSCI-N 100 level courses do not count for any credit toward any degree in the School of

Science. Also, CSCI-N 241 and CSCI-N 299 do not count in Area IIID, but may count as general electives.

Area IV Chemistry Concentration Requirements
CHEM-C 105, CHEM-C 125, CHEM-C 106, CHEM-C 126, CHEM-C 294, CHEM-C 310, CHEM-C 311, CHEM-C 325, CHEM-C 326, CHEM-C 341, CHEM-C 342, CHEM-C 343, CHEM-C 344, CHEM-C 360 (recommended CHEM-C 361), and CHEM-C 495. Recommended CHEM-C 384 or CHEM-C 484. A total of 34 credit hours of chemistry courses are required. The Department requires a minimum grade of C in all chemistry courses (C- grades are unacceptable).

Bachelor of Arts Preprofessional Chemistry Major Sample Program (120 cr. required):

Freshman Year

First Semester	
SCI-I 120 Windows on Science	1
CHEM-C 105 Principles of Chemistry I	3
CHEM-C 125 Experimental Chemistry I	2
MATH-I 231 Calculus for the Life Sciences I	3
ENG-W 131 Reading, Writing and Inquiry I	3
World Language	4
Total	**16**
Second Semester	
CHEM-C 106 Principles of Chemistry II	3
CHEM-C 126 Experimental Chemistry II	2
MATH-I 232 Calculus for the Life Sciences II	3
World Language	4
2nd Written communication course	3
Total	**15**

Sophomore Year

Third Semester	
CHEM-C 341 Organic Chemistry I	3
CHEM-C 343 Organic Chemistry Laboratory I	2
Life and Physical Science with lab (approved elective)	5
COMM-R 110 Fundamentals of Speech Communication	3
Arts and Humanities/Social Science (choose from list)	3
Total	**16**
Fourth Semester	
CHEM-C 342 Organic Chemistry II	3
CHEM-C 344 Organic Chemistry Laboratory II	2
CHEM-C 294 Cornerstone in Chemistry	1
Life and Physical Science (approved elective)	5
Arts and Humanities/Social Sciences (choose from list)	3
Total	**14**

Junior Year

Fifth Semester	
CHEM-C 310 Analytical Chemistry Lecture	3
CHEM-C 311 Analytical Chemistry Lab	1
PHYS-P 201 General Physics I	5
Arts & Humanities or Social Sciences (choose from list)	3
Elective	3
Total	**15**
Sixth Semester	
CHEM-C 325 Intro to Instrumental Analysis	3
CHEM-C 326 Introduction to Instrumental Analysis Lab	2
Computer Programming (approved course)	3
PHYS-P 202 General Physics 2	5
Electives	3
Total	**16**

Senior Year

Seventh Semester	
Electives	15
Total	**15**
Eighth Semester	
CHEM-C 360 Elementary Physical Chemistry	3
CHEM-C 495 Capstone in Chemistry	1
Electives	9
Total	**13**

Bachelor of Science in Chemistry, Professional Chemistry Major, A.C.S. Certified

This degree is for students who plan to be professional chemists or who plan to pursue graduate studies in chemistry. It carries certification by the Committee on Professional Training of the American Chemical Society. Three options are available: a Chemistry option, a Biochemistry option and a Medicinal Chemistry option.

Degree Requirements (Chemistry Option)

First-Year Experience Course Beginning freshmen and transfer students with fewer than 19 credit hours are

required to take SCI-I 120 Windows on Science (1 cr.) or an equivalent first-year experience course.

Area I English Composition and Communication Competency See the School of Science requirements under “Undergraduate Programs” in this bulletin. The second semester of English composition may be satisfied only by ENG-W 150, ENG-W 230, ENG-W 231, ENG-W 270, ENG-W 320, or ENG-W 350.

Area II World Language Competency No world language proficiency is required for a Bachelor of Science degree.

Area IIIA Arts and Humanities, Social Sciences, and Cultural Understanding Competencies See the School of Science requirements under "Undergraduate Programs" in this bulletin.

For the most current list of courses in the areas of Arts and Humanities, Social Sciences and Cultural Understanding, please refer to the IU Indianapolis General Education Curriculum.

Area IIIC Life and Physical Sciences Competency PHYS-I 152, PHYS-I 251, and at least two additional courses outside chemistry, which may be chosen from, for example, biology, geology, or physics.

Area IIID Analytical Reasoning Competency MATH-I 165, MATH-I 166, MATH-I 171, and MATH-I 261. One computer programming course is also required.

Note: Computer Science CSCI-N 100 level courses do not count for any credit toward any degree in the School of Science. Also, CSCI-N 241 and CSCI-N 299 do not count in Area IIID, but may count as general electives.

Area IV Chemistry Concentration Requirements CHEM-C 105, CHEM-C 125, CHEM-C 106, CHEM-C 126, CHEM-C 294, CHEM-C 310, CHEM-C 311, CHEM-C 341, CHEM-C 342, CHEM-C 343, CHEM-C 344, CHEM-C 361, CHEM-C 362, CHEM-C 363, CHEM-C 410, CHEM-C 411, CHEM-C 430, CHEM-C 435, CHEM-C 484 and CHEM-C 495. A total of 47 credit hours of chemistry courses are required. The Department of Chemistry requires a minimum grade of C in all chemistry courses (C- grades are unacceptable).

In addition to the above requirements, a minimum of 6 additional credit hours of advanced chemical elective courses is required. Courses may be chosen from the following: CHEM-C 409 (3 cr. min.), CHEM-C 309, CHEM-C 371, CHEM-C 372, CHEM-C 420, CHEM-C 475, CHEM-C 485, CHEM-C 488, CHEM-C 489, certain CHEM-C 496 topics courses (permission required), any graduate-level chemistry course (permission required), FIS-I 400, FIS-I 410, GEOL-G 406, or GEOL-G 483. Three advanced chemical elective credit hours must be from CHEM-C or CHEM-I courses.

Degree Requirements (Biochemistry Option)

First-Year Experience Course Beginning freshmen and transfer students with fewer than 19 credit hours are required to take SCI-I 120 Windows on Science (1 cr.) or an equivalent first-year experience course.

Area I English Composition and Communication Competency See the School of Science requirements under “Undergraduate Programs” in this bulletin. The second semester of English composition may be satisfied only by ENG-W 150, ENG-W 230, ENG-W 231, ENG-W 270, ENG-W 320, or ENG-W 350.

Area II World Language Competency No world language proficiency is required for a Bachelor of Science degree.

Area IIIA Arts and Humanities, Social Sciences, and Cultural Understanding Competencies See the School of Science requirements under “Undergraduate Programs” in this bulletin.

Area IIIC Life and Physical and Sciences Competency PHYS-I 152, PHYS-I 251, BIOL-K 101, and BIOL-K 103. Beyond the introductory level, an additional 3 credit hours of biology should be chosen from one of the following: BIOL-K 324 Cell Biology, BIOL-K 356 Microbiology, or BIOL-K 322 Genetics and Molecular Biology.

Area IIID Analytical Reasoning Competency MATH-I 165, MATH-I 166, MATH-I 171, and MATH-I 261. One computer programming course is also required.

Note: Computer Science CSCI-N 100 level courses do not count for any credit toward any degree in the School of Science. Also, CSCI-N 241 and CSCI-N 299 do not count in Area IIID, but may count as general electives.

Area IV Chemistry Concentration Requirements CHEM-C 105, CHEM-C 125, CHEM-C 106, CHEM-C 126, CHEM-C 294, CHEM-C 310, CHEM-C 311, CHEM-C 341, CHEM-C 342, CHEM-C 343, CHEM-C 344, CHEM-C 361, CHEM-C 362, CHEM-C 363, CHEM-C 410, CHEM-C 411, CHEM-C 430, CHEM-C 435, CHEM-C 484, CHEM-C 485, CHEM-C 486, and CHEM-C 495. A total of 52 credit hours of chemistry courses are required. The Department requires a minimum grade of C in all chemistry courses (C- grades are unacceptable).

In addition to the above requirements, a minimum of 3 additional credit hours of advanced chemical elective courses is required. Courses may be chosen from the following: CHEM-C 409 (3 cr. min.), CHEM-C 309, CHEM-C 371, CHEM-C 372, CHEM-C 420, CHEM-C 475, CHEM-C 488, CHEM-C 489, certain CHEM-C 496 topics courses (permission required), any graduate-level chemistry course (permission required), FIS-I 400, FIS-I 410, GEOL-G 406, or GEOL-G 483.

Degree Requirements (Medicinal Chemistry Option)

First-Year Experience Course Beginning freshmen and transfer students with fewer than 19 credit hours are required to take SCI-I 120 Windows on Science (1 cr.) or an equivalent first-year experience course.

Area I English Composition and Communication Competency See the School of Science requirements under “Undergraduate Programs” in this bulletin. The second semester of English composition may be satisfied only by ENG-W 150, ENG-W 230, ENG-W 231, ENG-W 270, ENG-W 320, or ENG-W 350.

Area II World Language Competency No world language proficiency is required for a Bachelor of Science degree.

Area IIIA Arts and Humanities, Social Sciences, and Cultural Understanding Competencies See the School

of Science requirements under “Undergraduate Programs” in this bulletin.

Area IIIC Life and Physical Sciences Competency PHYS-I 152, PHYS-I 251, BIOL-K 101, and BIOL-K 103. Beyond the introductory level, an additional 3 credit hours of biology should be chosen from one of the following: BIOL-K 324 Cell Biology, BIOL-K 356 Microbiology, or BIOL-K 322 Genetics and Molecular Biology.

Area IIID Analytical Reasoning Competency MATH-I 165, MATH-I 166, MATH-I 171, and MATH-I 261. One computer programming course is also required.

Note: Computer Science CSCI-N 100 level courses do not count for any credit toward any degree in the School of Science. Also, CSCI-N 241 and CSCI-N 299 do not count in Area IIID, but may count as general electives.

Area IV Chemistry Concentration Requirements CHEM-C 105, CHEM-C 125, CHEM-C 106, CHEM-C 126, CHEM-C 294, CHEM-C 310, CHEM-C 311, CHEM-C 341, CHEM-C 342, CHEM-C 343, CHEM-C 344, CHEM-C 361, CHEM-C 362, CHEM-C 363, CHEM-C 410, CHEM-C 411, CHEM-C 430, CHEM-C 435, CHEM-C 484, CHEM-C 486, CHEM-C 488, CHEM-C 489, and CHEM-C 495. A total of 55 credit hours of chemistry courses are required. The Department requires a minimum grade of C in all chemistry courses (C- grades are unacceptable).

Bachelor of Science: Sample Program, Chemistry Option- Professional Chemistry Major- A.C.S. Certified (120 cr. required)

Freshman Year

First Semester	
CHEM-C 105 Principles of Chemistry I	3
CHEM-C 125 Experimental Chemistry I	2
MATH-I 165 Analytic Geometry and Calculus I	4
Arts and Humanities/Social Sciences (choose from list)	3
ENG-W 131 Reading, Writing and Inquiry I	3
SCI-I 120 Windows on Science	1
Total	**16**
Second Semester	
CHEM-C 106 Principles of Chemistry II	3
CHEM-C 126 Experimental Chemistry II	2
MATH-I 166 Analytic Geometry and Calculus II	4
PHYS-I 152 Mechanics	4
2nd Written Communication Course	3
Total	**16**

Sophomore Year

Third Semester	
CHEM-C 341 Organic Chemistry I	3
CHEM-C 343 Organic Chemistry Laboratory I	2
MATH-I 171 Multidimensional Mathematics	3
Life and Physical Science (approved elective)	3
Arts & Humanities/Social Science (choose from list)	3
COMM-R 110 Fundamentals of Speech Communication	3
Total	**17**
Fourth Semester	
CHEM-C 342 Organic Chemistry II	3
CHEM-C 344 Organic Chemistry Laboratory II	2
CHEM-C 294 Cornerstone in Chemistry	1
PHYS-I 251 Heat, Electricity and Optics	5
MATH-I 261 Multivariate Calculus	4
Total	**15**

Junior Year

Fifth Semester	
CHEM-C 362 Physical Chemistry of Molecules	4
CHEM-C 310 Analytical Chemistry Lecture	3
CHEM-C 311 Analytical Chemistry Lab	1
Arts & Humanities/Social Science (choose from list)	3
Cultural Understanding (choose from list)	3
Total	**14**
Sixth Semester	
CHEM-C 361 Physical Chemistry of Bulk Matter	3
CHEM-C 363 Experimental Physical Chemistry	2
CHEM-C 484 Biomolecules and Catabolism	3
Computer Programming (approved course)	3
Elective	3
Total	**14**

Senior Year

Seventh Semester	
CHEM-C 410 Principles of Chemical Instrumentation	3

CHEM-C 411 Principles of Chemical Instrumentation Laboratory	2
Life and Physical Science (approved elective)	3
Advanced Chemical Elective	3
Electives	3
Total	**14**
Eighth Semester	
CHEM-C 430 Inorganic Chemistry	3
CHEM-C 435 Inorganic Chemistry Laboratory	1
CHEM-C 495 Capstone in Chemistry	1
Advanced Chemical Elective	3
Electives	6
Total	**14**

Bachelor of Science: Sample Program Biochemistry Option-Professional Chemistry Major-A.C.S. Certified (120 cr. required)

Freshman Year

First Semester	
CHEM-C 105 Principles of Chemistry I	3
CHEM-C 125 Experimental Chemistry I	2
BIOL-K 101 Concepts of Biology I	5
MATH-I 165 Analytic Geometry and Calculus I	4
SCI-I 120 Windows on Science	1
Total	**15**
Second Semester	
CHEM-C 106 Principles of Chemistry II	3
CHEM-C 126 Experimental Chemistry II	2
MATH-I 166 Analytic Geometry and Calculus II	4
BIOL-K 103 Concepts of Biology II	5
ENG-W 131 Reading, Writing and Inquiry I	3
Total	**17**

Sophomore Year

Third Semester	
CHEM-C 341 Organic Chemistry I	3
CHEM-C 343 Organic Chemistry Laboratory I	2
MATH-I 171 Multidimensional Mathematics	3
PHYS-I 152 Mechanics	4
2nd written communication course	3
Total	**15**
Fourth Semester	
CHEM-C 342 Organic Chemistry II	3
CHEM-C 344 Organic Chemistry Laboratory II	2
CHEM-C 294 Cornerstone in Chemistry	1
PHYS-I 251 Heat, Electricity and Optics	5
MATH-I 261 Multivariate Calculus	4
Total	**15**

Junior Year

Fifth Semester	
CHEM-C 362 Physical Chemistry of Molecules	4
CHEM-C 310 Analytical Chemistry Lecture	3
CHEM-C 311 Analytical Chemistry Lab	1
COMM-R 110 Fundamentals of Speech Communication	3
Arts and Humanities (choose from list)	3
Total	**14**
Sixth Semester	
CHEM-C 361 Physical Chemistry of Bulk Matter	3
CHEM-C 363 Experimental Physical Chemistry	2
CHEM-C 484 Biomolecules and Catabolism	3
Arts and Humanities/Social Sciences (choose from list)	3
Arts and Humanities/Social Sciences (choose from list)	3
Total	**14**

Senior Year

Seventh Semester	
CHEM-C 410 Principles of Chemical Instrumentation	3
CHEM-C 411 Principles of Chemical Instrumentation Lab	2
CHEM-C 485 Biosynthesis and Physiology	3
CHEM-C 486 Biological Chemistry Lab	2
Computer Programming (approved course)	3
Biology (approved elective)	3
Total	**16**

Eighth Semester	
CHEM-C 430 Inorganic Chemistry	3
CHEM-C 435 Inorganic Chemistry Laboratory	1
Advanced Chemistry Elective	3
Cultural Understanding (choose from list)	3
Elective	3
CHEM-C 495 Capstone in Chemistry	1
Total	**14**

Bachelor of Science: Sample Program Medicinal Chemistry Option-Professional Chemistry Major-A.C.S. Certified (120 cr. required)

Freshman Year

First Semester	
CHEM-C 105 Principles of Chemistry I	3
CHEM-C 125 Experimental Chemistry I	2
BIOL-K 101 Concepts of Biology I	5
MATH-I 165 Analytic Geometry and Calculus I	4
SCI-I 120 Windows on Science	1
Total	**15**
Second Semester	
CHEM-C 106 Principles of Chemistry II	3
CHEM-C 126 Experimental Chemistry II	2
MATH-I 166 Analytic Geometry and Calculus II	4
BIOL-K 103 Concepts of Biology II	5
ENG-W 131 Reading, Writing and Inquiry I	3
Total	**17**

Sophomore Year

Third Semester	
CHEM-C 341 Organic Chemistry I	3
CHEM-C 343 Organic Chemistry Laboratory I	2
MATH-I 171 Multidimensional Mathematics	3
PHYS-I 152 Mechanics	4
2nd written communication course	3
Total	**15**
Fourth Semester	
CHEM-C 342 Organic Chemistry II	3
CHEM-C 344 Organic Chemistry Laboratory II	2
CHEM-C 294 Cornerstone in Chemistry	1
PHYS-I 251 Heat, Electricity and Optics	5
MATH-I 261 Multivariate Calculus	4
Total	**15**

Junior Year

Fifth Semester	
CHEM-C 310 Analytical Chemistry Lecture	3
CHEM-C 311 Analytical Chemistry Lab	1
CHEM-C 362 Physical Chemistry of Molecules	4
COMM-R 110 Fundamentals of Speech Communication	3
Arts and Humanities/Social Sciences (choose from list)	3
Total	**14**
Sixth Semester	
CHEM-C 361 Physical Chemistry of Bulk Matter	3
CHEM-C 363 Experimental Physical Chemistry	2
CHEM-C 484 Biomolecules and Catabolism	3
Arts and Humanities/Social Sciences (choose from list)	3
Arts and Humanities/Social Sciences (choose from list)	3
Total	**14**

Senior Year

Seventh Semester	
CHEM-C 410 Principles of Chemical Instrumentation	3
CHEM-C 411 Principles of Chemical Instrumentation Laboratory	2
CHEM-C 486 Biological Chemistry Laboratory	2
CHEM-C 488 Introduction to Medicinal and Agricultural Chemistry	3
Computer Programming (approved course)	3
Biology (approved elective)	3
Total	**16**
Eighth Semester	
CHEM-C 430 Inorganic Chemistry	3

CHEM-C 435 Inorganic Chemistry Laboratory	1
CHEM-C 489 The Practice of Medicinal Chemistry	3
CHEM-C 495 Capstone in Chemistry	1
Cultural Understanding (choose from list)	3
Elective Course	3
Total	**14**

The Department will not grant credit for a course when 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-C 360 and CHEM-C 361
- MATH-I 231 / MATH-I 232 or MATH-I 241 / MATH-I 242 and MATH-I 165 / MATH-I 166
- PHYS-P 201 / PHYS-P 202 or PHYS-I 218 / PHYS-I 219 and PHYS-I 152 / PHYS-I 251
- PHYS-I 100 or PHYS-I 200 and PHYS-P 201, PHYS-I 218, or PHYS-I 152

For example, if a student has earned credit in MATH-I 165 / MATH-I 166, the student will receive no credit for MATH-I 231 / MATH-I 232, 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 (B- or lower is unacceptable) in CHEM-C 360 and approval of the departmental chairperson, credit will be granted for CHEM-C 361 and the student may proceed to CHEM-C 362.
- If a student has earned credit for the MATH-I 231 / MATH-I 232 sequence, the student will be placed in MATH-I 166. If the student passes MATH-I 166, the MATH-I 165 / MATH-I 166 requirement will be considered fulfilled. Credit will be granted for MATH-I 231 and MATH-I 166 only (7 credit hours). If the student does not pass MATH-I 166, the student must start with MATH-I 165.
- If a student has earned credit for MATH-I 231 only, the student must take the MATH-I 165 / MATH-I 166 sequence, and no credit will be allowed for MATH-I 231.
- If a student has earned credit for the PHYS-P 201 / PHYS-P 202 or PHYS-I 218 / PHYS-I 219 sequence, the student will be placed in PHYS-I 251. If the student passes PHYS-I 251, the PHYS-I 152 / PHYS-I 251 requirement will be considered fulfilled. Credit will be granted for PHYS-P 201 and PHYS-I 251 only (10 credit hours). If the student does not pass PHYS-I 251, the student must start with PHYS-I 152.
- If a student has earned credit for PHYS-P 201 or PHYS-I 218 only, the student must take the PHYS-I 152 / PHYS-I 251 sequence, and no credit will be allowed for PHYS-P 201 or PHYS-I 218.

On occasion, a student who initially enrolled in the B.S. in Chemistry program decides to transfer to the pre-professional B.A. in Chemistry program, having already taken one or more of the above-listed higher-level courses. A higher-level course will always substitute for a lower-level course to satisfy the requirement.

Minor in Chemistry

The undergraduate minor in chemistry requires a minimum of 21 credit hours of chemistry courses. The following courses are required: CHEM-C 105, CHEM-C 125, CHEM-C 106, CHEM-C 126, CHEM-C 341, CHEM-C 342, CHEM-C 343, and CHEM-C 310, or CHEM-C 360 or CHEM-C 484.

NOTE: MATH-I 232 and PHYS-P 202 or PHYS-I 251 are prerequisites for CHEM-C 360.

A grade of C or better must be earned in each chemistry course (a grade of C minus does not count).

For other requirements see the School of Science requirements under "Undergraduate Programs, Minors" elsewhere in the bulletin.

Graduate Programs (M.S. and Ph.D. Degrees)

Admission Requirements

The prospective student should have a bachelor's degree from an accredited institution, show promise of ability to engage in advanced work, and have adequate preparation, at least 35 credit hours of chemistry, broadly representative of the fields of the discipline, in a chemistry curriculum.

Incoming students with an undergraduate grade point average (GPA) of 3.00 or higher (on a 4.00 scale) will be considered for admission as regular graduate students. Those with a GPA below 3.00 could be considered for admission.

Application for Admission

Inquiries concerning the application process can be made directly to the Department by writing to Graduate Admissions; Department of Chemistry and Chemical Biology, IU Indianapolis, 402 N. Blackford Street, Indianapolis, IN 46202-3272; phone (317) 274-6876; web. Applications for full-time study should be completed by January 15th for the following Fall semester to ensure complete consideration for fellowships and other financial support (see “Graduate Program Financial Aid” in this section). Applications for part-time graduate admission may be submitted at any time.

Non-degree seeking graduate students who wish to enroll in courses, though not necessarily in a degree program, should contact the IU Graduate Office Indianapolis, University Library, UL 1170, 755 W. Michigan Street, Indianapolis, IN 46202; phone (317) 274-1577. Students should be aware that no more than 12 credit hours earned as a non-degree student may be counted toward a degree program. Please contact the graduate administrator in the Department of Chemistry and Chemical Biology for guidelines.

Transfer Credit

The Department will accept by transfer a maximum of 6 hours of graduate credit, in excess of undergraduate degree requirements, from approved institutions subject to approval by the graduate director in the Department of Chemistry and Chemical Biology.

Graduate Program Financial Aid

All full-time Ph.D. graduate students receive support stipends through teaching assistantships, research assistantships, departmental fellowships, university fellowships, or through the Industrial Co-op Program. Full-time students receive fee remissions; students with assistantships and fellowships are also eligible for health insurance. Consult the graduate advisor for current funding levels.

Master of Science Program

The M.S. program in chemistry, culminates in an Indiana University degree and requires 30 credit hours of study beyond the baccalaureate level. It is designed for students seeking careers as professional chemists. Graduates of the program often choose industrial positions, but others enter Ph.D. programs in chemistry or related areas. Graduates have been placed in positions throughout the United States and abroad.

General Degree Options and Requirements

Specific area requirements (core courses) apply for course work. Courses from three of the following areas must be taken: analytical, biological, inorganic, organic, and physical. Typically, students take three courses in their primary area and two courses outside of it to meet these requirements.

The M.S. degree can be earned through any of three different options: the thesis option, the Industrial Co-op Program, and the nonthesis option.

Thesis Option This traditional full-time program requires 20 hours of course work and 10 hours of thesis research. The research activity culminates in the completion and defense of a thesis. This option is available to full- or part-time students.

Nonthesis Option The nonthesis option requires 30 hours of course work alone. Because actual research experience is essential in an advanced chemistry program, this option is recommended for part-time students only. Students in this option are usually employed full time and are already engaged in research activity as part of their employment. However, nonthesis students may still enroll in a limited amount of research study that applies to the degree requirements (usually through CHEM-I 599).

Ph.D. Program

The Ph.D. program is a full-time, thesis-based research program that culminates in an Indiana University degree. This program provides a substantially larger research component than that of the M.S. degree and requires original and significant research contributions by the student. As a result, the Ph.D. student is qualified for employment where the ability to design, develop, and complete a research program is expected.

To establish candidacy, students must pass five written 'cumulative' examination questions within their first four semesters and an oral examination before the end of their fifth semester of graduate study. The oral examination will include a discussion of the student's research and defense of an original research proposal that is different from the student's thesis research.

Course requirements include a core of three courses in the student's major division plus three additional courses outside the major division. A number of additional courses may be recommended that cover material appropriate to the written part of the preliminary examination.

Bachelor of Science in Environmental Chemistry, non-A.C.S. Certified

With increased awareness of climate change and the impact of human endeavors on nature and human health, the Environmental Chemistry B.S. degree will provide curriculum that examines the environment at a molecular level. Lectures and laboratory courses and a broad selection of required courses in chemistry, geology, and biology are included.
Students who want to pursue an Environmental Chemistry major will find careers in applied fields, especially in industrial or manufacturing settings, analyzing chemicals and their impact on the environment. Additional paths for environmental chemists are in government agencies and for those who want to pursue teaching or fundamental research.

Degree Requirements

First-Year Experience Course Beginning freshmen and transfer students with fewer than 19 credit hours are required to take SCI-I 120 Windows on Science (1 cr.) or an equivalent first-year experience course.

Area I English Composition and Communication Competency See the School of Science requirements under "Undergraduate Programs" in this bulletin. The second semester of English composition may be satisfied only by ENG-W 150, ENG-W 230, ENG-W 231, ENG-W 270, ENG-W 320, or ENG-W 350.

Area II World Language Competency No world language proficiency is required for a Bachelor of Science degree.

Area IIIA Arts and Humanities, Social Sciences, and Cultural Understanding Competencies See the School of Science requirements under "Undergraduate Programs" in this bulletin.

For the most current list of courses in the areas of Arts and Humanities, Social Sciences and Cultural Understanding, please refer to the IU Indianapolis General Education Curriculum.

Area IIIC Life and Physical Sciences Competency BIOL-K 101, BIOL-K 103, BIOL-K 341, GEOL-G 107, GEOL-G 306, GEOL-G 406, PHYS-P 201 and PHYS-P 202.

Area IIID Analytical Reasoning Competency MATH-I 231 and MATH-I 232 (or equivalent introductory calculus

sequence). One computer programming course is also required.

Note: Computer Science CSCI-N 100 level courses do not count for any credit toward any degree in the School of Science. Also, CSCI-N 241 and CSCI-N 299 do not count in Area IIID, but may count as general electives.

Area IV Chemistry Concentration Requirements
CHEM-C 105, CHEM-C 125, CHEM-C 106, CHEM-C 126, CHEM-C 294, CHEM-C 310, CHEM-C 311, CHEM-C 341, CHEM-C 342, CHEM-C 343, CHEM-C 344, CHEM-C 325, CHEM-C 326, CHEM-C 360, CHEM-C 420, CHEM-C 421, CHEM-C 484, and CHEM-C 495. A total of 42 credit hours of chemistry courses are required. The Department of Chemistry and Chemical Biology requires a minimum grade of C in all chemistry courses (C- grades are unacceptable).

Bachelor of Science: Sample Program, Environmental Chemistry Major - Non-A.C.S. Certified (120 cr. required)

Freshman Year

First Semester	
CHEM-C 105 Principles of Chemistry I	3
CHEM-C 125 Experimental Chemistry I	2
BIOL-K 101 Concepts of Biology I	5
GEOL-G 107 Earth and Our Environment	3
MATH-I 231 Calculus for the Life Sciences I	3
SCI-I 120 Windows on Science	1
Total	**17**
Second Semester	
CHEM-C 106 Principles of Chemistry II	3
CHEM-C 126 Experimental Chemistry II	2
BIOL-K 103 Concepts of Biology II	5
GEOL-G 117 Earth and Our Environment Lab	1
MATH-I 232 Calculus for the Life Sciences II	3
ENG-W 131 Reading, Writing and Inquiry I	3
Total	**17**

Sophomore Year

Third Semester	
CHEM-C 341 Organic Chemistry I	3
CHEM-C 343 Organic Chemistry Laboratory I	2
BIOL-K 341 Principles of Ecology and Evolution	3
PHYS-P 201 General Physics I	5
2nd Written Communication Course	3
Total	**16**
Fourth Semester	
CHEM-C 342 Organic Chemistry II	3
CHEM-C 344 Organic Chemistry Laboratory II	2
CHEM-C 294 Cornerstone in Chemistry	1
PHYS-P 202 General Physics II	5
COMM-R 110 Fundamentals of Speech Communication	3
Total	**14**

Junior Year

Fifth Semester	
CHEM-C 310 Analytical Chemistry Lecture	3
CHEM-C 311 Analytical Chemistry Lab	1
STAT-I 301 Elementary Statistical Methods	3
Arts & Humanities/Social Science (choose from list)	3
General Elective	3
Total	**13**
Sixth Semester	
CHEM-C 325 Intro to Chemical Instrumentation	3
CHEM-C 326 Intro Chemical Instrumentation Lab	2
CHEM-C 484 Biomolecules and Catabolism	3
GEOL-G 306 Earth Materials	4
Arts & Humanities/Social Science (choose from list)	3
Total	**15**

Senior Year

Seventh Semester	
GEOL-G 406 Introduction to Geochemistry	3
Computer Programming (approved course)	3
Arts & Humanities/Social Science (choose from list)	3
Cultural Understanding (choose from list)	3
General Elective	3
Total	**15**
Eighth Semester	

CHEM-C 360 Introduction to Physical Chemistry	3
CHEM-C 420 Environmental Chemistry	3
CHEM-C 421 Environmental Chemistry Lab	1
CHEM-C 495 Capstone in Chemistry	1
General Electives	5
Total	**13**

The Department will not grant credit for a course when 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-C 360 and CHEM-C 361
- MATH-I 231 / MATH-I 232 or MATH-I 241 / MATH-I 242 and MATH-I 165 / MATH-I 166
- PHYS-P 201 / PHYS-P 202 and PHYS-I 152 / PHYS-I 251
- PHYS-I 100 or PHYS-I 200 and PHYS-P 201 or PHYS-I 152

For example, if a student has earned credit in MATH-I 165 / MATH-I 166, the student will receive no credit for MATH-I 231 / MATH-I 232, even if earned previously. Note: MATH-I 165 / MATH-I 166 will satisfy the calculus requirement for the Environmental Chemistry major, as it is considered a more comprehensive calculus sequence.

On occasion, a student who initially enrolled in the B.S. in Chemistry program decides to transfer to the pre-professional B.A. in Chemistry program, having already taken one or more of the above-listed higher-level courses. A higher-level course will always substitute for a lower-level course to satisfy the requirement.

Department of Earth and Environmental Sciences

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Department Chair: Kathy Licht, Ph.D.

Undergraduate Program Advisor: School of Science Advising Group

Graduate Program Advisor: Lin Li, Ph.D.

Geology is the study of the planet Earth: the materials of which it is made, the processes that act upon these materials, and the history of the planet and life forms since its origin. Earth Science considers the physical forces acting on the earth, the chemistry of its constituent materials, and the biology of its past inhabitants. Environmental Science also includes the study of the interrelationships in the modern environment of humans and geological phenomena and focuses on such important concerns as how our global climate is changing and how that change will affect human activities.

The Department of Earth and Environmental Sciences offers the Bachelor of Arts (B.A.) degree in Geology and Bachelor of Science (B.S.) degrees in Geology and in Environmental Science from Indiana University. These programs prepare students for graduate studies and for a variety of careers with emphasis on investigation of the environment by federal and state agencies, industries, and consulting companies, or earth and space science education. The programs allow flexibility to accommodate the needs and interests of all students. Selection of a particular program should be made in consultation with a departmental advisor.

Minors in Climate Resilience, Geochemistry, Geology and Environmental Science are available to supplement other campus, school, and department major programs. Minors allow for in-depth study of concepts to complement another degree program, or to pursue interests.

The Department of Earth and Environmental Sciences offers graduate study leading to the Master of Science (M.S.) and Doctor of Philosophy (Ph.D.) degrees granted by Indiana University. The M.S. program in Geology offers both thesis and non-thesis options. The Ph.D. program in Applied Earth Sciences is an interdisciplinary research training program involving students and faculty from the IU Indianapolis Schools of Science, Liberal Arts, and Medicine.

Faculty and students of the Department of Earth and Environmental Sciences are actively engaged in basic and applied research. Specific research areas include biogeochemistry, biomineralization, geoscience education, glacial geology, geochemistry, geomicrobiology, history of geology, hydrology, mineralogy, paleoceanography, paleoclimatology, paleontology, petrology, remote sensing and planetary geology, sedimentology and soil biogeochemistry.

- Bachelor of Arts
- Bachelor of Science
- Graduate Programs
- Minors

Bachelor of Arts in Geology

Degree Requirements

First-Year Experience Course Beginning freshmen and transfer students with less than 19 credit hours are required to take SCI-I 120 Windows on Science (1 cr.) or an equivalent first-year experience course.

Area I English Composition and Communication Competency See the School of Science requirements under “Undergraduate Programs” in this bulletin. The second semester of English composition may be satisfied by ENG-W 270, ENG-W 231, ENG-W 230 or ENG-W 350. GEOL-G 205 may satisfy the second writing requirement in Area I, but the 3 credit hours cannot then also be counted as part of the geology credit hours required in Area IV.

Area II World Language Competency First-year proficiency in a modern world language is required for the Bachelor of Arts degree program. See the School of

Science requirements under “Undergraduate Programs” in this bulletin.

Area IIIA Arts and Humanities, Social Sciences, and Cultural Understanding Competencies See the School of Science requirements under “Undergraduate Programs” in this bulletin. For the most current list of courses in the areas of Arts and Humanities, Social Sciences and Cultural Understanding, please refer to the IU Indianapolis General Education Curriculum.

Area IIIC Life and Physical Sciences Competency See the School of Science requirements under “Undergraduate Programs” in this bulletin, but all four courses must include laboratories; two of the four courses must include CHEM-C 105 / CHEM-C 125 and CHEM-C 106 / CHEM-C 126 and at least one of the four courses must be in biological sciences. No grade below C- will be accepted in any of these courses.

Students should consult with an academic advisor in the Department to determine approved science courses for the major.

Area IIID Analytical Reasoning Competency MATH-I 153 / MATH-I 154 or MATH-I 159 and CSCI-N 207 or another CSCI course approved by the Department of Earth Sciences. No grade below C- will be accepted in any of these courses.

Note: Computer Science CSCI-N 100 level courses do not count for credit toward any degree in the School of Science. Also, CSCI-N 241 and CSCI-N 299 do not count in Area IIID, but may count as an elective.

Area IV Geology Concentration Requirements GEOL-G 110, GEOL-G 120, GEOL-G 205 (or 300-level or 400-level GEOL-G course if GEOL-G 205 is used as a second composition course), GEOL-G 335, GEOL-G 221, GEOL-G 222, GEOL-G 334, four 300-level or higher geology courses, and a capstone course (GEOL-G 420, GEOL-G 460, or GEOL-G 495). Thirty-nine (39) credit hours in GEOL-G course work required. Geology majors cannot earn credit for both GEOL-G 221/GEOL-G 222 and GEOL-G 306. Other 100-level courses and 1 - 2 credit courses do not count toward the geology concentration, but may be applied as electives toward the university-required total of 120 credit hours. No grade below C- will be accepted in any of these courses.

Other Requirements

See the School of Science requirements under Undergraduate Programs, Baccalaureate Degree, General Requirements in this bulletin. Three credit hours of GEOL-G 420, GEOL-G 460, or GEOL-G 495 may be used to satisfy the School of Science capstone requirement, with approval by the Department of Earth Sciences.

Bachelor of Arts Sample Program (120 cr. required)

Freshman Year

First Semester	
SCI-I 120 Windows on Science	1
GEOL-G 110 Physical Geology	3
GEOL-G 120 Physical Geology Laboratory	1
CHEM-C 105 Principles of Chemistry I	3
CHEM-C 125 Experimental Chemistry I	2
ENG-W 131 Reading, Writing and Inquiry	3
MATH-I 153 College Algebra	3
Total	**16**
Second Semester	
CHEM-C 106 Principles of Chemistry II	3
CHEM-C 126 Experimental Chemistry II	2
MATH-I 154 Trigonometry	3
COMM-R 110 Fundamentals of Speech Communication	3
CSCI-N 207 or other approved computer course	3
Elective (GEOL-G 130 course suggested)	1
Total	**15**

Sophomore Year

Third Semester	
Second Composition Course (GEOL-G 205 recommended)	3
GEOL-G 221 Introductory Mineralogy	5
Approved Biology course with laboratory	5
Arts and Humanities (choose from list)	3
Total	**16**
Fourth Semester	
GEOL-G 335 Evolution of the Earth and Life	4
GEOL-G 222 Petrology	5
Approved Science course with laboratory	5
Elective (GEOL-G 130 recommended)	1
Total	**15**

Junior Year

Fifth Semester	
GEOL-G 300/GEOL-G 400 elective	3
GEOL-G 334 Principles of Sedimentation and Stratigraphy	5
Social Sciences Course (choose from list)	3
World Language Course	4
Total	**15**
Sixth Semester	

GEOL-G 300/GEOL-G 400 elective	3
Arts & Humanities or Social Sciences (choose from list)	3
World Language Course	4
Electives	5
Total	**15**

Senior Year

Seventh Semester	
GEOL-G 300/GEOL-G 400 electives	3
World Language Course	4
Elective	3
Elective	3
Elective	3
Total	**16**
Eighth Semester	
GEOL-G 300/GEOL-G 400 elective	3
Geology Capstone Course	3
Elective	3
Elective	3
Total	**12**

Bachelor of Science in Geology

Degree Requirements

First-Year Experience Course Beginning freshmen and transfer students with less than 19 credit hours are required to take SCI-I 120 Windows on Science (1 cr.) or an equivalent first-year experience course.

Area I English Composition and Communication Competency See the School of Science requirements under “Undergraduate Programs” in this bulletin. The second semester of English composition may be satisfied by ENG-W 270, ENG-W 231, ENG-W 230 or ENG-W 350. GEOL-G 205 may satisfy the second writing course requirement in Area I, but the 3 credit hours cannot then also be counted as part of the geology credit hours required in Area IV and another GEOL-G course must be taken.

Area II World Language Competency No world language proficiency is required for a Bachelor of Science degree.

Area IIIA Arts and Humanities, Social Sciences, and Cultural Understanding Competencies See the School of Science requirements under “Undergraduate Programs” in this bulletin.

For the most current list of courses in the areas of Arts and Humanities, Social Sciences and Cultural Understanding, please refer to the IU Indianapolis General Education Curriculum.

Area IIIC Life and Physical Sciences Competency CHEM-C 105 / CHEM-C 125, CHEM-C 106 / CHEM-C 126; PHYS-P 201 / PHYS-P 202; BIOL-K 341 / BIOL-K 342; and two Life and Physical Science courses or certain geography courses, outside the Department of Earth Sciences at the 300 or 400-level approved by the Department of Earth Sciences. No grade below C- will be accepted in any of these courses.

Students should consult with an academic advisor in the Department to determine approved science courses for the major.

Area IIID Analytical Reasoning Competency MATH-I 231 / MATH-I 232; CSCI-N 207 or another CSCI course approved by the Department of Earth Sciences; and STAT-I 301 or another statistics course approved by the Department of Earth Sciences. No grade below C- will be accepted in any of these courses.

Note: Computer Science CSCI-N 100 level courses do not count for credit toward any degree in the School of Science. Also, CSCI-N 241 and CSCI-N 299 do not count in Area IIID, but may count as an elective.

Area IV Geology Concentration Requirements GEOL-G 110, GEOL-G 120, GEOL-G 205 (or GEOL-G 300 level or GEOL-G 400 level course if GEOL-G 205 is used as a second composition course), GEOL-G 335, GEOL-G 221, GEOL-G 222, GEOL-G 334, GEOL-G 323, 12 credits of 300-level or 400-level geology courses, and GEOL-G 420 or another field camp of at least 3 credit hours approved by the Department of Earth Sciences. Forty-six (46) credit hours in GEOL-G course work required. Geology majors cannot earn credit for both GEOL-G 221/GEOL-G 222 and GEOL-G 306. Other 100-level courses, and 1 - 2 credit courses do not count toward the geology concentration requirement, but may be applied as electives toward the university-required total of 120 credit hours. No grade below C- will be accepted in any of these courses.

Other Requirements See the School of Science requirements under Undergraduate Programs, Baccalaureate Degree, General Requirements in this bulletin. GEOL-G 420 satisfies the School of Science capstone requirement.

Bachelor of Science Sample Program (120 cr. required)

Freshman Year	
First Semester	
SCI-I 120 Windows on Science	1
GEOL-G 110 Physical Geology/GEOL-G 120 Laboratory	4
ENG-W 131 Reading,Writing & Inquiry I	3
CHEM-C 105 Principles of Chemistry I	3
CHEM-C 125 Experimental Chemistry I	2
Arts & Humanities Course (choose from list)	3
Total	**16**
Second Semester	
COMM-R 110 Fundamentals of Speech Communication	3
CHEM-C 106 Principles of Chemistry II	3

CHEM-C 126 Experimental Chemistry II	2
MATH-I 231 Calculus for the Life Sciences I	3
CSCI-N 207 or other approved computer course	3
Total	**14**

Sophomore Year	
Third Semester	
Second Composition Course (GEOL-G 205 recommended)	3
GEOL-G 221 Introductory Mineralogy	5
MATH-I 232 Calculus for the Life Sciences II	3
Social Sciences Course (choose from list)	3
Total	**14**
Fourth Semester	
PHYS-P 201 General Physics I	5
GEOL-G 222 Introductory Petrology	5
GEOL-G 335 Evolution of Earth and Life	4
STAT-I 301 Elementary Statistical Methods	3
Total	**17**

Junior Year	
Fifth Semester	
PHYS-P 202 General Physics II	5
GEOL-G 323 Structural Geology	5
GEOL-G 334 Sedimentology and Stratigraphy	5
Total	**15**
Sixth Semester	
BIOL-K 341 Ecology and Evolution Lecture/BIOL-K 342 Laboratory	5
GEOL-G 300/GEOL-G 400 elective	3
300-400 level Science or Geography course	3
Elective	3
Total	**14**

Senior Year	
Seventh Semester	
GEOL-G 300/GEOL-G 400 elective	3
GEOL-G 300/GEOL-G 400 elective	3
Arts & Humanities or Social Sciences (choose from list)	3
Cultural Understanding Course (choose from list)	3
Elective	3
Total	**15**
Eighth Semester	
GEOL-G 300/GEOL-G 400 elective	3
GEOL-G 300/GEOL-G 400 elective	3
300-400 level Science or Geography course	3
Elective	3
GEOL-G 420 Regional Geology Field Trip (Summer)	3
Total	**15**

Minors

Minor in Climate Resilience

The minor in climate resilience is highly interdisciplinary, drawing on coursework offered in the Schools of Science, Arts, Public Health, SPEA, and Health & Human Services. The minor includes courses that introduce students to the Earth-Climate system, climate dynamics, and human dimensions of climate change. Students will also select a higher-level proficiency course in the area of their interest and complete a proficiency course about climate change and society.

The undergraduate minor in climate resilience requires 15 credit hours, with an overall grade point average of 2.00 (C) and with no grade less than a C, distributed as follows:

Earth-Climate system courses: 3 credits from the following list
*GEOL-G 107 Earth and our Environment (3 cr.)
*GEOL-G 110 How the Earth Works (3 cr.)
*GEOL-G 115 Oceanography (3 cr.)
*GEOG-G 114 The Greenhouse Effect and Global Warming (1 cr.)
*GEOG-G 108 Physical Systems of the Environment (2 cr.)

Climate dynamics courses: 3 credits from the following list
GEOG-G 303 Weather and Climate (3 cr.)
GEOL-G 185 Global Environmental Change (3 cr.)

Human dimensions of climate resilience: 3 credits from the following list
*SPEA-V 222 Principles of Sustainability (3 cr.)
*GEOL-G 132 Environmental Issues and Solutions (3 cr.)

Area proficiency courses: 3 credits from the following list
ANTH-B 468 Bioarcheology (3 cr.)
BIO-K 411 Global Change Biology (3 cr.)
CHEM-C 420 Environmental Chemistry (3 cr.)
GEOG-G 208 Environment and Society (3 cr.)
GEOG-G 310 Human Impact on the Environment (3 cr.)
GEOG-G 315 Environmental Conservation (3 cr.)
GEOL-G 410 Undergraduate Research in Geology (3 cr.)
GEOL-G 436 Earth Observation from Space (3 cr.)

GEOL-G 457 Paleoclimatology (3 cr.)
GEOL-G 460 Internship in Geology (3 cr.)
GEOL-G 488 Global Cycles (3 cr.)
GEOL-G 495 Senior Thesis in Geology (3 cr.)
PBHL-A 435 Energy, Climate Change, Resilience, and Health (3 cr.)
PBHL-A 445 Global Environmental Health and Sustainable Development (3 cr.)
PHIL-P 237 Environmental Ethics (3 cr.)
SPEA-V 310 Environmental Justice (3 cr.)
SPEA-V 311 Natural Resources and Environmental Policy (3 cr.)
SPEA-E 476 Environmental Law and Regulation (3 cr.)
TESM-T 207 Tourism Policy and Sustainability (3 cr.)

Proficiency course on climate resilience:
GEOL-G 477 - Climate Change and Society (3 cr.)

*Courses that apply to the IU Indianapolis General Education requirement.

At least 9 credit hours of the minor must be taken at IU Indianapolis (this does not include transfer credit, AP, or CLEP credit). Prerequisites to the minor courses are not included but are required in order to complete the minor. In addition, recommended courses include one year of college chemistry and at least one course in college algebra.

Minor in Geology

The undergraduate minor in geology requires 18 credit hours, with an overall grade point average of 2.00 (C) and with no grade less than a C-, distributed as follows:

- Students must complete the following four courses that total 12 credit hours: GEOL-G 110 (3 cr.), GEOL-G 120 (1 cr.), GEOL-G 335 (4 cr.), and GEOL-G 221 (4 cr.) or GEOL-G 306 (4 cr.).
- Students must complete an additional 6 credit hours minimum, including two of the following courses: GEOL-G 222 (4 cr.), GEOL-G 304 (3 cr.), GEOL-G 334 (4 cr.), GEOL-G 406 (3 cr.), GEOL-G 415 (3 cr.), GEOL-G 430 (4 cr.), GEOL-G 451 (3 cr.), or another 400-level geology course with departmental approval.

At least 9 credit hours of the minor must be taken at IU Indianapolis (this does not include transfer credit, AP, or CLEP credit). In addition, recommended courses include one year of college chemistry and at least one course in college algebra.

Minor in Geochemistry

The undergraduate minor in geochemistry requires five courses that total 15 credit hours, with an overall grade point average of 2.00 (C) and with no grade less than a C, distributed as follows:

At least three courses (9 credit hours) are geology courses chosen from the following: GEOL-G 406, GEOL-G 483, GEOL-G 486, and GEOL-G 488.

A maximum of two courses/course sequences may be chosen from the following: CHEM-C 310/CHEM-C 311, CHEM-C 341, CHEM-C 360, CHEM-C 361, CHEM-C 410/CHEM-C 411, BIOL-K 411.

At least 9 credit hours of the minor must be taken at IU Indianapolis (this does not include transfer credit, AP, or CLEP credit). Prerequisites to the minor courses are not included but are required in order to complete the minor. This information can be found in the School of Science bulletin. Additional recommended courses include one year of college chemistry and at one course in college algebra.

Minor in Environmental Science

A minor in Environmental Science requires satisfactory completion of 16-17 credit hours distributed as follows, with a minimum grade of C- in each course. At least 9 credits must be completed at IU Indianapolis (this does not include transfer credit, AP, or CLEP credit).

- GEOL-G 107 (3 cr.)
- GEOL-G 117 (1 cr.)
- GEOL-G 115 or GEOL-G 132 (3 cr.)
- GEOL-G 306 (4 cr.)
- Choose one (3 cr.) SPEA-V 222, SPEA-V 311, GEOG-G 303, PBHL-A 435, SPEA-E 476
- Choose one (2-3 cr.): GEOL-G 436, GEOL-G 477, GEOL-G 467, GEOL-G 415, or GEOL-G 420 British Virgin Islands Experiential Field Study

At least 9 credit hours of the minor must be taken at IU Indianapolis (this does not include transfer credit, AP, or CLEP credit). In addition, recommended courses include one year of college chemistry and at least one course in college algebra.

Graduate Programs

Master of Science in Geology

The Department of Earth and Environmental Sciences graduate program leads to a Master of Science degree from Indiana University. The program is administered by a departmental graduate advisory committee, composed of the graduate advisor and two or more members of the graduate faculty.

Admission Requirements

Prospective students should have a bachelor's degree in environmental science or geology, including a summer field course, and a minimum of a B (3.00) grade point average in geoscience courses. One year of chemistry and mathematics through college algebra and trigonometry are required. Individuals with a bachelor's degree in another area of science are also encouraged to apply; the departmental graduate advisory committee will prescribe a plan of study to remove deficiencies. The Graduate Record Examination (GRE) General Test is not required but scores may be submitted. Each student must submit three letters of recommendation.

Financial Aid

Admitted students may be appointed as research assistants or as teaching assistants in introductory geology courses. Several such assistantships are available each year. Assistantships include remission of tuition and fees.

Degree Requirements

Both thesis and non-thesis M.S. degree options are available.

The **thesis option** requires 30 credit hours of total course work. Of the 30 credit hours, 21 to 24 are non-research course work and 6 to 9 are GEOL-G 810 Research credits. 1 credit of colloquium is required and all students are required to take the class "1st Year Graduate Student Seminar" (3 cr.). At least 6, but no more than 9 credits of GEOL-G 810 Research credits shall be counted toward the 30 total credit hours for the M.S. thesis option. Of the non-research course work, 15 to 21 credit hours shall be completed within the department. At least 3 credit hours, and up to 6, of non-research course work approved at the graduate level must be taken outside of the department from allied disciplines with the approval of the graduate advisor. Up to 6 credit hours of 400-level courses approved for graduate credit may be counted toward the 15 to 24 credit hours of non-research course work with the approval of the graduate advisor. Up to 6 credit hours of GEOL-G 700 credits may be counted toward the non-research course work requirements.

The **non-thesis option** requires a total of 36 credit hours, none of which are to be taken as GEOL-G 810 Research. Of the 36 credit hours, 24 to 33 are to be completed within the department. 3 to 6 of the in-department course work credit hours must be completed as GEOL-G 700 Geologic Problems. At least 3, and up to 12, credit hours of non-research courses approved at the graduate level must be taken outside of the department from allied disciplines with the approval of the graduate advisor. The departmental graduate committee must approve elective credits outside the Department of Earth and Environmental Sciences for both the thesis and non-thesis options.

M.S. Degree Option	In Department Credit Hours	Outside of Department Credit Hours	GEOL-G 810 Research Credit Hours	GEOL-G 700 Geologic Problems Credit Hours	Total Credit Hours
Thesis	15-21	3-6	6-9	0-6	30
Non-Thesis	24-33	3-12	0	3-6	36

Admitted students will be assigned a three-person advisory committee at the beginning of the first year of graduate study. The committee will prescribe a study program based on the interests of the student and the principal graduate advisor. Students must complete all degree requirements within five years of beginning the study program. Students must maintain a B (3.00) average or higher, and no grade below C is acceptable.

Bachelor of Science/Master of Science in Geology

Program Structure and Admission

The B.S./M.S. program blends the undergraduate BS program with the M.S. program in Geology, leading to a joint award of B.S. and M.S. degrees upon completion of the M.S. thesis. The departmental graduate advisory committee administers the B.S./M.S. program in cooperation with the undergraduate advisor.

Prospective students should have advanced standing in the undergraduate program. Students will apply to the Earth and Environmental Sciences graduate program in early spring of the junior year under consultation of the undergraduate advisor. Students should submit three letters of recommendation. Application requires a minimum GPA of 3.00 and will be considered by the departmental graduate committee.

Upon acceptance into the program, the student will prepare an M.S. research and course plan in consultation with a B.S./M.S. academic advisor, or will elect to complete a non-thesis (coursework) M.S. degree. Research reading and data collection begins in the summer prior to the senior year of undergraduate study, and will be completed in the following summer. The fifth year of study is devoted to graduate course work and completion of the M.S. thesis research, or M.S. non-thesis coursework.

Degree Requirements

The proposed curriculum includes the core undergraduate courses that are currently required for the B.S. in Geology, and all the graduate courses that are currently required for the M.S. in Geology. The total credit hours for this integrated degree program will be 138 credit hours for a thesis M.S., and 147 credit hours for a non-thesis M.S. For reference, the B.S. Geology degree requires 120 hours, and the M.S. Geology degree requires 30 hours for a thesis M.S., and 36 hours for a non-thesis M.S. The integrated program utilizes overlap credits, reducing the number of required credit hours by 12 hours for students pursuing a thesis M.S., and by 9 hours for students pursuing a non-thesis (coursework) M.S.

- For thesis M.S.: GEOL-G 700 Geologic Problems (3 cr.), is taken in the Summer after the senior year, to develop a research project for the M.S. degree.
- For non-thesis M.S.: GEOL-G 690 Advanced Geology Seminar (3 cr.), is taken with a faculty member in the Earth and Environmental Sciences department to explore a research focus.
- Two 400-level or higher GEOL-G courses (6 cr.) satisfy both the B.S. Geology major course requirements, and 6 credits of the M.S. Geology graduate coursework requirements.
- For a thesis M.S., two 500-level or higher GEOL-G courses (6 cr.) satisfy both the B.S. Geology major concentration requirements, and M.S. Geology graduate coursework requirements.
- For a non-thesis M.S., one 500-level or higher GEOL-G course (3 cr.) satisfies both the B.S. Geology major concentration requirements, and M.S. Geology graduate coursework requirements.

Doctor of Philosophy in Applied Earth Sciences

The Ph.D. program prepares students for academic positions or research and leadership positions in local, state, national, or private environmental organizations. The goal of the program is to prepare future researchers

and leaders who assess complex environmental systems and assist in providing sound options and solutions for optimizing human-environment interactions.

Admission Requirements

Prospective students should have a B.S. or M.S. degree in the physical, biological, or health sciences, and a cumulative GPA of 3.0 or higher is expected. The Graduate Record Examination (GRE) General Test is not required. Individuals for whom English is a second language must demonstrate proficiency in English. Scores from the TOEFL exam should be submitted with the application for admission. Each student must submit three letters of recommendation.

Degree Requirements

Upon admittance to the program, students are assigned a preliminary advisory committee from among program faculty. Students identify an appropriate sub-discipline after their first year, and the preliminary advisory committee is reconstituted into a research committee (5 members) to suit the research goals of the student. The research committee includes at least three faculty members from the Department of Earth and Environmental Sciences and the minor advisor (who must be outside the Department of Earth and Environmental Sciences). In order to maintain proper balance in the expertise represented in the research committee, the graduate advisor can petition the Graduate Affairs committee to replace one Earth and Environmental Sciences faculty with an external member. If not an IU-affiliated faculty, that external member must be approved by the University Graduate School Indianapolis. The research advisory committee ensures successful progress in later coursework, coordinates oral qualifying exams, and advises students in their progress to degree completion as appropriate. Students will complete four or five core graduate courses in applied earth science topical areas, based on their prior academic background. After completing the core courses, students identify a specialization area and enroll in at least 18 credit hours of additional courses in support of that specialization, with consultation of the research advisory committee. Because of the interdisciplinary nature of the program and the diverse academic background of admitted students, all students are required to take the common core class, "1st Year Graduate Student Seminar (3 cr.)." The advisory committee may recommend one more fundamental earth sciences course to address deficiencies. All Ph.D. students must also complete a minor which is composed of 6 to 15 credit hours of coursework in a related area. The minor is chosen in consultation with the research committee. Students must complete all degree requirements within six years of beginning the study program, and must maintain a B (3.00) average.

Environmental Science Program

IU Indianapolis
Engineering, Science, and Technology Building, SL 118
723 W. Michigan Street
Indianapolis, IN 46202-5132
Phone: (317) 274-7484; fax: (317) 274-7966
Web: click here

- **Director:** Kathy Licht, Ph.D.

Bachelor of Science in Environmental Science

The Bachelor of Science of Environmental Science (BSES) degree is awarded by Indiana University. This program prepares students for graduate studies and for a variety of careers with emphasis on investigation of the environment by federal and state agencies, industry, and consulting firms. The program allows flexibility to accommodate the needs and interests of all students.

Faculty and students in the Departments of Earth and Environmental Sciences (Science), Geography (Liberal Arts), and the Fairbanks School of Public Health are actively engaged in basic and applied research. Specific research areas include geochemistry, hydrology, paleoclimatology, biogeochemical cycles, soils, wetland restoration, water resource analysis, environmental remote sensing, land cover dynamics, urban ecosystems, human health and the environment, environmental and water resources planning, environmental health policy, food science, and indoor air quality.

The Bachelor of Science in Environmental Science degree program offers three concentrations.

The Earth and Water Resources concentration provides students with a quantitative background in soils, hydrology, and biogeochemistry and an understanding of biological interactions, processes affecting soil and water resources, and advanced analytical techniques related to environmental quality assessments.

The Environmental Remote Sensing and Spatial Analysis concentration builds theoretical background and advanced knowledge in spatial analytical techniques using remote sensing (satellite and airborne sensors), geographic information systems (GIS), and global positioning system (GPS) technologies.

The Environmental Management concentration prepares students who wish to focus on the management of pollution in the air, land, and water. Students who complete this concentration have the theoretical foundation and applied skills needed to characterize hazards, track the fate and transport of pollutants, identify health and environmental effects of pollutants, and plan and manage programs to control environmental hazards.

Selection of a particular concentration should be made in consultation with the academic and concentration advisors.

- Bachelor of Science in Environmental Science
- Minor in Environmental Science

Bachelor of Science in Environmental Science

Degree Requirements

First-Year Experience Course Beginning freshmen and transfer students with fewer than 19 credit hours are required to take SCI-I 120 Windows in Science (1 cr.) or an equivalent first-year experience course.

Area I English Composition and Communication Competency (9 cr.) See the School of Science requirements under “Undergraduate Programs” in this bulletin. The second semester of English composition

may be satisfied by ENG-W 270, ENG-W 231, ENG-W 230 or ENG-W 350. GEOL-G 205 may be used to fulfill the second writing course requirement, but the 3 credit hours cannot then also be counted as part of the core and concentration credit hours required in Area IV.

Area II World Language No world language proficiency is required for a Bachelor of Science degree.

Area IIIA Arts and Humanities, Social Sciences, and Cultural Understanding Competencies (12 cr.) See the School of Science requirements under "Undergraduate Programs" in this bulletin. SPEA-V 222 Principles of Sustainability is recommended as a Social Science course.

For the most current list of courses in the areas of Arts and Humanities, Social Sciences and Cultural Understanding, please refer to the IU Indianapolis General Education Curriculum.

Area IIIC Life and Physical Sciences Competency (26 cr.) BIOL-K 341 / BIOL-K 342, CHEM-C 105/CHEM-C 125 / CHEM-C 106/CHEM-C 126, and PHYS-P 201 / PHYS-P 202. No grade below C- will be accepted in any of these courses.

Area IIID Analytical Reasoning Competency (12 cr.) MATH-I 231 / MATH-I 232 or MATH-I 165 / MATH-I 166, CSCI-N 207 or another CSCI course approved by the Department of Earth and Environmental Sciences; and STAT-I 301, SPEA-K 300, or a course in statistics approved by the Department of Earth and Environmental Sciences. No grade below C- will be accepted in any of these courses.

Note: Computer Science CSCI-N 100 level courses do not count for credit toward any degree in the School of Science. Also, CSCI-N 241 and CSCI-N 299 do not count in Area IIID, but may count as an elective.

Area IV Major Core and Concentration Requirements
Thirty-two (32) credit hours of environmental science core courses including:

- GEOL-G 107 / GEOL-G 117 Environmental Geology Lecture and Laboratory
- GEOL-G 205 Reporting Skills in Geoscience (or, with approval, a GEOL 300-level or higher course if GEOL-G 205 is used as the second composition course).
- GEOG-G 208 Environment & Society or PBHL-A 115 Environment and Human Health
- PHIL-P 237 Environmental Ethics
- GEOG-G 303 Weather and Climate
- GEOL-G 306 Earth Materials
- GEOL-G 406 Introduction to Geochemistry
- GEOL-G 436 Earth Observation from Space
- GEOL-G 477 Climate Change and Society
- GEOG-G 315 Environmental Conservation or SPEA-V 311 Natural Resources and Environmental Policy
- HIST-A 410 American Environmental History

No grade below C- will be accepted in any of these courses.

Concentration Requirements Seventeen to Eighteen (17-18) credit hours of courses within one of three Environmental Science concentrations. Students select one of the Environmental Science Concentrations – Earth and Water Resources, Environmental Remote Sensing and Spatial Analysis, or Environmental Management.

A. Earth and Water Resources Seventeen (17) credit hours, including:

- GEOL-G 334 Sedimentology and Stratigraphy
- GEOL-G 430 Principles of Hydrology
- One GEOL-G 300 or higher course

One (1) concentration elective course, chosen from the following:

- GEOL-G 483 Isotope Geochemistry
- GEOL-G 486 Soil Biogeochemistry
- BIOL-K 411 Global Change Biology
- GEOL-G 415 Geomorphology
- Other applicable topic courses as approved by advisor

One (1) capstone course, chosen from the following:

- GEOL-G 420 Regional Geology Field Trip
- GEOL-G 460 Internship
- GEOL-G 467 GeoHealth: When our Health Collides with our Environment
- GEOL-G 488 Global Cycles
- GEOL-G 495 Senior Thesis
- Or another GEOL-G, GEOG-G, or SPEA-V class with department approval

No grade below C- will be accepted in any courses in the Earth and Water Resources concentration.

B. Environmental Remote Sensing and Spatial Analysis Eighteen (18) credit hours, including:

- GEOG-G 336 Environmental Remote Sensing
- GEOL-G 338 Introduction to GIS
- GEOG-G 337 Computer Cartography and Graphics or GEOL-G 415 Geomorphology
- Two (2) courses chosen from:
  - GEOG-G 436 Advanced Remote Sensing
  - GEOG-G 438 Advanced Geographic Information Science
  - GEOL-G 487 Remote Sensing of Global Change
  - GEOG-G 311 Research Methods in Geography
- One capstone course, chosen from the following:
  - GEOL-G 420 Regional Geology Field Trip
  - GEOG-G 439 GIS and Environmental Analysis
  - GEOL-G 460 Internship
  - GEOL-G 495 Senior Thesis
  - Or another GEOL-G, GEOG-G, or SPEA-V class with department approval

No grade below C- will be accepted in any courses in the Environmental Remote Sensing and Spatial Analysis concentration.

C. Environmental Management Seventeen (17) credit hours, including:

- PBHL-A 316 Environmental Health Science

- SPEA-E 476 Environmental Law and Regulation
- One (1) course in Spatial Analysis, chosen from the following:
  - GEOG-G 338 Introduction to GIS
  - GEOG-G 438 Advanced GIS
  - GEOG-G 439 GIS and Environmental Analysis
  - PBHL-A 441 Public Health Applications of GIS
- Two (2) concentration elective courses, chosen from the following:
  - GEOG-G 315 Environmental Conservation
  - PBHL-A 415 Explosions, Collapses, and Toxic Spills
  - PBHL-A 430 eWaste, Toxic Materials and Conflict Minerals
  - PBHL-A 435 Energy, Climate Change, Resilience and Health
  - PBHL-A 445 Global Health and Sustainable Development
  - SPEA-V 310 Environmental Justice
  - SPEA-V 311 Natural Resources and Environmental Policy
- One (1) capstone course, chosen from the following:
  - GEOL-G 420 Regional Geology Field Trip
  - GEOL-G 460 Internship
  - GEOL-G 467 GeoHealth: When our Health Collides with our Environment
  - GEOL-G 488 Global Cycles
  - GEOL-G 495 Senior Thesis
  - Or another GEOL-G, GEOG-G, or SPEA-V class with department approval

No grade below C- will be accepted in any courses in the Environmental Management concentration.

D. Other Requirements See the School of Science requirements under “Undergraduate Programs, Baccalaureate Degree, General Requirements” in this bulletin.

Environmental Science Plans of Study

There is no single semester-by-semester plan of study for the B.S.E.S. degree because of the flexibility encouraged within the program and the three concentration options. However, a possible plan for courses is given below. Variations from this sample plan of study should be made in consultation with the academic and concentration advisors.

Bachelor of Science Environmental Science Sample Programs (120 cr. required)

Sample Plan of Study

- **Freshman Year**

First Semester	
GEOL-G 107 Earth and Our Environment	3
GEOL-G 117 Laboratory: Earth and Our Environment	1
CHEM-C 105 Principles of Chemistry I/CHEM-C 125 Experimental Chemistry	5
ENG-W 131 Reading, Writing and Inquiry	3
SPEA-V 222 Principles of Sustainability	3
SCI-I 120 Windows on Science	1
1 credit elective	1
Total	**17**
Second Semester	
CHEM-C 106 Principles of Chemistry II/CHEM-C 126 Experimental Chemistry II	5
GEOG-G 208 Environment & Society or PBHL-A 115 Environment & Human Health	3
Calculus I	3
COMM-R 110 Fundamentals of Speech Communication	3
Cultural Understanding Course	3
Total	**17**

Sophomore Year

Third Semester	
GEOL-G 205 Reporting Skills in Geoscience (as 2nd composition course)	3
PHIL-P 237 Environmental Ethics	3
Calculus II	3
CSCI-N 207 Data Analysis Using Spreadsheets	3
GEOG-G 303 Weather and Climate	3
Total	**15**
Fourth Semester	
GEOL-G 306 Earth Materials	4
PHYS-P 201 General Physics 1	5
Social Science or Arts and Humanities Course	3
Arts and Humanities Course	3
Total	**15**

Junior Year - EARTH AND WATER RESOURCES CONCENTRATION

Fifth Semester	
GEOL-G 334 Sedimentology and Stratigraphy	5
BIOL-K 341 Principles of Ecology and Evolution Lecture	3
BIOL-K 342 Principles of Ecology and Evolution Lab	2
PHYS-P 202 General Physics 2	5
1 credit elective	1
Total	**16**
Sixth Semester	
GEOL-G 477 Climate and Society	3
CSCI-N 207 Data Analysis Using Spreadsheets	3
GEOG-G 315 Environmental Conservation or SPEA-V 311 Natural Resources and Environmental Policy	3
Upper Level GEOL, GEOG, SPEA, or PBHL elective (replace GEOL-G 205 as 2nd composition)	3
Total	**12**

Junior Year - REMOTE SENSING CONCENTRATION

Fifth Semester	
BIOL-K 341 Principles of Ecology & Evolution Lecture	3
BIOL-K 342 Principles of Ecology & Evolution Lab	2
PHYS-P 202 General Physics 2	5
GEOG-G 338 Introduction to GIS	3
GEOG-G 336 Introduction to Remote Sensing	3
Total	**16**
Sixth Semester	
CSCI-N 207 Data Analysis Using Spreadsheets	3
GEOL-G 477 Climate and Society	3
GEOG-G 315 Environmental Conservation or SPEA-V 311 Natural Resources and Environmental Policy	3
GEOG-G 337 Computer Cartography or GEOL-G 415 Geomorphology	3
Total	**12**

Senior Year - EARTH AND WATER RESOURCES CONCENTRATION

Seventh Semester	
STAT-I 301 or SPEA-K 300 Statistics	3
GEOL-G 430 Hydrology	3
GEOL-G 436 Earth Observation from Space	3
GEOL-G 486 Soil Biogeochemistry	3
Elective	3
Total	**15**
Eighth Semester	
Concentration Elective	3
Concentration Capstone	3
HIST-A 410 American Environmental History	3
Electives	6
Total	**15**

Senior Year - REMOTE SENSING CONCENTRATION

Seventh Semester	
STAT-I 301 or SPEA-K 300 Statistics	3
GEOL-G 406 Geochemistry	3
GEOL-G 436 Earth Observation from Space	3
Electives	6
Total	**15**
Eighth Semester	
Concentration Elective	3
Concentration Capstone	3
HIST-A 410 American Environmental History	3
Upper Level GEOL, GEOG, SPEA, or PBHL elective (replace GEOL-G 205 as 2nd composition)	3
Elective	3

Total	**15**

Junior Year - ENVIRONMENTAL MANAGEMENT CONCENTRATION

Fifth Semester	
BIOL-K 341 Principles of Ecology and Evolution Lecture	3
BIOL-K 342 Principles of Ecology and Evolution Lab	2
PHYS-P 202 General Physics 2	5
SPEA-E 476 Environmental Law and Regulation	3
PBHL-A 316 Environmental Health Science	3
Total	**16**
Sixth Semester	
CSCI-N 207 Data Analysis Using Spreadsheets	3
GEOL-G 477 Climate and Society	3
GEOG-G 315 Environmental Conservation or SPEA-V 311 Natural Resources and Environmental Policy	3
Concentration Elective	3
Total	**14**

Senior Year - ENVIRONMENTAL MANAGEMENT CONCENTRATION

Seventh Semester	
STAT-I 301 or SPEA-K 300 Statistics	3
Concentration Elective (Spatial Analysis)	3
GEOL-G 436 Earth Observation from Space	3
GEOL-G 406 Geochemistry	3
Elective	3
Total	**15**
Eighth Semester	
Concentration Elective	3
Concentration Capstone	3
HIST-A 410 American Environmental History	3
Upper Level GEOL, GEOG, SPEA, or PBHL elective (replace GEOL-G 205 as 2nd composition)	3
Elective	3
Total	**15**

Minor in Environmental Science

A minor in Environmental Science requires satisfactory completion of 16-17 credit hours distributed as follows, with a minimum grade of C- in each course.

- GEOL-G 107 (3 cr.)
- GEOL-G 117 (1 cr.)
- GEOL-G 115 or GEOL-G 132 (3 cr.)
- GEOL-G 306 (4 cr.)
- Choose one (3 cr.) SPEA-V 222, SPEA-V 311, GEOG-G 303, PBHL-A 435, SPEA-E 476
- Choose one (2-3 cr.): GEOL-G 436, GEOL-G 477, GEOL-G 467, GEOL-G 415, or GEOL-G 420 British Virgin Islands Experiential Field Study

At least 9 credits must be completed at IU Indianapolis (this does not include transfer credit, AP, or CLEP credit). In addition, recommended courses include one year of college chemistry and at least one course in college algebra.

FIS Programs

IU Indianapolis
Science Building, LD 326
402 N. Blackford Street
Indianapolis, IN 46202-3274
Phone: (317) 274-6882; fax: (317) 274-4701
Web: click here

- **Director:** Gina M. Londino-Smolar, Ed.D.
- **Undergraduate Program Advisor:** School of Science Advising Group

Forensic science is the application of the methods of science to matters involving the public. In many cases this means the application of science in solving crimes. Forensic science is multidisciplinary; it involves chemistry, biology, physics, math, biochemistry, engineering, computer science, psychology, medicine, law, criminal justice, etc. Forensic scientists analyze evidence and testify in court. They may be called upon to attend some crime scenes, train police investigators and attorneys, and conduct research.

In the Fall of 2004, the first forensic science degree program in Indiana began at IUPUI. This FEPAC-accredited program was developed by faculty from the School of Law, the School of Science, and the School of Public and Environmental Affairs (SPEA). Completion of this program leads to the Bachelor of Science in Forensic and Investigative Sciences. All students take a core of science classes and university-required courses. Then each student chooses one concentration:

- Forensic Biology
- Forensic Chemistry

The baccalaureate program also includes courses in law and forensic science, laboratory courses in forensic chemistry, biology, and microscopy, as well as opportunities to complete an internship or a research project with a member of the faculty. Graduates of the

program will be able to seek employment in crime labs, scientific industries, environmental agencies, and federal or local law enforcement. Students are also well qualified to apply for graduate or medical school.

Admission to the Major

There are specific credit, GPA, and course requirements for admission to the FIS program. These depend upon your status. For more information about the undergraduate or graduate program, please contact: forsci@iu.edu or 317-274-6882.

- Bachelor of Science
- Minor in Forensic and Investigative Sciences
- Graduate Program

Bachelor of Science

This degree is for students who plan to work in the criminal justice system as scientists in crime laboratories or other law enforcement environments. This degree also allows students to be well prepared for medical school, graduate school, law school, teaching or research laboratories.

Degree Requirements

See the School of Science requirements under "Undergraduate Programs" in this bulletin for additional restrictions.

First-Year Experience Course Beginning freshmen and transfer students with fewer than 19 credit hours are required to take SCI-I 120 Windows on Science (1 cr.) or an equivalent first-year experience course.

Area I English Composition and Communication Competency (9 cr.)

Written Communication (6 cr.)

A minimum grade of C must be obtained in both composition courses.

- ENG-W 131 Reading, Writing and Inquiry
- The second semester of English composition may be satisfied only by ENG-W 270, ENG-W 231, or ENG-W 230.

Oral Communication (3 cr.)

A minimum grade of C must be obtained.

- COMM-R 110 Fundamentals of Speech Communication

Area II World Language Competency

No world language proficiency is required for a Bachelor of Science degree.

Area IIIA Arts and Humanities, Social Sciences, and Cultural Understanding Competencies (12 cr.)

- Arts and Humanities course: Choose one course (3 cr.) from this list. The list of course choices is located under the School of Science requirements "Undergraduate Programs" in this bulletin.
- Social Sciences course: Choose one course (3 cr.) from this list. The list of course choices is located under the School of Science requirements "Undergraduate Programs" in this bulletin.
- One additional course (3 cr.) from Humanities or Social Sciences list.
- Cultural Understanding course: Choose one course (3 cr.) from this list. The list of course choices is located under the School of Science requirements "Undergraduate Programs" in this bulletin.

For the most current list of courses in the areas of Arts and Humanities, Social Sciences and Cultural Understanding, please refer to the IU Indianapolis General Education Curriculum.

Area IIIC Life and Physical Sciences Competency (20 cr.)

- *Physics:* Two semesters of basic physics: PHYS-P 201 General Physics I (5 cr.) and PHYS-P 202 General Physics II (5 cr.)
  - *PHYS-I 152 and PHYS-I 251 are acceptable substitutes.*
- *Chemistry:* Two semesters of introductory college chemistry with a laboratory: CHEM-C 105 Principles of Chemistry I (3 cr.) / CHEM-C 125 Experimental Chemistry I (2 cr.) and CHEM-C 106 Principles of Chemistry II (3 cr.) / CHEM-C 126 Experimental Chemistry II (2 cr.)

Area IIID Analytical Reasoning Competency (9 cr.)

- *Mathematics:* MATH-I 231 Calculus for the Life Sciences I (3 cr.) and MATH-I 232 Calculus for the Life Sciences II (3 cr.)
  - *MATH-I 165 and MATH-I 166 are acceptable substitutes.*
  - *Students pursuing a B.S. in Chemistry must take MATH-I 165 and MATH-I 166.*
- *Computer Programming:* Choose one course from the following: CSCI-N 200, CSCI-N 201, CSCI-N 207 recommended), CSCI-N 211, or CSCI-N 301 (all are 3 cr.)

Note: Computer Science CSCI-N 100 level courses do not count for credit toward any degree in the School of Science. Also, CSCI-N 241 and CSCI-N 299 do not count in Area IIID but may count as a general elective.

Area IV Forensic and Investigative Sciences Major Concentration (17 cr.)

A) Required forensic science courses in addition to those required for the concentration (16 cr.) All FIS courses applicable to the major must have a minimum grade of C.

- FIS-I 205 Concepts of Forensic Science I (3 cr.)
- FIS-I 206 Concepts of Forensic Science II (3 cr.)
- FIS-I 300 Forensic Microscopy (1 cr.)
- FIS-I 301 Forensic Microscopy Lab (2 cr.)
- FIS-I 305 Professional Issues in Forensic Science (3 cr.)
- FIS-I 415 Forensic Science and the Law (3 cr.)
- FIS-I 380 Forensic Science Professional Capstone I (1 cr.)
- FIS-I 480 Forensic Science Capstone II (Fall) (1 cr.)

B) Required biology courses (10 cr.) A minimum grade of C- is required in both of these courses.

- BIOL-K 101 Concepts of Biology I (5 cr.)

- BIOL-K 103 Concepts of Biology II (5 cr.)

C) Required chemistry courses beyond introductory chemistry (10 cr.) A minimum grade of C- is required in all of these courses.

- CHEM-C 341 Organic Chemistry Lectures I (3 cr.)
- CHEM-C 343 Organic Chemistry Laboratory I (2 cr.)
- CHEM-C 342 Organic Chemistry Lectures II (3 cr.)
- CHEM-C 344 Organic Chemistry Laboratory II (2 cr.)

D) Required statistics course (3 cr.) A minimum grade of C- is required in this course.

- STAT-I 301 Elementary Statistical Methods (3 cr.)

E) Concentrations

Forensic Biology Concentration (24 cr.)

FIS courses applicable to the major must have a minimum grade of C. A minimum grade of C- is required in all of the Biology courses.

- BIOL-K 322 Genetics and Molecular Biology (3 cr.)
- BIOL-K 323 Genetics and Molecular Biology Laboratory (Fall) (2 cr.)
- BIOL-K 324 Cell Biology (3 cr.)
- BIOL-K 325 Cell Biology Laboratory (Spring) (2 cr.)
- BIOL-K 384 Biological Chemistry (3 cr.)
- FIS-I 420 Forensic Biology (Fall) (3 cr.)
- FIS-I 421 Forensic Biology Laboratory (Fall) (1 cr.)
- FIS-I 430 Forensic Genetics (Spring) (3 cr.)
- FIS-I 431 Forensic Biology Capstone III (Spring) (1 cr.)
- FIS-I 440 Population Genetics (Spring) (3 cr.)

F) Advanced Specialization Courses: Refer to the list below (9 cr. minimum)

Forensic Biology Concentration Advanced Specialization Course List

- ANTH-B 426 Human Osteology (3 cr.)
- ANTH-B 468 Bioarchaeology (3 cr.)
- ANTH-B 474 Forensic Anthropology, Archaeology & Taphonomy (3 cr.)
- BIOL-K 331 Developmental Biology (3 cr.)
- BIOL-K 333 Developmental Biology Laboratory (2 cr.)
- BIOL-K 338 Intro Immunology (3 cr.)
- BIOL-K 339 Immunology Laboratory (2 cr.)
- BIOL-K 341 Principles of Ecology & Evolution (Fall & even numbered Springs) (3 cr.)
- BIOL-K 342 Principles of Ecology & Evolution Laboratory (Fall) (2 cr.)
- BIOL-K 356 Microbiology (3 cr.)
- BIOL-K 357 Microbiology Laboratory (2 cr.)
- BIOL-N 217 Human Physiology (5 cr.)
- BIOL-N 261 Human Anatomy (5 cr.)
- CHEM-C 310 Analytical Chemistry (3 cr.)
- CHEM-C 311 Analytical Chemistry Laboratory (1 cr.)
- CHEM-C 360 Elementary Physical Chemistry (3 cr.)
- CHEM-C 325 Introduction to Chemistry Instrumentation (Spring) (3 cr.)
- CHEM-C 326 Introduction to Chemistry Instrumentation Lab (Spring) (2 cr.)
- CHEM-C 420 Environmental Chemistry (3 cr.)
- CHEM-C 421 Environmental Chemistry Lab (1 cr.)
- CHEM-C 430 Inorganic Chemistry (3 cr.)
- CHEM-C 435 Inorganic Chemistry Laboratory (1 cr.)
- CHEM-C 485 Biosynthesis and Physiology (3 cr.)
- CHEM-C 486 Biological Chemistry Laboratory (2 cr.)
- FIS-I 400 Forensic Chemistry I (Fall) (3 cr.)
- FIS-I 401 Forensic Chemistry Laboratory I (Fall) (1 cr.)
- FIS-I 410 Forensic Chemistry II (Spring) (3 cr.)
- FIS-I 411 Forensic Chemistry Capstone III (Spring) (1 cr.)
- FIS-I 450 Forensic Science Research (1-4 cr.)
- FIS-I 495 Forensic Science Internship (0-5 cr.)
- FIS-I 496 Special Topics in Forensic Science (credit hours vary - repeatable with different topics)
- SPEA-J 260 Topics in Criminal Justice (1 cr.) (ONLY approved topics, including: Death Investigation, Investigating Post Blast Crime Scene, Serial Murder, and Indiana Homicide)

Forensic Chemistry Concentration (19 cr.)

FIS courses applicable to the major must have a minimum grade of C. A minimum grade of C- is required for all Chemistry courses.

- CHEM-C 310 Analytical Chemistry (3 cr.)
- CHEM-C 311 Analytical Chemistry Laboratory (1 cr.)
- CHEM-C 325 Introduction to Chemistry Instrumentation (Spring) (3 cr.)
- CHEM-C 326 Introduction to Chemistry Instrumentation Lab (Spring) (2 cr.) CHEM-C 410 / CHEM-C 411 are acceptable substitutes for students pursuing a B.S. in Chemistry.
- CHEM-C 360 Elementary Physical Chemistry (Spring) (3 cr.)CHEM-C 362 is an acceptable substitute for students pursuing a B.S. in Chemistry.
- FIS-I 400 Forensic Chemistry I (Fall) (3 cr.)
- FIS-I 401 Forensic Chemistry I Lab (Fall) (1 cr.)
- FIS-I 410 Forensic Chemistry II (Spring) (3 cr.)
- FIS-I 411 Forensic Chemistry Capstone III (Spring) (1 cr.)

G) Advanced Chemistry or Biology Course (3 cr.)

Forensic Chemistry Concentration Advanced Specialization (choose one) (3 cr.)

- BIOL-K 322 Genetics and Molecular Biology (3 cr.)
- BIOL-K 356 Microbiology (3 cr.)
- BIOL-K 384 Biological Chemistry (3 cr.)
- CHEM-C 384 Biochemistry (3 cr.)
- CHEM-C 420 Environmental Chemistry (3 cr.)
- CHEM-C 430 Inorganic Chemistry (3 cr.)
- CHEM-C 484 Biomolecules and Catabolism (3 cr.)
- CHEM-C 485 Biosynthesis and Physiology (3 cr.)

H) Advanced Specialization Courses (9 cr.)

Forensic Chemistry Concentration Advanced Specialization Course List (9 cr.)

- ANTH-B 426 Human Osteology (3 cr.)
- ANTH-B 468 Bioarchaeology (3 cr.)

- ANTH-B 474 Forensic Anthropology, Archaeology & Taphonomy (3 cr.)
- *BIOL-K 322 Genetics and Molecular Biology (3 cr.)
- BIOL-K 323 Genetics and Molecular Biology Laboratory (Fall) (2 cr.)
- BIOL-K 324 Cell Biology (3 cr.)
- BIOL-K 325 Cell Biology Laboratory (Spring) (2 cr.)
- BIOL-K 331 Developmental Biology (3 cr.)
- BIOL-K 333 Developmental Biology Laboratory (1 cr.)
- BIOL-K 338 Intro Immunology (3 cr.)
- BIOL-K 339 Immunology Laboratory (2 cr.)
- BIOL-K 341 Principles of Ecology & Evolution (Fall and even numbered Springs) (3 cr.)
- BIOL-K 342 Principles of Ecology & Evolution Laboratory (Fall) (2 cr.)
- *BIOL-K 356 Microbiology (3 cr.)
- BIOL-K 357 Microbiology Laboratory (2 cr.)
- *BIOL-K 384 Biological Chemistry (3 cr.)
- BIOL-K 484 Cellular Biochemistry (3 cr.)
- BIOL-N 217 Human Physiology (5 cr.)
- BIOL-N 261 Human Anatomy (5 cr.)
- *CHEM-C 420 Environmental Chemistry (3 cr.)
- CHEM-C 421 Environmental Chemistry Lab (1 cr.)
- *CHEM-C 430 Inorganic Chemistry (3 cr.)
- CHEM-C 435 Inorganic Chemistry Laboratory (2 cr.)
- *CHEM-C 384 Biochemistry (3 cr.)
- *CHEM-C 484 Biomolecules and Catabolism (3 cr.)
- *CHEM-C 485 Biosynthesis and Physiology (3 cr.)
- CHEM-C 486 Biological Chemistry Laboratory (2 cr.)
- FIS-I 420 Forensic Biology I (Fall) (3 cr.)
- FIS-I 421 Forensic Biology I Laboratory (Fall) (1 cr.)
- FIS-I 430 Forensic Biology II (Spring) (3 cr.)
- FIS-I 431 Forensic Biology Capstone III (Spring) (1 cr.)
- FIS-I 440 Population Genetics (Spring) (3 cr.)
- FIS-I 450 Forensic Science Research (1-4 cr.)
- FIS-I 495 Forensic Science Internship (0-5 cr.)
- FIS-I 496 Special Topics in Forensic Science (credit hours vary - repeatable with different topics)
- SPEA-J 260 Topics in Criminal Justice (1 cr.) (ONLY approved topics, including: Death Investigation, Investigating Post Blast Crime Scene, Serial Murder, and Indiana Homicide)

*Course counts as an additional advanced elective if not chosen as the one selection from list (1) above.

Area V Electives This degree requires no electives not defined by degree requirements.

Additional Policies

1) Overlapping Courses

The Forensic and Investigative Sciences Program will not grant credit for a course when considerable duplication of course content occurs with another course that has been taken for credit. In general, credit will be allowed for the higher-level or Honors courses, but not for the lower-level courses. The following listings are considered to be duplications (lower-level courses listed first):

- BIOL-K 384 and CHEM-C 384
- CHEM-C 101 and CHEM-C 105
- MATH-I 231 and MATH-I 165
- MATH-I 232 and MATH-I 166
- PHYS-P 201 and PHYS-I 152
- PHYS-P 202 and PHYS-I 251

For example, if a student has earned credit for MATH-I 165 / MATH-I 166, the student will receive no credit for MATH-I 231 / MATH-I 232, even if earned previously.

As a result of completing a Bachelor of Science in Forensic and Investigative Sciences and depending on the concentration selected, a student may earn enough credit hours to satisfy the requirements for a minor in chemistry or biology in addition to the major in FIS. Please consult with the academic advisor for the FIS program and the appropriate academic unit that awards the minor.

Bachelor of Science: Forensic and Investigative Sciences Forensic Biology Concentration Sample Plan of Study (124 cr.)

Freshman Year

First Semester	
BIOL-K 101 Concepts of Biology I	5
CHEM-C 105 Principles of Chemistry I	3
CHEM-C 125 Experimental Chemistry I	2
MATH-I 231 Calculus for the Life Sciences I	3
FIS-I 205 Concepts of Forensic Science I	3
SCI-I 120 Windows on Science	1
Total	**17**
Second Semester	
BIOL-K 103 Concepts of Biology II	5
CHEM-C 106 Principles of Chemistry II	3
CHEM-C 126 Experimental Chemistry II	2
MATH-I 232 Calculus for the Life Sciences II	3
FIS-I 206 Concepts of Forensic Science II	3
Total	**16**

Sophomore Year

Third Semester	
ENG-W 131 Reading, Writing and Inquiry	3
BIOL-K 322 Genetics and Molecular Biology	3
BIOL-K 323 Genetics and Molecular Biology Lab (Fall only)	2
CHEM-C 341 Organic Chemistry I	3

CHEM-C 343 Organic Chemistry Laboratory I	2
Cultural Understanding (choose from list)	3
Total	**16**
Fourth Semester	
COMM-R 110 Fundamentals of Speech Communication	3
CHEM-C 342 Organic Chemistry II	3
CHEM-C 344 Organic Chemistry Laboratory II	2
BIOL-K 324 Cell Biology	3
BIOL-K 325 Cell Biology Laboratory (Spring only)	2
FIS-I 305 Professional Issues Forensic Science	3
Total	**16**

Junior Year

Fifth Semester	
BIOL-K 384 Biological Chemistry	3
PHYS-P 201 General Physics I	5
2nd Written Communication Course	3
FIS-I 415 Forensic Science and the Law	3
Total	**14**
Sixth Semester	
FIS-I 300 Forensic Microscopy Lecture	1
FIS-I 301 Forensic Microscopy Lab	2
Advanced Science Elective	3
PHYS-P 202 General Physics II	5
FIS-I 380 Forensic Science Professional Capstone I	1
STAT-I 301 Elementary Statistical Methods 1	3
Total	**15**

Senior Year

Seventh Semester	
FIS-I 420 Forensic Biology I (Fall only)	3
FIS-I 421 Forensic Biology I Laboratory (Fall only)	1
FIS-I 480 Forensic Science Capstone II (Fall only)	1
Computer Programming (CSCI-N 207 recommended)	3
Advanced Science Elective	3
Arts and Humanities/Social Sciences (choose from list)	3
Total	**14**
Eighth Semester	
FIS-I 430 Forensic Genetics (Spring only)	3
FIS-I 431 Forensic Biology Capstone III (Laboratory Spring only)	1
Arts and Humanities/Social Sciences (choose from list)	6
FIS-I 440 Population Genetics (Spring only)	3
Advanced Science Elective	3
Total	**16**

Bachelor of Science: Forensic and Investigative Sciences Forensic Chemistry Option Sample Plan of Study (123 cr.)

Freshman Year

First Semester	
BIOL-K 101 Concepts of Biology I	5
CHEM-C 105 Principles of Chemistry I	3
CHEM-C 125 Experimental Chemistry I	2
MATH-I 231 Calculus for the Life Sciences	3
FIS-I 205 Concepts of Forensic Science I	3
SCI-I 120 Windows on Science	1
Total	**17**
Second Semester	
BIOL-K 103 Concepts of Biology II	5
CHEM-C 106 Principles of Chemistry II	3
CHEM-C 126 Experimental Chemistry II	2
MATH-I 232 Calculus for the Life Sciences II	3
FIS-I 206 Concepts of Forensic Science II	3
Total	**16**

Sophomore Year

Third Semester	
CHEM-C 341 Organic Chemistry I	3
CHEM-C 343 Organic Chemistry Laboratory I	2
PHYS-P 201 General Physics I	5
ENG-W 131 Reading, Writing and Inquiry	3
Cultural Understanding (choose from list)	3
Total	**16**

Fourth Semester	
CHEM-C 342 Organic Chemistry II	3
CHEM-C 344 Organic Chemistry Laboratory II	2
PHYS-P 202 General Physics II	5
FIS-I 305 Professional Issues in Forensic Science	3
COMM-R 110 Fundamentals of Speech Communication	3
Total	**16**

Junior Year

Fifth Semester	
Computer Programming (CSCI-N 207 recommended)	3
CHEM-C 310 Analytical Chemistry Lecture	3
CHEM-C 311 Analytical Chemistry Lab	1
FIS-I 300 Forensic Microscopy Lecture	1
FIS-I 301 Forensic Microscopy Lab	2
Advanced Science Elective	3
2nd written communication course	3
Total	**16**
Sixth Semester	
CHEM-C 325 Intro to Chemistry Instrumentation (Spring only)	3
CHEM-C 326 Intro to Chemistry Instrumentation Lab (Spring only)	2
STAT-I 301 Elementary Statistical Methods	3
Arts and Humanities/Social Science (choose from list)	3
FIS-I 380 Forensic Science Professional Capstone	1
Advanced Science Elective	3
Total	**15**

Senior Year

Seventh Semester	
FIS-I 400 Forensic Chemistry I (Fall only)	3
FIS-I 401 Forensic Chemistry I Lab (Fall only)	1
FIS-I 415 Forensic Science and the Law	3
FIS-I 480 Forensic Science Capstone II	1
Advanced Chemistry/ Biology Elective	3
Arts and Humanities/Social Sciences (choose from list)	3
Total	**14**
Eighth Semester	
FIS-I 410 Forensic Chemistry II (Spring only)	3
FIS-I 411 Forensic Chemistry Capstone III (Laboratory Spring only)	1
Advanced Science Elective	3
CHEM-C 360 Introductory Physical Chemistry (Spring only)	3
Arts and Humanities/Social Sciences (choose from list	3
Total	**13**

Minors in Forensic and Investigative Sciences

Undergraduate Minor

The minor in Forensic and Investigative Sciences can be used in relevant majors where the student's primary interest is in the major but who wishes to learn the basic concepts of forensic science and how to apply them to other fields of knowledge. Prerequisites to any of the minor courses are not included but are required in order to complete the minor. All FIS classes require a grade of C or higher. All SPEA classes require a grade of C- or higher.

Students must have a 2.0 GPA average for all courses used for the minor.

- FIS-N 100 Investigating Forensic Science Lecture (1 cr.)
- FIS-N 101 Investigating Forensic Science Lab (2 cr.)
- FIS-I 205 Concepts of Forensic Science I (3 cr.)
- FIS-I 206 Concepts of Forensic Science II (3 cr.)*
- FIS-I 305 Professional Issues in Forensic Science (3 cr.)**
- FIS-I 415 Forensic Science and the Law (3 cr.)**

*P: FIS-I 205 and CHEM-C 101 or CHEM-C 105 or FIS-N 101

**P: FIS-I 205 and FIS-I 206

Choose 3 credit hours from the following courses:

- FIS-I 300 Microscopy Lecture (1 cr.) (P: FIS-I 205 and FIS-I 206)
- FIS-I 440 Population Genetics (3 cr.) (P: BIOL-K 322, BIOL-K 323, and STAT-I 301)
- FIS-I 496 Special Topics in Forensic Science (credits vary - repeatable under different topics)
- SPEA-J 303 Evidence (3 cr.) (P: SPEA-J 101)
- SPEA-J 320 Criminal Investigation (3 cr.) (P: SPEA-J 101)

Doctoral Minor in Forensic Science

The Forensic and Investigative Sciences Program offers a Ph.D. minor program in forensic science that requires 6 credit hours of selected course work. The minor provides basic knowledge of the application of science to the

forensic science system via graduate coursework in either a chemistry or biological background. The doctoral minors are restricted to School of Science Ph.D. students.

Course requirements are as follows:

Required Courses (Two courses: 3 credit hours)

- FIS-I 500 Crime Scene Investigation and Quality Assurance (2 cr.)
- FIS-I 505 Overview of Forensic Biology (1 cr.) this is meant for chemistry focused students to get an overview of forensic biology concepts

  OR

- FIS-I 515 Overview of Forensic Chemistry (1 cr.) this is meant for biology focused students to get an overview of forensic chemistry concepts

Elective Courses include (Total 3 credit hours):

- FIS-I 510 Advanced Forensic Microscopy Lecture (1 cr.)
- FIS-I 540 Forensic Biology (3 cr.)
- FIS-I 560 Population Genetics (3 cr.)
- FIS-I 520 Forensic Chemistry I (3 cr.)
- FIS-I 530 Forensic Chemistry II (3 cr.)
- FIS-N 570 Design of a Research Project (2 cr.)
- FIS-I 550 Forensic Science and the Law (3 cr.)

PLEASE NOTE:

- No grade lower than B (e.g., B-) is acceptable for any course in the minor.
- A minimum grade point average of 2.00 in minor courses is required.
- A minimum of 6 credit hours in the minor must be completed at IU Indianapolis.
- The doctoral minors are restricted to School of Science Ph.D. students.

Graduate Program

Master of Science in Forensic Science

Description

The M.S. Program in Forensic Science, which awards an Indiana University degree, requires 30 credit hours of study beyond the baccalaureate level. It is designed for students seeking careers as professional forensic scientists who desire employment in the criminal justice field or a related area. There are two ways to complete the MS, the thesis MS or the non-thesis, accelerated MS. The MS Thesis Program is FEPAC-accredited.

General Degree Options and Requirements

Students must apply in one of the following concentrations; forensic chemistry or forensic biology. All students take a core of required courses which include a professional issues course, law courses and a microscopy course. Each concentration and track (thesis or non-thesis) contains specific required courses taken by students in that concentration and track.

This thesis program requires 18 credit hours of course work and 12 credit hours of thesis completion and defense and is available to full time students. A non-thesis option is available and this program includes 30 credit hours of classes approved by the department. This may include up to six credits of internship and research.

Admission

The **admission requirements** are as follows:

- A Bachelor's degree from an accredited institution in the physical or life sciences such as chemistry, biology, forensic science, pharmacology/toxicology, or a related science
- A minimum GPA of 3.0 for all undergraduate work

The program will serve full- and part-time students who meet the above requirements as well as students who are presently employed full time in a forensic science laboratory or other analytical laboratory.

How to Apply for the Full-Time Thesis MS

Application to the program can be done completely online. The online application is called the "Indiana University Graduate Centralized Application System (CAS)."

You will be directed to create an account to begin your application. The application can be filled out in stages and saved along the way so you can return to it later. The CAS system has provisions for uploading your personal statement and listing contact names for two letters of recommendation.

These people will automatically be emailed and asked to input their letters of recommendation.

Please arrange for your previous academic institutions to send official, sealed transcripts to FIS Graduate Admissions, 402 N. Blackford St., LD 326, Indianapolis, IN 46202. International applicants will need to provide transcripts in both native language and English, as well as a certificate of diploma.

The Forensic and Investigative Sciences Program accepts applications once a year for beginning matriculation in the Fall semester. The deadline for applying to the thesis program is **December 15** prior to the year you wish to start. Applications must be complete by **January 15** or they will not be considered. Applicants must submit the following:

1. The completed application which will also require:
   - Two letters of recommendation. These would normally be from professors who can evaluate your ability to successfully complete graduate work in forensic science.
   - A personal statement that discusses your educational and work background, and experience (if any) in forensic science, and research interests if you are full time. Supplemental questions requests information about which degree (thesis or non-thesis) and track (forensic biology or chemistry) is applied for along with requiring a list of relevant coursework.
2. Official final transcripts from all higher education institutions that you attended.

Applicants are not normally considered on a rolling basis. They are generally considered en masse after

the December 15 deadline. You will be notified by mid-February after the decision is made.

How to Apply for the Non-Thesis MS

Application to the program can be done completely online. The online application is called the "Indiana University Graduate Centralized Application System (CAS)."

You will be directed to create an account to begin your application. The application can be filled out in stages and saved along the way so you can return to it later. The CAS system has provisions for uploading your personal statement, supplemental questions for, and listing contact names for two letters of recommendation. These people will automatically be emailed and asked to input their letters of recommendation.

The Forensic and Investigative Sciences Program review of applications will begin in late February and will continue on a rolling basis until the **March 15** deadline. Applications will also be considered for the Spring term if there is availability (completed by October 1).

Applicants must submit the following:

1. The completed application which will also require:

- Two letters of recommendation. These would normally be from professors who can evaluate your ability to successfully complete graduate work in forensic science.
- A personal statement that discusses your educational and work background, interest and experience (if any) in forensic science, and research interests if you are full time. Supplemental questions requests information about which degree (thesis or non-thesis) and track (forensic biology or chemistry) is applied for along with requiring a list of relevant coursework.

2. Official final transcripts from all higher education institutions that you attended.

You will be notified within a few weeks after the decision is made.

The Curriculum

The thesis and non-thesis M.S. program consists of 30 semester credit hours. It is anticipated that the thesis program can be completed within two years by full-time students. The non-thesis program can be completed in one academic year plus two summer courses. The credit hours are to be distributed as follows:

All students (thesis and non-thesis) take the following courses (course substitutions only with Graduate Advisor approval):

1. FIS-I 500 Crime Scene Investigation and Quality Assurance (2 cr.)
2. FIS-I 510 Forensic Microscopy Lecture (1 cr.)
3. FIS-I 511 Forensic Microscopy Lab (2 cr.)
4. FIS-I 550 Forensic Science and the Law (3 cr.)
5. FIS-I 590 Forensic Science Seminar (1 cr.)

Students in the forensic chemistry concentration (thesis and non-thesis) must take the following courses:

1. FIS-I 505 Overview of Forensic Biology (1 cr.)
2. FIS-I 520 Forensic Chemistry (3 cr.)
3. FIS-I 521 Forensic Chemistry I Lab (1 cr.)
4. FIS-I 530 Forensic Chemistry II (3 cr.)
5. FIS-I 531 Forensic Chemistry II Lab (1 cr.)

Students in the forensic biology concentration (thesis and non-thesis) must take the following courses:

1. FIS-I 515 Overview of Forensic Chemistry (1 cr.)
2. FIS-I 540 Forensic Biology I Lecture (3 cr.)
3. FIS-I 541 Forensic Biology I Lab (2 cr.)
4. FIS-I 560 Population Genetics (3 cr.)

Thesis students must take the following courses:

1. FIS-I 698 Thesis Research (12 cr.)

Non-thesis students must take the following courses:

1. FIS-N 570 Laboratory Project Design (2 cr.)
2. FIS-N 580 Forensic Science Laboratory Management (2 cr.)

Elective Courses MS Non-Thesis

Electives approved by department (8 cr.). This may include up to 6 credits of internship and/or research. A student may also take courses in other concentrations as part of these credits.

*No more than 6 credits of 300-level or 400-level courses are allowed on the plan of study.

- *FIS-I 300 Forensic Microscopy (1 cr.)
- FIS-I 596 Special Topics in Forensic and Investigative Sciences (1-6 cr.)
- ANTH-A 560 Forensic Anthropology (3 cr.)
- BIOL-I 507 Principles of Molecular Biology (3 cr.)
- BIOL-I 512 Advanced Cell Biology (3 cr.)
- BIOL-I 697 Special Topics in Biology (1-3 cr.)
- CHEM-I 613 Mass Spectrometry (3 cr.)
- CHEM-I 619 Electroanalytical Chemistry (3 cr.)
- PSY-I 600 Statistical Inference (3 cr.)
- PSY-I 601 Correlation and Experimental Design (3 cr.)

Other electives are available that vary year-to-year. Check with the FIS program and obtain approval before registering.

Internship or Research for MS Non-Thesis

- FIS-I 595 Internship in Forensic Science (1-6 cr.)
- FIS-I 596 Research in Forensic Science (1-6 cr.)

Interdisciplinary Studies of Bachelor of Science Degree Program

School of Science, IU Indianapolis
Science Building, LD 222
402 N. Blackford Street
Indianapolis, IN 46202-3276
Phone: (317) 274-0625; Fax: (317) 274-0628

- **Director** Jane R. Williams, Ph.D.
- **Program Advisor** Diana S. Sims-Harris, Ph.D.
- **Program Advisor** Joseph L. Thompson

The purpose of the Bachelor of Science (B.S.) in Interdisciplinary Studies Program is to provide an opportunity for IU Indianapolis students to construct individual majors that are science-based, interdisciplinary, and not represented by existing major programs. Instead of a prescribed area of study as with standard majors, the interdisciplinary studies (IDS) major will accommodate a variety of plans of study, with courses drawn from many subject areas in the sciences and beyond. The Interdisciplinary Studies degree program provides an academic structure that encourages creative and motivated undergraduates to design unique science-based interdisciplinary majors. In collaboration with an academic advisor and faculty mentors, students will create plans of study that demonstrate coherence, rigor, rationale, and vision. The B.S. in Interdisciplinary Studies requires a capstone project or internship experience, including a strong writing component. Particular plans of study may take advantage of the IU Indianapolis Honors College, the IU Indianapolis Center for Research and Learning, the Consortium for Urban Education to include relevant courses taught through other Indianapolis colleges and universities, or may include specialized service learning experiences in consultation with the IU Indianapolis Center for Service and Learning.

Though not meant to be a definitive list, examples of interdisciplinary majors with an emphasis in the sciences include:

- Art Restoration and Preservation
- Art Therapy
- Chemical Science and Technology
- Music Therapy
- Physics of Music
- Religion and Science
- Science and Gender
- Science, Technology, and Society
- Scientific Writing
- Urban Ecology

View the following information to learn more about Interdisciplinary Studies.

- Admissions and Curriculum
- Bachelor of Science

Admissions

All students admitted to the Interdisciplinary Studies (IDS) Program must have a minimum GPA of 2.50 and meet existing admission requirements of the School of Science. Students interested in the IDS program should contact the program advisor to discuss the interdisciplinary theme under consideration. The program advisor works with interested students in a pre-IDS period to identify faculty with expertise relevant to the IDS theme. In consultation with those faculty members and the program advisor, the student prepares a program proposal consisting of coursework from two or more disciplines, at least one of which is in the School of Science. The student also prepares a statement explaining the justification for the IDS theme chosen, how it relates to the student's future professional interests and what learning outcomes will be met through the proposed IDS program. The student is accepted for admission to the Interdisciplinary Studies Program when the faculty advisors and the Undergraduate Education Committee of the School of Science approve the student's proposal.

Before admission to the Interdisciplinary Studies Program, students must have completed a minimum of 15 credit hours of course work, but no more than 60 credit hours. The course work must include ENG-W 131, a introductory major science course with lab, and an appropriate mathematics course. All science and mathematics courses on record must have minimum grades of C. Courses included in a specific IDS major may have prerequisites specified by the departments that offer them.

Curriculum

The curriculum for each interdisciplinary studies student will vary so as to meet the particular academic objective of the student. The interdisciplinary studies major areas of study will consist of a coherent set of courses that define a clearly recognizable focus of study for which faculty can provide oversight and ensure intellectual integrity and rigor. A faculty committee will approve all interdisciplinary study major areas, and each student in the program will work closely with a faculty mentor and academic advisor.

The interdisciplinary major will comprise 40-45 credit hours of regular courses from at least two disciplines and culminate with a 3-hour to 6-hour senior capstone project or internship.

- A minimum of 120 credit hours in the IDS program will be distributed as follows
  - General education (45-50 credits)
  - Interdisciplinary major with courses from at least two disciplines (40-45 credits)
  - Electives (25-35 credits)

Bachelor of Science Degree Requirements

For details on school specific policies, see the School of Science requirements under ‘‘Undergraduate Programs” in this bulletin. Please note that at least 32 credit hours of course work completed at IU Indianapolis must be at the 300 level or higher.

First-Year Experience Course Beginning freshmen and transfer students with fewer than 19 credit hours are required to take SCI-I 120 Windows on Science (1 cr.), or an equivalent first-year experience course.

Area I English Composition and Communication Competency (9 cr.)

English Composition (6 cr.)
- ENG-W 131 Elementary Composition I
- Second Composition Course that has ENG-W 131 as a prerequisite, e.g. ENG-W 270, ENG-W 230, ENG-W 231, ENG-W 320, or ENG-W 350

Speech Communication (3 cr.)
- COMM-R 110 Fundamentals of Speech Communication

Area II World Language Competency

No world language proficiency is required for the Bachelor of Science degree. However, if knowledge of a world

language is pertinent to the interdisciplinary major, a student may choose to pursue one.

Area IIIA Arts and Humanities, Social Sciences, and Cultural Understanding Competencies (12 cr.)

The information about the IIIA requirements in the School of Science part of this bulletin lists courses that may be used to satisfy the requirements below. Students should consult the program advisor before registering for these courses.

- List H course: Choose one course (3 cr.) from this list. The list of course choices is located under the School of Science requirements “Undergraduate Programs” in this bulletin.
- List S course: Choose one course (3 cr.) from this list. The list of course choices is located under the School of Science requirements “Undergraduate Programs” in this bulletin.
- One additional course from either List H or List S
- List C course: Choose one course (3 cr.) from this list. The list of course choices is located under the School of Science requirements “Undergraduate Programs” in this bulletin.

For the most current list of courses in the areas of Arts and Humanities, Social Sciences and Cultural Understanding, please refer to the IU Indianapolis General Education Curriculum.

Area IIIC Life and Physical Sciences Competency

See the School of Science requirements under “Undergraduate Programs” in this bulletin. Four (4) lecture courses outside the major from the life and physical sciences, one of which must include a corresponding laboratory. Laboratory courses without a lecture component may be taken for credit, but do not count toward the four-course requirement. No grade below C- will be accepted in any of these courses. Consult the program advisor concerning the acceptability of courses.

Area IIID Analytical Reasoning Competency (9 cr.)

- Two courses beyond college algebra and trigonometry. (6 cr.)
- One computer programming course. (3 cr.)

No grade below C- will be accepted in any of these courses.

Note: Computer Science CSCI-N 100 level courses not count for credit toward any degree in the School of Science. Also, CSCI-N 241 and CSCI-N 299 do not count in Area IIID but may count as a general elective.

Area IV Interdisciplinary Major Concentration (40-45 cr.)

Minimum requirements include 40 credit hours of core interdisciplinary major courses.

All courses applicable to the major must have a minimum grade of C.

Curriculum

The curriculum for each interdisciplinary studies student will vary so as to meet the particular academic objective of the student. The interdisciplinary studies major areas of study will consist of a coherent set of courses that define a clearly recognizable focus of study for which faculty can provide oversight and ensure intellectual integrity and rigor. A faculty committee will approve all interdisciplinary study major areas, and each student in the program will work closely with a program advisor and faculty mentors.

The interdisciplinary major area will be comprised of 40-45 credit hours of regular courses from at least two disciplines and culminate with a senior capstone project or internship.

Department of Mathematical Sciences

IU Indianapolis
Science Building, LD 270
402 N. Blackford Street
Indianapolis, IN 46202-3216
Phone: (317) 274-6918; fax: (317) 274-3460
Web: https://science.indianapolis.iu.edu/math/

Department Chair: Jeffrey X. Watt, Ph.D.

Department Associate Chair: Daniel Ramras, Ph.D.

Undergraduate Program Advisor:

- Undergraduate Advisor: Rebecca Burris, MSW
- School of Science Advising Group

Graduate Advisors:

- Graduate Director: Roland Roeder, Ph.D.
- Graduate Advisor: Lisa Hastings-Smith

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

- Undergraduate Degree Programs
- Undergraduate Major Requirements and Plans of Study
- Graduate Programs
- Minors: Undergraduate and Doctoral

Undergraduate Degree Programs

The department offers the Indiana University Bachelor of Science degree in mathematics with options in pure mathematics, applied mathematics, actuarial science (in person or through IU Online), applied statistics (in person or through IU Online) and secondary school teaching.

Graduate degrees offered include the Indiana University Master of Science, with concentrations in Pure Mathematics, Applied Mathematics, Mathematics Education, Applied Statistics, and the Indiana University Doctor of Philosophy in mathematics with all requirements completed on the IU Indianapolis campus. In addition, together with the Division of Biostatistics in the Indiana University School of Medicine, the department administers and offers an Indiana University Doctor of Philosophy in Biostatistics, with all requirements completed on the IU Indianapolis campus.

Bachelor of Science

Students are encouraged to declare a mathematics major in their freshman year, so they can receive proper academic advising. A grade point average of 2.50 with no grades below C in mathematics courses through MATH-I 351 is a minimum indication of success in this major.

Degree Requirements

The baccalaureate degree general requirements, the area requirements are listed earlier in this bulletin (see the School of Science requirements under “Undergraduate Programs”). For a Bachelor of Science degree in mathematics, the following additional requirements and restrictions apply:

First-Year Experience Course

Beginning freshmen and transfer students with fewer than 19 credit hours are required to take SCI-I 120 Windows on Science (1 cr.) or an equivalent first-year experience course.

Area I English Composition and Communication Competency

No additional requirements beyond School-level requirements, located under the School of Science requirements “Undergraduate Programs” in this bulletin. The second semester of English composition may be satisfied by ENG-W 270, ENG-W 231, ENG-W 230, or ENG-W 350.

Area II World Language Competency

All degree options require first year proficiency (8 credit hours) in a modern world language. American sign language is acceptable.

Area IIIA Arts and Humanities, Social Sciences, and Cultural Understanding Competencies (12 cr.)

List H course: Choose one course (3 cr.) from this list. The list of course choices is located under the School of Science requirements “Undergraduate Programs” in this bulletin.

List S course: Choose one course (3 cr.) from this list. The list of course choices is located under the School of Science requirements “Undergraduate Programs” in this bulletin.

One additional course from either List H or List S.

List C course: Choose one course (3 cr.) from this list. The list of course choices is located under the School of Science requirements “Undergraduate Programs” in this bulletin.

For the most current list of courses in the areas of Arts and Humanities, Social Sciences and Cultural Understanding, please refer to the IU Indianapolis General Education Curriculum.

Area IIIC Life and Physical Sciences Competency

Refer to specific mathematics option major requirements for any additional Area IIIC course requirement.

Note: Certain courses, such as CHEM-C 101, CHEM-C 102, CHEM-C 110; PHYS-I 100, PHYS-I 200, PHYS-I 218, and PHYS-I 219, 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 advisor.

Area IIID Analytical Reasoning Competency

See Area IV Major Requirements for required mathematics courses. Mathematics courses below MATH-I 165 and those mathematics courses in which the student has received grades below C- do not count toward the degree. MATH-M 118 will count as general elective.

The Area IIID computer programming requirement must be in a higher-level programming course (not BASIC). A grade of C (2.00) or better is required.

Note: Computer Science CSCI-N 241 and CSCI-N 299 do not count in Area IIID, but may count as a general elective.

Area IV Mathematical Sciences Major Requirements

Mathematics courses in which a student has received grades below C (2.00) do not count in Area IV. The Area IV requirements for the secondary area of concentration and the major for the four degree options—pure mathematics, applied mathematics, applied statistics, actuarial science, and secondary teaching—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 that shows one possible sequence of courses is given for each option. Variations from the sample program should be made in consultation with the student’s advisor. Because of the complexity of the requirements and because certain courses are not offered every semester, it is important that each student consult his or her assigned advisor as soon as possible in order to proceed through a proper plan of study for the chosen degree program. A minimum grade point average of 2.50 is required in all mathematics courses that count toward the major.

Area IV Secondary Area of Concentration Requirements

For each student to acquire some depth of study in a subject outside of the major area, the Department of Mathematical Sciences requires students to have a secondary area of concentration or minor outside of the department. The secondary area of concentration consists of at least 18 credit hours and includes at least three courses beyond the introductory level or a recognized minor from another department. It is subject to the approval of the student’s advisor. Although a second area of concentration is usually in one department, it may be from two or more if the advisor approves.

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

The requirement of 18 credit hours in a secondary area of concentration does not, by itself, constitute an official minor that would be acknowledged on the student's transcript. A minor must be offered through the department or school in which the minor is taken. Students in the Actuarial Science Option satisfy the requirements for a minor in economics by the economics courses they are required to take (Students must apply to the Economics Department to be awarded an official minor.).

In addition to the in-person degrees offered, two IU Online degrees can be completed through the Department of Mathematical Sciences.

1. The IU Online BS in Actuarial Science is an Indiana University degree that offers instruction in mathematics, actuarial mathematics, probability and statistics, finance, statistical modeling, data analysis, and software application. More information can be found here.

2. The IU Online BS in Applied Statistics is an Indiana University degree that offers instructions in solving problems in calculus, linear algebra, and calculus-based probability using statistical methods and modeling. More information can be found here.

Degree Requirements

Major Requirements

IU Online Actuarial Science Option

With this option, students will study the key concepts of insurance, risk management, and interest theory. Solve conceptual and computational problems. Learn to price-risk to determine premiums, analyze data, determine suitable models and parameter values, and provide measures of confidence. Calculate present and accumulated values for various streams of cash flow.

Please contact the academic advisor for program-specific requirements.

IU Online Applied Statistics Option

With this option, students will study differentiation, integration, infinite series, properties of univariate and multivariate random variables, and discrete and continuous distributions. Students also study:

- Statistical methods and theory
- Design of studies and exploratory data analysis
- Statistical modeling and computation
- Data analytics communication

Please contact the academic advisor for program-specific requirements.

Pure Mathematics Option

With this option, students will 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, educational research, engineering, law, medicine, operations research, physics, psychology, and statistics. Persons with advanced degrees in pure mathematics find careers primarily in college teaching, but careers in business, industry, or government service are also possible.

Courses taken to satisfy the Area IIIC requirements must include PHYS-I 152 (or a more advanced physics course).

The Area IV major requirements are as follows:

- Core curriculum (21 credit hours):
  - MATH-I 165 Analytic Geometry and Calculus I
  - MATH-I 166 Analytic Geometry and Calculus II
  - MATH-I 171 Multidimensional Mathematics
  - MATH-I 261 Multivariate Calculus
  - MATH-I 276 Discrete Mathematics
  - MATH-I 351 Elementary Linear Algebra

- Advanced Core curriculum (15 credit hours):
  - MATH-I 300 Logic & Foundations of Algebra
  - MATH-I 366 Ordinary Differential Equations
  - MATH-I 425 Elements of Complex Analysis
  - MATH-I 444 Foundations of Analysis I
  - MATH-I 453 Beginning Abstract Algebra

- One Pure Advanced Elective (3 credit hours) selected from:
  - MATH-I 321 Elementary Topology
  - MATH-I 445 Analysis 2
  - MATH-I 454 Galois Theory
  - MATH-I 456 Theory of Numbers
  - MATH-I 462 Differential Geometry

- One Applied or statistics advanced elective (3 credit hours) select from:
  - MATH-I 421 Optimization
  - MATH-I 423 Discrete Modeling
  - MATH-I 426 Intro to Applied Mathematics
  - STAT-I 416 Probability.

- One additional math/stat elective (3 credit hours) selected from MATH-I courses numbered 300 or above or STAT-I courses number above 351.
- Minimum of two credit hours of MATH-I 492 Capstone Experience.

Pure Mathematics Option Sample Program (120 credits required)

Freshman Year

First Semester	
MATH-I 165 Analytic Geometry and Calculus I	4
MATH-I 171 Multidimensional Mathematics	3
ENG-W 131 Reading, Writing and Inquiry	3
GE Cultural Understanding World Language I	4
SCI-I 120 Windows on Science	1
Total	**15**
Second Semester	
MATH-I 166 Analytic Geometry and Calculus II	4
MATH-I 276 Discrete Mathematics	3
PHYS-I 152 Mechanics	4

COMM-R 110 Fundamentals of Speech Communication	3
World Language II	4
Total	**18**

Sophomore Year

Third Semester	
MATH-I 261 Multivariate Calculus	4
MATH-I 351 Elementary Linear Algebra	3
CSCI-C 200 Intro to Computers and Programming	4
2nd Written Communication Course	3
Secondary Area elective	3
Total	**17**
Fourth Semester	
MATH-I 300 Logic & Foundations of Algebra	3
MATH-I 366 Differential Equations	3
Life and Physical Science (approved elective)	3
Social Sciences (choose from list)	3
Secondary Area elective	3
Total	**15**

Junior Year

Fifth Semester	
MATH-I 425 Elements of Complex Analysis	3
MATH-I 444 Foundations of Analysis I	3
Arts and Humanities elective (choose from list)	3
Secondary Area electives	6
Total	**15**
Sixth Semester	
Applied Advanced elective	3
Pure Advanced elective	3
Life and Physical Sciences (approved elective)	3
Secondary Area electives	6
Total	**15**

Senior Year

Seventh Semester	
MATH-I 453 Beginning Abstract Algebra	3
Arts & Humanities/Social Science (choose from list)	3
Life and Physical Sciences (approved elective)	3
General elective	3
Total	**12**
Eighth Semester	
MATH-I 492 Capstone Experience	2
Advanced MATH/STAT elective	3
General elective	8
Total	**13**

Applied Mathematics Option

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

Courses taken to satisfy the Area IIIC requirements must include PHYS-I 152 and PHYS-I 251 (or more advanced physics courses).

The Area IV major requirements are as follows:

- Core curriculum (21 credit hours):
  - MATH-I 165 Analytic Geometry and Calculus I
  - MATH-I 166 Analytic Geometry and Calculus II
  - MATH-I 171 Multidimensional Mathematics
  - MATH-I 261 Multivariate Calculus
  - MATH-I 276 Discrete Mathematics
  - MATH-I 351 Elementary Linear Algebra
- Advanced Core curriculum (15 credit hours):
  - MATH-I 300 Logic & Foundations of Algebra
  - MATH-I 366 Ordinary Differential Equations
  - MATH-I 414 Numerical Methods
  - MATH-I 421 Linear Programming and Optimization Techniques or MATH-I 423 Discrete Modeling
  - MATH-I 426 Intro to Applied Mathematics and Modeling or MATH-I 444 Foundations of Analysis I
- Two Advanced Electives (6 credit hours) selected from:
  - MATH-I 354 Linear Algebra II for Data Science
  - MATH-I 425 Elements of Complex Analysis
  - MATH-I 520 or MATH-I 522 or MATH-I 523 "Differential Equations"
  - MATH-I 552 Applied Computational Methods II or MATH-I 559 Applied Computational Methods I
  - MATH-I 555 Introduction to Biomathematics
  - STAT-I 350 Introduction to Statistics

- STAT-I 416 Probability

- Minimum of two credit hours of MATH-I 492 Capstone Experience.

Applied Mathematics Option Sample Program (120 credits required)

Freshman Year

First Semester	
MATH-I 165 Analytic Geometry and Calculus I	4
MATH-I 171 Multidimensional Mathematics	3
ENG-W 131 Reading, Writing and Inquiry	3
GE Cultural Understanding World Language I	4
SCI-I 120 Windows on Science	1
Total	**15**
Second Semester	
MATH-I 166 Analytic Geometry and Calculus II	4
MATH-I 276 Discrete Mathematics	3
PHYS-I 152 Mechanics	4
COMM-R 110 Fundamentals of Speech Communication	3
World Language II	4
Total	**18**

Sophomore Year

Third Semester	
MATH-I 261 Multivariate Calculus	4
MATH-I 351 Elementary Linear Algebra	3
PHYS-I 251 Heat, Electricity, and Optics	5
2nd Written Communication Course	3
Secondary area elective	3
Total	**18**
Fourth Semester	
MATH-I 366 Differential Equations (beginning Fall 2024)	3
MATH-I 300 Logic & Foundations of Algebra	3
CSCI-C 200 Intro to Computers and Programming	4
Secondary area elective	3
Social Sciences (choose from list)	3
Total	**16**

Junior Year

Fifth Semester	
MATH-I 444 Foundations of Analysis I	3
Advanced MATH/STAT elective	3
Arts and Humanities (choose from list)	3
Secondary area electives	6
Total	**15**
Sixth Semester	
MATH-I 426 Introduction to Applied Mathematics and Modeling	3
Advanced MATH/STAT elective	3
Secondary area electives	4
Life and Physical Sciences (approved elective)	3
Total	**13**

Senior Year

Seventh Semester	
MATH-I 414 Numerical Methods	3
MATH-I 421 Linear Programming and Opt. Tech. or MATH-I 423 Discrete Modeling	3
Life and Physical Sciences (approved elective)	3
General elective	3
Total	**12**
Eighth Semester	
MATH-I 492 Capstone Experience	2
Arts and Humanities/Social Sciences (choose from list)	3
General electives	8
Total	**13**

Actuarial Science Option

The Actuarial Science Option for mathematics majors will provide students with the strong background in mathematics, statistics, and economics necessary to analyze financial risks. This option aims to prepare students for the first three actuarial examinations administered by the professional actuarial organizations. The secondary area of concentration for students in this option is fulfilled by required courses in business and economics.

Actuarial science deals with the analysis of financial consequences of risk. Actuaries are highly trained professionals, well versed in mathematical, statistical, and economic techniques that enable them to evaluate financial risk of uncertain future events, especially those pertaining to health care, insurance, and pension plans.

Actuaries answer risk-related questions by developing, implementing, and interpreting sophisticated mathematical models.

Courses taken to satisfy Area IIIC requirements must include PHYS-I 152 (or a more advanced physics course).

The Area IV major requirements are as follows:

- Core Math curriculum (21 credit hours):
  - MATH-I 165 Analytic Geometry and Calculus I
  - MATH-I 166 Analytic Geometry and Calculus II
  - MATH-I 171 Multidimensional Mathematics
  - MATH-I 261 Multivariate Calculus
  - MATH-I 266 or MATH-I 366 Ordinary Differential Equations
  - MATH-I 351 Elementary Linear Algebra
- Core Economics curriculum (15 credit hours):
  - ECON-E 201 Intro to Microeconomics or ECON-S 201 Intro to Microeconomics Honors
  - ECON-E 202 Intro to Macroeconomics or ECON-S 202 Intro to Macroeconomics Honors
  - ECON-E 305 Money and Banking
  - ECON-E 321 Intermediate Microeconomic Theory
  - ECON-E 322 Intermediate Macroeconomic Theory
- Core Business curriculum (9 credit hours):
  - BUS-A 200 Foundations of Accounting for Non-Business Majors
  - BUS-F 300 Introductory Financial Management
  - BUS-F 305 Intermediate Corporate Finance
- MATH-I 373 Mathematical Finance
- Mathematical Modeling: MATH-I 426 Introduction to Applied Mathematics and Modeling or MATH-I 421 Linear Programming and Optimization Techniques or MATH-I 423 Discrete Modeling
- STAT-I 416 Probability and STAT-I 417 Statistical Theory
- Actuarial Models: STAT-I 472 and STAT-I 473
- Two credit hour or three credit hour STAT elective at the 300 level or above (not STAT-I 301, STAT-I 350, or STAT-S 351) Suggested course: STAT-I 512 or STAT-I 371 (Prep for Actuarial Exam 1)
- Three credit hour MATH or STAT course selected from STAT-I 421, STAT-I 433, STAT-I 512, or STAT-I 522.
- Two or three credit hours of MATH-I 492 Capstone Experience.

Actuarial Science Option Sample Program (120 credits required)

Freshman Year

First Semester	
MATH-I 165 Analytic Geometry and Calculus I	4
MATH-I 171 Multidimensional Mathematics	3
SCI-I 120 Windows on Science	1
ENG-W 131 Reading, Writing and Inquiry	3
GE Cultural Understanding World Language I	4
Total	**15**
Second Semester	
MATH-I 166 Analytic Geometry and Calculus II	4
Arts and Humanities (choose from list)	3
COMM-R 110 Fundamentals of Speech Communication	3
Life and Physical Science (approved elective)	3
World Language II	4
Total	**17**

Sophomore Year

Third Semester	
MATH-I 261 Multivariate Calculus	4
Life and Physical Science (approved elective)	3
MATH-I 373 Financial Mathematics	3
ECON-E 201/ECON-S 201 Intro to Microeconomics	3
BUS-A 200 Foundations of Accounting	3
Total	**16**
Fourth Semester	
MATH-I 351 Elementary Linear Algebra	3
MATH-I 266 or MATH-I 366 Ordinary Differential Equations	3
PHYS-I 152 Mechanics	4
ECON-E 202/ECON-S 202 Intro to Macroeconomics	3
2nd Written Communication Course	3
Total	**16**

Junior Year

Fifth Semester	
STAT-I 416 Probability	3
ECON-E 305 Money and Banking	3
BUS-F 300 Introduction to Finance	3
CSCI-C 200 Intro to Computers and Programming	4

Social Sciences (choose from list)	3
Total	**16**
Sixth Semester	
STAT-I 371 Prep for Exam P/1	2
STAT-I 417 Statistical Theory	3
STAT-I 472 Actuarial Models 1	3
Arts and Humanities/Social Sciences (choose from list)	3
BUS-F 305 Intermediate Finance	3
Total	**14**

Senior Year

Seventh Semester	
STAT-I 473 Actuarial Models II	3
ECON-E 321 Intermed. Microeconomic Theory	3
MATH-I 421 Linear Prog. and Optim. Tech. or MATH-I 423 Discrete Modeling	3
STAT-I 512 Regression Analysis or STAT-I 421 Modern Statistical Methods	3
Elective or MATH-I 390 (Topics)	1
Total	**13**
Eighth Semester	
MATH-I 492 Capstone Experience	3
ECON-E 322 Intermediate Macroeconomic Theory	3
Life and Physical Science (approved elective)	3
General elective	4
Total	**13**

Applied Statistics Option

The Applied Statistics Option for mathematics majors will provide students with the strong background in mathematics and statistics necessary to analyze risks. The secondary area of concentration may be selected by the student or fulfilled by required courses in business and economics.

The Area IV major requirements are as follows:

- Core Math curriculum (21 credit hours):
  - MATH-I 165 Analytic Geometry and Calculus I
  - MATH-I 166 Analytic Geometry and Calculus II
  - MATH-I 171 Multidimensional Mathematics
  - MATH-I 261 Multivariate Calculus
  - MATH-I 266 or MATH-I 366 Ordinary Differential Equations
  - MATH-I 351 Elementary Linear Algebra
- Math Major curriculum (12 credit hours):
  - STAT-I 416 Probability
  - STAT-I 417 Statistical Theory
  - STAT-I 421 Modern Statistical Modeling Using R and SAS
  - STAT-I 512 Applied Regression Analysis
- Four Advanced Electives (12 credit hours):
  - MATH-I 414 Numerical Methods
  - MATH-I 421 or MATH-I 423 or MATH-I 426
  - STAT-I 414 or STAT-I 433 or STAT-I 522 or STAT-I 524
  - One additional 3-credit advanced MATH or STAT course. Please contact the academic advisor for options.
-
- Secondary area of concentration selected by student.
- Two or three credit hours of MATH-I 492 Capstone Experience.

Applied Statistics Option Sample Program (120 credits required)

Freshman Year

First Semester	
MATH-I 165 Analytic Geometry and Calculus I	4
MATH-I 171 Multidimensional Mathematics	3
SCI-I 120 Windows on Science	1
ENG-W 131 Reading, Writing and Inquiry	3
GE Cultural Understanding World Language I	4
Total	**15**
Second Semester	
MATH-I 166 Analytic Geometry and Calculus II	4
CSCI-C 200 Intro to Computers and Programming	4
COMM-R 110 Fundamentals of Speech Communication	3
Life and Physical Science (approved elective)	3
World Language II	4
Total	**18**

Sophomore Year

Third Semester	
MATH-I 261 Multivariate Calculus	4
Courses for concentration or minor	6

2nd Written Communication Course	3
General elective	3
Total	**16**
Fourth Semester	
MATH-I 351 Elementary Linear Algebra	3
MATH-I 266/MATH-I 366 Ordinary Differential Equations	3
PHYS-I 152 Mechanics	4
Arts and Humanities (choose from list)	3
Course for concentration or minor	3
Total	**16**

Junior Year

Fifth Semester	
STAT-I 416 Probability	3
MATH-I 414 Numerical Methods	3
Mathematics or Statistics elective	3
Courses for concentration or minor	3
Social Sciences (choose from list)	3
Total	**15**
Sixth Semester	
STAT-I 417 Statistical Theory	3
Arts and Humanities/Social Sciences (choose from list)	3
Course for concentration or minor	5
Life and Physical Science (approved elective)	3
Total	**14**

Senior Year

Seventh Semester	
STAT-I 512 Applied Regression Analysis	3
STAT-I 421 Modern Statistical Modeling/R & SAS	3
MATH-I 421 Linear Prog. & Opt. Techniques or MATH-I 423 Discrete Modeling	3
Course for concentration or minor	3
General elective	1
Total	**13**
Eighth Semester	
MATH-I 492 Capstone Experience	3
STAT-I 414 Intro to Design of Experiments or STAT-I 433 Intro to Nonparametric Statistics	3
Course for concentration or minor	3
Life and Physical Science (approved elective)	3
General elective	1
Total	**13**

Secondary School Teaching Option

Students who wish to teach in secondary schools must meet the requirements for teacher certification in the state in which they expect to teach. Interested persons can obtain these requirements by writing to the Department of Public Instruction, Certification Office, in the capital city of any state.

To satisfy Indiana law, a student should have 40 credit hours in general education courses and a specified core of professional education courses as part of the requirement for a teaching license. Students should be sure to see an advisor to ensure that these hours are properly distributed and that the professional education requirements are met.

Courses taken to satisfy the Area IIIC requirements must include PHYS-I 152 (or a more advanced physics course).

The Area IV major requirements are as follows:

- Core Math curriculum (21 credit hours):
  - MATH-I 165 Analytic Geometry and Calculus I
  - MATH-I 166 Analytic Geometry and Calculus II
  - MATH-I 171 Multidimensional Mathematics
  - MATH-I 261 Multivariate Calculus
  - MATH-I 266 or MATH-I 366 Ordinary Differential Equations
  - MATH-I 351 Elementary Linear Algebra
- MATH-I 276 Discrete Math
- MATH-I 300 Logic and the Foundations of Algebra
- MATH-I 453 Abstract Algebra
- MATH-I 463 Intermediate Euclidean Geometry for Secondary Teachers
- Probability and Statistics: STAT-I 350
- MATH-I 583 History of Elementary Mathematics
- EDUC-M 457 Methods of Teaching Senior High/ Junior High/Middle School Mathematics

Secondary School Teaching Option Sample Program (124 credits required)

Freshman Year

First Semester	
MATH-I 165 Analytic Geometry and Calculus I	4
MATH-I 171 Multidimensional Mathematics	3
SCI-I 120 Windows on Science	1

ENG-W 131 Reading, Writing and Inquiry	3
GE Cultural Understanding World Language I	4
Total	**15**
Second Semester	
MATH-I 166 Analytic Geometry and Calculus II	4
MATH-I 276 Discrete Mathematics	3
COMM-R 110 Fundamentals of Speech Communication	3
2nd Written Communication Course	3
World Language II	4
Total	**17**

Sophomore Year

Third Semester	
MATH-I 261 Multivariate Calculus	4
MATH-I 300 Logic and the Foundations of Algebra	3
EDUC-H 341 American Culture and Education	3
PSY-B 110 Introduction to Psychology	3
CSCI-C 200 Intro to Computers and Programming	4
Total	**17**
Fourth Semester	
MATH-I 266 Ordinary Differential Equations	3
MATH-I 351 Elementary Linear Algebra	3
MATH-I 583 History of Mathematics	3
PHYS-I 152 Mechanics	4
Arts and Humanities (choose from list)	3
Total	**16**

Junior Year

Education Block IIA3

Fifth Semester	
Block I-Diversity & Learning, Content Area Literacy, Field Exp.	10
Life and Physical Science (approved electives)	6
Total	**16**
Sixth Semester	
MATH-I 463 Intermediate Euclidean Geometry for Secondary Teachers	3
Education Block IIA	7
Education Block IIB-EDUC-M 457 Methods of Teaching Senior High/Junior High/ Middle School Mathematics	3
Arts and Humanities/Social Sciences (choose from list)	3
Total	**16**

Senior Year

Seventh Semester	
MATH-I 453 Abstract Algebra	3
STAT-I 350 Introduction to Statistics	3
Block III-High School Methods, Field Exp.	4
Life and Physical Science (approved elective)	3
Total	**13**
Eighth Semester	
Block IV-Student Teaching in Middle School/Junior High School Student Teaching in High School	14
Total	**14**

Math-Physics Double Major

This option is for students intending to double major in mathematics and physics.
Courses taken to satisfy the Area IIIC requirements must include PHYS-I 152, PHYS-I 251, CHEM-C 105, and CHEM-C 106.
The Area IV major requirements are as follows:

- Core Math curriculum (21 credit hours):
  - MATH-I 165 Analytic Geometry and Calculus I
  - MATH-I 166 Analytic Geometry and Calculus II
  - MATH-I 171 Multidimensional Mathematics
  - MATH-I 261 Multivariate Calculus
  - MATH-I 266 or MATH-I 366 Ordinary Differential Equations
  - MATH-I 276 Discrete Mathematics
  - MATH-I 351 Elementary Linear Algebra
- MATH-I 300 Logic and the Foundations of Algebra
- MATH-I 414 Numerical Methods
- MATH-I 426 Introduction to Applied Mathematics
- MATH-I 444 Foundations of Analysis I
- Twelve (9) additional credit hours:
  - three credit hours selected from MATH-I 353 or MATH-I 354 or MATH-I 453
  - PHYS-I 442 Quantum Mechanics
  - three additional credit hours from MATH numbered 300 or higher, statistics numbered 350 or higher, or from physics courses numbered 300 or higher

- Students planning on attending graduate school in mathematics or physics are advised to take MATH-I 445 and MATH-I 453.
- Core Physics curriculum, including chemistry labs (26 credit hours):
  - PHYS-I 299 Introduction to Computational Physics (2)
  - PHYS-I 310 Intermediate Mechanics (4)
  - PHYS-I 330 Intermediate Electricity and Magnetism (3)
  - PHYS-I 342 Modern Physics (3)
  - PHYS-I 353 Advanced Physics Laboratory I: Modern Physics and Electronics (2)
  - PHYS-I 400 Physical Optics (3)
  - PHYS-I 401 Advanced Physics Laboratory II: Modern Optics (2)
  - PHYS-I 418 Thermal and Statistical Physics (3)
  - Laboratory courses CHEM-C 125 and CHEM-C 126
- Minimum of two credit hours of PHYS-I 490 Capstone Experience.

Math-Physics Double Major Option Sample Program (123 credits required)

Freshman Year

First Semester	
MATH-I 165 Analytic Geometry and Calculus I	4
MATH-I 171 Multidimensional Mathematics	3
SCI-I 120 Windows on Science	1
ENG-W 131 Reading, Writing and Inquiry	3
CHEM-C 105/CHEM-C 125 Principles of Chemistry I Lecture/Lab	5
Total	**16**
Second Semester	
MATH-I 166 Analytic Geometry and Calculus II	4
MATH-I 276 Discrete Mathematics	3
PHYS-I 152 Mechanics	4
CHEM-C 106/CHEM-C 126 Principles of Chemistry II Lecture/Lab	5
Total	**16**

Sophomore Year

Third Semester	
MATH-I 261 Multivariate Calculus	4
MATH-I 351 Elementary Linear Algebra	3
PHYS-I 251 Heat, Electricity & Optics	5
PHYS-I 299 Intro to Computational Physics	2
COMM-R 110 Fundamentals of Speech Communication	3
Total	**17**
Fourth Semester	
MATH-I 366 Ordinary Differential Equations	3
MATH-I 300 Logic and the Foundations of Algebra	3
PHYS-I 342 Modern Physics	3
CSCI-C 200 Intro to Computers and Programming	4
Social Science (choose from list)	3
Total	**16**

Junior Year

Fifth Semester	
MATH-I 444 Foundations of Analysis I	3
*MATH-I 453 Abstract Algebra	3
PHYS-I 310 Intermediate Mechanics	4
GE Cultural Understanding World Language I	4
Total	**14**
Sixth Semester	
MATH-I 426 Intro to Applied Math/Modeling	3
PHYS-I 330 Intermediate Electricity & Magnetism	3
PHYS-I 353 Electronics Laboratory	2
2nd Written Communication Course	3
World Language II	4
Total	**15**

*complete MATH-I 453 in Fall or MATH-I 354 in Spring

Senior Year

Seventh Semester	
MATH-I 414 Numerical Methods	3
PHYS-I 400 Physical Optics	3
PHYS-I 401 Physical Optics Laboratory	2
PHYS-I 442 Quantum Mechanics	3
Arts and Humanities or Social Science	3
Total	**14**
Eighth Semester	
PHYS-I 418 Thermal and Statistical Physics	3

PHYS-I 490 (Capstone)	3
MATH/STAT/PHYS elective	3
Arts and Humanities (Choose from List)	3
General elective	3
Total	**15**

Total 123 credit hours.

Undergraduate and Graduate Minors in Mathematical Sciences

Undergraduate Mathematics and Statistics for Data Science Minor

An undergraduate minor in mathematics and statistics is useful in many fields. The curriculum for this minor provides background in linear algebra and statistics needed for advanced work in data science and computer science. Students from various disciplines can benefit from this minor: e.g. Computer Science and Data Science (Luddy School of Informatics), and Digital Forensics (School of Science). This minor exposes students to critical thinking, high-level problem-solving, and mathematics. It will be advantageous to those pursuing careers involving of mathematics and statistics, including: science teachers, technical journalism, computer programming, artificial intelligence, science writing, and data science.

Requirements

1. Required Courses (21 credit hours):
   - MATH-I 241 Calculus for Data Science I (3 cr.)
   - MATH-I 242 Calculus for Data Science II (3 cr.)
   - MATH-I 243 Linear Algebra for Data Science I (3 cr.)
   - MATH-I 354 Linear Algebra for Data Science II (3 cr.)
   - STAT-I 416 Probability (3 cr.)
   - STAT-I 417 Statistical Theory (3 cr.)
   - STAT-I 421 Modern Statistical Modeling Using R and SAS (3 cr.)
2. Nine (9) credit hours of the minor must be completed at IU Indianapolis.
3. The grade in each course submitted for the minor must be C (2.00) or higher.*

*A single grade of C- (1.70) will be allowed in any MATH or STAT course counting towards the minor.

Correspondence courses may not be used to fulfill requirements for the minor.

Undergraduate Math Minor

An undergraduate minor in mathematics is useful in many fields. A scientist or engineer may need knowledge of differential equations and linear algebra, while someone in business or a social science may need a background in probability or statistics.

Requirements

1. Calculus Sequence (15 credit hours):
   - MATH-I 165 Analytic Geometry and Calculus I (4 cr.)
   - MATH-I 166 Analytic Geometry and Calculus II (4 cr.)
   - MATH-I 171 Multidimensional Mathematics (3 cr.)
   - MATH-I 261 Multivariate Calculus (4 cr.)
2. Two additional courses (3 credit hours each) selected from mathematics courses numbered MATH-I 266 or higher or from statistics courses numbered STAT-I 350 or higher
3. Nine (9) credit hours of the minor must be completed at IU Indianapolis.
4. The grade in each course submitted for the minor must be C (2.00) or higher.*

*A single grade of C- (1.70) will be allowed in any MATH or STAT course counting towards the minor.

Correspondence courses may not be used to fulfill requirements for the minor.

Doctoral Minors

Minor in Mathematical Sciences:

This minor is intended for students who are doing their Ph.D. in departments other than Mathematical Sciences. The doctoral minors are restricted to School of Science Ph.D. students.

Requirements

A student must pass any two 3 credit 500 level MATH or STAT courses.

Minor in Algebra and Discrete Mathematics:

This minor is intended for students who are doing their Ph.D. in the Department of Mathematical Sciences and who are not specializing in the area of Algebra and Discrete Mathematics.

Requirements

A student must pass two of the following 3-credit courses:
MATH-I 518 Advanced Discrete Mathematics
MATH-I 574 Mathematical Physics I
MATH-I 674 Mathematical Physics II

Minor in Applied Mathematics:

This minor is intended for students who are doing their Ph.D. in the Department of Mathematical Sciences and who are not specializing in the area of Applied Mathematics.

Requirements

A student must pass two of the following 3-credit courses:

MATH-I 514 Numerical Analysis
MATH-I 520 Boundary Val. Problems and Differential Equations
MATH-I 522 Qual. Theory of Differential Equations
MATH-I 526 Principles of Mathematical Modeling
MATH-I 535 Theoretical Mechanics
MATH-I 552 Applied Computational Methods II
MATH-I 555 Introduction to Biomathematics

MATH-I 578 Mathematical Modeling of Physical Systems I
MATH-I 588 Mathematical Modeling of Physical Systems II

Minor in Geometry and Topology:

This minor is intended for students who are doing their Ph.D. in the Department of Mathematical Sciences and who are not specializing in the area of Geometry and Topology.

Requirements

A student must pass two of the following 3-credit courses:

MATH-I 562 Intro to Diff. Geometry and Topology
MATH-I 563 Advanced Geometry
MATH-I 571 Elementary Topology
MATH-I 572 Intro. to Algebraic Topology
MATH-I 567 Dynamical Systems I
MATH-I 667 Dynamical Systems II
MATH-I 672 Algebraic Topology I
MATH-I 673 Algebraic Topology II

Minor in Mathematical Analysis:

This minor is intended for students who are doing their Ph.D. in the Department of Mathematical Sciences and who are not specializing in the area of Mathematical Analysis.

Requirements

A student must pass two of the following 3-credit courses:

MATH-I 520 Boundary Val. Problems Differential Equations
MATH-I 523 Intro to Partial Differential Equations
MATH-I 531 Functions of a Complex Var. II
MATH-I 545 Principles of Analysis II
MATH-I 546 Intro to Functional Analysis
MATH-I 574 Mathematical Physics I
MATH-I 646 Functional Analysis
MATH-I 674 Mathematical Physics II

Minor in Statistics:

This minor is intended for students who are doing their Ph.D. in the Department of Mathematical Sciences and who are not specializing in the area of Statistics.

Requirements

A student must pass two of the following 3-credit courses:

STAT-I 512 Applied Regression Analysis
STAT-I 513 Statistical Quality Control
STAT-I 514 Design of Experiments
STAT-I 519 Introduction to Probability
STAT-I 520 Time Series and Applications
STAT-I 521 Statistical Computing
STAT-I 522 Sampling and Survey Techniques
STAT-I 523 Categorical Data Analysis
STAT-I 524 Applied Multivariate Analysis
STAT-I 525 Generalized Linear Model
STAT-I 528 Mathematical Statistics I
STAT-I 529 Bayesian Statistics and Applied Decision Theory
STAT-I 532 Elements of Stochastic Processes
STAT-I 533 Nonparametric Statistics
STAT-I 536 Introduction to Survival Analysis
STAT-I 619 Probability Theory
STAT-I 628 Advanced Statistical Inference

Graduate Programs

The Department of Mathematical Sciences offers graduate training leading to an Indiana University Ph.D. in Mathematics with concentrations in pure mathematics, applied mathematics, and statistics. In addition, the department offers a Master of Science degree in Mathematics, with concentrations in pure mathematics, applied mathematics, math education, and applied statistics. Together with the Department of Biostatistics in the Indiana University School of Medicine and the Indiana University Fairbanks School of Public Health at IU Indianapolis, the department also administers and offers an Indiana University Ph.D. in Biostatistics. Requirements for both Ph.D. programs are completed entirely on the IU Indianapolis campus. The M.S. degree requires two years of full-time study, and the Ph.D. typically requires two to three additional years of full-time study.

Admission Requirements

Details about the admission requirements are available at the section of this bulletin dedicated to graduate admissions in Mathematics (click below). This includes information about prerequisite coursework and degrees.

Master of Science in Mathematics (M.S.)

Master of Science in Computational Data Science (M.S.)

Doctor of Philosophy in Biostatistics (Ph.D.)

Doctor of Philosophy in Mathematics (Ph.D.)

Transfer Credit

The Department of Mathematical Sciences may accept by transfer a maximum of 12 credit hours of graduate credit from an approved institution to an M.S. degree. A maximum of 12 credit hours in excess of undergraduate degree requirements from approved institutions may be applied to a Ph.D. degree if the applicant has not completed a master's degree; up to 30 credit hours of an awarded master's degree from an approved institution may apply to a Ph.D. degree. Transfer credit must be approved by the student's faculty advisor and the Graduate Committee.

Assistantships and Fellowships

Competitive financial support is available to qualified full-time thesis students in the form of university fellowships, school fellowships, graduate teaching assistantships, and research assistantships.

English Requirements

All advanced degree candidates are required to demonstrate acceptable proficiency in English composition.

Students for whom English is not their native language must take the EAP exam administered by the IU Indianapolis English for Academic Purposes program. Students not scoring high enough will be required to

take designated courses in English while pursuing their graduate studies.

Master of Science (Pure and Applied Mathematics Concentrations)

The Master of Science with focus in pure or applied mathematics consists of a minimum of 30 credit hours. Course grades must be A or B with the possible exception of at most two grades of C. Neither a thesis nor a comprehensive examination is required. Several core courses are specific to an M.S. plan of study and vary according to the student's interest in (a) pure mathematics with a Ph.D. objective, (b) pure mathematics without a Ph.D. objective, (c) applied mathematics with a Ph.D. objective, or (d) applied mathematics without a Ph.D. objective. The remaining courses are selected by the student and his or her advisory committee.

A thesis option is available for both tracks, in which the 3-credit research course MATH-I 698 replaces at least one and up to three of the courses in the student's plan of study.

Master of Science (Applied Statistics Concentration)

The Master of Science degree with a concentration in Applied Statistics consists of a minimum of 30 credit hours. Course grades must be A or B with the possible exception of at most two grades of C. A combined written and oral final examination is required. Candidates for this degree may choose either the thesis option or the non-thesis option. Both options require 15 credit hours in the core curriculum consisting of STAT-I 512, STAT-I 514, STAT-I 519, STAT-I 524, and STAT-I 528.

The non-thesis option consists of 15 credit hours beyond the core curriculum, at least 9 of which must be statistics (STAT) courses. The remaining courses may be taken in mathematics or in areas relevant to statistical applications, subject to approval of the academic advisor.

The thesis option requires a thesis worth 6 credit hours on a topic approved by the student's academic advisor. At least 6 of the remaining 9 credit hours must be taken in statistics coursework beyond the core curriculum. The remaining 3 credit hours of coursework may be taken in Mathematics or in a subject related to statistical applications that has been approved by the advisor. An oral defense of the thesis is required.

Master of Science (Mathematics Education Concentration)

The Master of Science with focus in mathematics education consists of a minimum of 30 credit hours and is tailored for secondary school teachers and students who are preparing to become secondary school teachers. Course grades must be A or B with the possible exception of at most two grades of C. Core requirements include a course in abstract algebra (MATH-I 505), a course in analysis (MATH-I 547 or MATH-I 504), a course in geometry (MATH-I 561 or MATH-I 563), a course in probability (STAT-I 516), and a course in statistics (STAT-I 517).

A thesis option is available in which the 3-credit research course MATH-I 698 replaces at least one and up to three of the courses in the student's plan of study.

Master of Science in Computational Data Science

The objective of the Master of Science in Computational Data Science program is to prepare students to enter the workforce in the rapidly advancing field of data science, an interdisciplinary domain that cuts across computer science and statistics, by providing a solid, comprehensive background in the related topics of theory and their applications.

This program will provide the skills necessary that will enable students to be flexible and competitive in today's job market by gaining deep understanding of theory, implementation (e.g., algorithms and appropriate computing languages), as well as the inherent "nature" of different data modalities, such as classification and prediction challenges on specific data (e.g., sparse and/or incomplete data).

The curriculum consists of computer science courses from the IU Indianapolis Luddy School of Informatics, Computing, and Engineering and statistics courses from the IU Indianapolis School of Science Department of Mathematical Sciences. The curriculum requires 30 credits in total that can be completed in three semesters.

The 15 credits of core courses include 9 credits in Computer Science and 6 credits in Statistics. Electives comprise 12 credits, of which 6 credits must be chosen from Computer Science and 6 credits from Statistics. A 3-credit capstone course in Statistics or Computer Science is also required.

Successful completion of the program requires a minimum plan of study GPA of 3.00, the minimum grade in any course is C and the maximum number of courses with grades of C or C+ is two.

Core Courses:
(course number pending) Introduction to Data Science
CSCI-B 555 Machine Learning
CSCI-B 565 Data Mining
STAT-I 512 Applied Regression Analysis
STAT-I 529 Applied Decision Theory and Bayesian Analysis

Elective courses:
CSCI-B 503 Algorithm Design and Analysis
CSCI-B 561 Advanced Database Concepts
CSCI-P 558 Deep Learning
CSCI-P 573 Introduction to Scientific Computing
CSCI-P 583 Data Visualization
STAT-I 514 Design of Experiments
STAT-I 520 Time Series and Applications
STAT-I 521 Statistical Computing
STAT-I 523 Categorical Data Analysis
STAT-I 524 Applied Multivariate Analysis
STAT-I 525 Generalized Linear Models
STAT-I 536 Introduction to Survival Analysis
Capstone Course:
(course number pending) M.S. Capstone Project in Data Science
STAT-I 598 Topics in Statistical Methods

The course sequence is crucial for successful completion of this program. Students should consult with the departmental advisor.

Doctor of Philosophy (Mathematics)

To be admitted to candidacy for the Ph.D. degree, the student must fulfill the following requirements and must be accepted by the graduate committee of the Department of Mathematical Sciences.

Requirements

- The student must pass a suite of four qualifying exams. They must select at least two out of four subject areas from the Core 4 with at least one being either MATH-I 544 Real Analysis or MATH-I 553 Abstract Algebra. They must also pass two additional exams from either the remaining Core 4 or the Area Exams.
- The student must satisfy, by one of the five options approved by the graduate school, the world language requirement in German, Russian, or French.
- The student must submit to the graduate school through the department a plan of study including at least 42 credit hours of approved graduate coursework.
- The student must pass an advanced topics examination. This examination may be taken only by students who have already passed the qualifying examinations.

A candidate will be recommended to the faculty to receive the Ph.D. degree after a dissertation, submitted in final form, has been accepted by the advisory committee and successfully defended at an open colloquium or seminar.

Doctor of Philosophy (Biostatistics)

Together with the Department of Biostatistics in the Indiana University School of Medicine and the Indiana University Fairbanks School of Public Health at IU Indianapolis, the Department of Mathematical Sciences offers graduate training leading to a Ph.D. in Biostatistics from Indiana University, with all requirements completed on the IU Indianapolis campus. To be admitted to candidacy for the Ph.D. degree, the student must fulfill the following requirements.

Requirements

- The student must pass an initial qualifying examination on the five core courses: STAT-I 519, STAT-I 525, STAT-I 528, STAT-I 536, and PBHL-B 574.
- The student must complete at least 45 credit hours of formal coursework, consisting of 33 credit hours of required courses and additional 12 credit hours in elective statistics/biostatistics courses of which six credit hours must be at the 600 level and above. An additional 45 credit hours are required and will consist of coursework in a minor area (minimum of 9 credits), further elective courses, independent studies, and directed Ph.D. dissertation research.
- The student must pass a preliminary oral examination, which consists of an oral presentation on an advanced research topic.

A candidate will be recommended to the faculty to receive the Ph.D. degree after a dissertation, submitted in final form, has been accepted by the advisory committee and successfully defended before an open colloquium or seminar.

The department has set time limits for the completion of the Ph.D. degree.

Neuroscience Program

402 N. Blackford Street, LD 124
Indianapolis, IN 46202-3276
Phone: (317) 278-2237; Fax: (317) 274-2846
Web: click here

- **Director** Bethany S. Neal-Beliveau, Ph.D.
- **Undergraduate Program Advisor:** School of Science Advising Group

Neuroscience is a rapidly advancing field that examines the structure and function of the nervous system with particular focus on the intersection between the brain and behavior. This field has emerged through the explosive growth of research in the neural sciences and increased interest in the mechanisms that support behavior in humans and in animal models.

The Bachelor of Science degree in Neuroscience offers an interdisciplinary curriculum that is grounded in biology, psychology, physics, chemistry, computer science and mathematical sciences, with the nervous system as a common focus. All students are encouraged to participate in research in laboratories across the School of Science and the IU School of Medicine utilizing the state-of-the-art experimental methods available to them.

Neuroscience courses will be drawn primarily from the Department of Biology and the Department of Psychology. Foundational coursework will also be completed in Chemistry, Physics, Neuroscience, and Computer Science. The degree program culminates in a capstone experience.

Because neuroscience is a rapidly advancing field of inquiry, there is a high demand for trained professionals with knowledge and skills related to neuroscience for careers in medicine, academic or government-supported research, health-related sciences, and biotechnology. It is anticipated that a substantial proportion of graduates may elect to continue their training in graduate or professional school, particularly schools of medicine.

- Bachelor of Science Degree Requirements
- Bachelor of Science Plan of Study
- Minor in Neuroscience Requirements
-

Bachelor of Science in Neuroscience Degree Requirements

Degree Requirements

First-Year Experience Course (1 cr.)

Beginning freshmen and transfer students with fewer than 19 credit hours are required to take SCI-I 120 Windows on Science (1 cr.) or an equivalent first-year experience course.

Area I English Composition and Communication Competency (9 cr.)

See the School of Science requirements under "Undergraduate Programs" in this bulletin. The second semester of English composition may be satisfied with ENG-W 231 (or ENG-W 230, ENG-W 270 / ENG-W 150, ENG-W 320, or ENG-W 350).

Area II World Language Competency

No world language proficiency is required for a Bachelor of Science degree. However, knowledge of a world language is strongly recommended for any student planning to attend graduate school.

Area IIIA Arts and Humanities, Social Sciences, and Cultural Understanding Competencies (12 cr.)

- List H Arts and Humanities Competency: Choose one course (3 cr.) from this list. The list of course choices is located under the School of Science requirements "Undergraduate Programs" in this bulletin.
- List S Social Sciences Competency: Choose one course (3 cr.) from this list. The list of course choices is located under the School of Science requirements "Undergraduate Programs" in this bulletin. NOTE: PSY-B 110 (or an equivalent introductory psychology course) cannot be used to satisfy this requirement, as the course is required in the major.
- One additional course from List H or List S
- List C Cultural Understanding Competency: Choose one course (3 cr.) from this list. The list of course choices is located under the School of Science requirements "Undergraduate Programs" in this bulletin.

For the most current list of courses in the areas of Arts and Humanities, Social Sciences and Cultural Understanding, please refer to the IU Indianapolis General Education Curriculum.

Area IIIC Life and Physical Sciences Competency (19-20 cr.)

The following courses are required:

CHEM-C 105 Principles of Chemistry I (3 cr.) and CHEM-C 125 Experimental Chemistry I (2 cr.)

CHEM-C 106 Principles of Chemistry II (3 cr.) and CHEM-C 126 Experimental Chemistry II (2 cr.)

CHEM-C 341 Organic Chemistry Lectures I (3 cr.) and CHEM-C 343 Organic Chemistry Laboratory I (2 cr.)

One of the following courses or course sequences is required:

CHEM-C 342 Organic Chemistry Lectures I (3 cr.) and CHEM-C 344 Organic Chemistry Laboratory I (2 cr.)

PHYS-I 152 Mechanics (4 cr.) **OR** PHYS-P 201 General Physics I (5 cr.) **OR** PHYS-I 218 General Physics I (4 cr.)

Area IIID Analytical Reasoning Competency (9 cr.)

Two courses in calculus are required. The starting point to be worked out with the departmental advisor based on the math placement test and/or background of the student. Acceptable calculus sequences include

MATH-I 231 / MATH-I 232 Calculus for the Life Sciences I and II (3 cr./3 cr.)

MATH-I 165 / MATH-I 166 Analytic Calculus and Geometry I and II (4 cr./4 cr.)

The computer programming requirement may be satisfied with the following. Alternate computer science programming courses may be approved in consultation with an academic advisor.

CSCI-N 200 Principles of Computer Science (3 cr.) **OR** CSCI-N 201 Programming Concepts (3 cr.) **OR** CSCI-N 207 Data Analysis Using Spreadsheets (3 cr.) **OR** CSCI-N 211 Introduction to Databases (3 cr.)

Note: Computer Science CSCI-N 241 and CSCI-N 299 do not count in Area IIID, but may count as a general elective.

Area IV Neuroscience Major Requirements (minimum 48 cr.)

A minimum grade of C- (1.70) or higher is required in all courses in Area IV, including neuroscience electives. An overall GPA of 2.00 GPA is required for AREA IV.

A. Foundation Courses (25 cr.)

- BIOL-K 101 Concepts of Biology I (5 cr.)
- BIOL-K 103 Concepts of Biology II (5 cr.) (P: BIOL-K 101)
- BIOL-K 324 Cell Biology (3 cr.) (P: BIOL-K 103 and CHEM-C 106)
- NSCI-K 416 or BIOL-K 416 Cellular & Molecular Neuroscience (3 cr.) (P: BIOL-K 324)
- PSY-B 110 Introduction to Psychology (3 cr.)
- NSCI-B 201 or PSY-B 201 Foundations in Neuroscience (3 cr.) (P: PSY-B 110 or BIOL-K 101)
- NSCI-B 301 or PSY-B 301 Systems Neuroscience (3 cr.) (P: PSY-B 201)

B. Statistical Research Methods(3 cr.)

- PSY-B 305 Statistics (3 cr.) (P: Math credit in School of Science and PSY-B 110)

  OR
- STAT-I 350 Introduction to Statistics (3 cr.) (P: MATH#I 165 or MATH#I 221 or MATH#I 231 or MATH#I 241, or higher, with a grade of C# or better)

C. Neuroscience Electives (18 cr.)

Students must complete 3 credits (1 course) from the biology electives course list, and 3 credits (1 course) from the psychology electives course list. Students must also complete an additional 12 credit hours (4 courses) from any courses included in the biology, psychology or chemistry/physics electives course lists. At least 6 Neuroscience elective courses must be completed overall.

A course cannot be used to satisfy two Area requirements. For example, if CHEM-C 342 Organic Chemistry Lecture II is taken for the Area IIIC Life and Physical Sciences requirement, then it cannot be subsequently used to satisfy Area IV Part C neuroscience elective requirement. This applies to other courses, including CHEM-C 344, PHYS-I 152, and PHYS-P 201. This is not a complete list of courses that could count in more than one Area.

Biology Electives Course List

- BIOL-K 322 Genetics and Molecular Biology (3 cr.) [strongly recommended, as this serves as a

prerequisite for other higher-level electives and is generally required for admission to graduate and professional programs] (P: BIOL-K 103 and CHEM-C 106)
- BIOL-K 331 Developmental Biology (3 cr.) (P: BIOL-K 103 and BIOL-K 322)
- BIOL-K 338 Introductory Immunology (3 cr.) (P: BIOL-K 103, BIOL-K 322, BIOL-K 324, CHEM-C 106)
- BIOL-K 384 Biological Chemistry (3 cr.) (P: BIOL-K 322 or BIOL-K 324 and CHEM-C 341)
- NSCI-K 451 or BIOL-K 451 Neuropharmacology (3 cr.) (P: BIOL-K 324)
- BIOL-K 484 Cellular Biochemistry (3 cr.) (P: BIOL-K 322 and CHEM-C 342, P or C: BIOL-K 324)
- NSCI-K 488 or BIOL-K 488 Endocrinology in Health and Disease (3 cr.) (P: BIOL-K 324 and BIOL-K 322 or approved equivalents)
- BIOL-N 461 Cadaveric Human Anatomy (only 3 cr. can count here, the other 2 in the lab requirement) (P: BIOL-N 261 or permission of instructor)
- NSCI-I 544 or BIOL-I 544 Sensory Systems (3 cr.) (P: BIOL-K 324)
- NSCI-I 559 or BIOL-I 559 Endocrinology (3 cr.)
- NSCI-I 560 or BIOL-I 560 Clinical and Molecular Aspects of Neurodegenerative Diseases (3 cr.)
- NSCI-I 561 or BIOL-I 561 Immunology (3 cr.)
- BIOL-I 568 Regenerative Biology and Medicine (3 cr.)
- NSCI-I 571 or BIOL-I 571 Developmental Neurobiology (3 cr.) (Not offered every semester)

Psychology Electives Course List

- PSY-B 334 Perception (3 cr.) (P: PSY-B 110)
- PSY-B 340 Cognition (3 cr.) (P: PSY-B 110)
- PSY-B 344 Learning (3 cr.) (P: PSY-B 110)
- PSY-B 356 Motivation (3 cr.) (P: PSY-B 110)
- PSY-B 365 Health Psychology (3 cr.) (P: PSY-B 110)
- PSY-B 380 Abnormal Psychology (3 cr.) (P: PSY-B 110)
- NSCI-B 394 or PSY-B 394 Drugs and Behavior (3 cr.) (P: PSY-B 110)
- NSCI-B 398 or PSY-B 398 Brain Mechanisms of Behavior (3 cr.) (P: PSY-B 301)
- NSCI-I 535 or PSY-I 535 Clinical Neuroscience (3 cr.)
- PSY-I 545 Psychopharmacology (3 cr.)
- PSY-I 560 Behavioral Genetics (3 cr.)

Chemistry/Physics Electives Course List

- CHEM-C 342 Organic Chemistry II (3 cr.) (If used in Area IIIC, then the course cannot apply to the Area IV Part C requirement.)
- CHEM-C 371 Chemical Informatics I (1 cr.)
- CHEM-C 372 Chemical Informatics II: Molecular Modeling (2 cr.)
- CHEM-C 484 Biomolecules and Catabolism (3 cr.)
- CHEM-C 485 Biosynthesis and Physiology (3 cr.)
- PHYS-I 152 Mechanics (4 cr.) (If used in Area IIIC, then the course cannot apply to the Area IV Part C requirement.)
- PHYS-I 251 Heat, Electricity and Optics (5 cr.)
- PHYS-P 201 General Physics I (5 cr.) (If used in Area IIIC, then the course cannot apply to the Area IV Part C requirement.)
- PHYS-P 202 General Physics II (5 cr.)
- PHYS-I 219 General Physics II (4 cr.)
- PHYS-I 585 Molecular Biophysics (3 cr.)

D. Upper-level Laboratory (1-2 cr.)

To receive credit for a laboratory for which there is an accompanying pre- or co-requisite lecture, the lecture must be completed with a minimum grade of C. Laboratory courses can be enrolled concurrently with the lecture (often preferred) or in a semester after the completed lecture.

- BIOL-K 323 Genetics and Molecular Biology Laboratory (2 cr.)
- BIOL-K 325 Cell Biology Laboratory (2 cr.)
- BIOL-K 333 Developmental Biology Laboratory (1 cr.)
- BIOL-K 339 Immunology Laboratory (2 cr.)
- NSCI-K 417 Neuroanatomy Lab (2 cr.) (P: NSCI-B 301 or NSCI-K 416)
- CHEM-C 344 Organic Chemistry Laboratory II (2 cr.) (If used in Area IIIC, then the course cannot apply to the Area IV Part C requirement.)
- CHEM-C 486 Biological Chemistry Laboratory (2 cr.)
- BIOL-N 461 Cadaveric Anatomy (2 cr. of the course can count here)

E. Capstone (1 course or course sequence; where not indicated, credit hours to be determined in consultation with advisor)

- BIOL-K 493 Independent Research (minimally 2 cr.) and BIOL-K 494 Senior Research Thesis (minimally 1 cr.) (2 semesters - Fall and Spring - and requires application due in Spring semester before the Fall semester starts)

  OR

- PSY-B 499 Capstone Honors Research (2 semesters - Fall and Spring - and requires application due in Spring semester before the Fall semester starts)

  OR

- NSCI-N 490 Capstone Library Research (one semester; by application only)

  OR

- NSCI-N 491 Capstone Lab in Behavioral Neuroscience (Spring semester only)

  OR

- NSCI-N 492 Capstone in Computational Neuroscience (Fall semester only)

  OR

- NSCI-N 493 Capstone Independent Laboratory Research (minimally 3 credits over two semesters; Fall and Spring semesters only; consent of instructor required)

  OR

- NSCI-N 494 Capstone Teaching Practicum Neuroscience (Fall and Spring semesters only; consent of instructor required)

  OR

- NSCI-N 496 Clinical Experiential Neuroscience Capstone

  OR

- CHEM-C 494 Intro to Capstone in Chemistry (1 cr.) (junior standing) and CHEM-C 495 Capstone in Chemistry (1 cr.) (senior standing). Requires permission from the instructor and independent project advisor.

  OR

- MATH-I 492 Capstone Experience

  OR

- PHYS-I 490 Undergraduate Readings and Research

Neuroscience Plan of Study

No single semester-by-semester plan of study will guide all students through the degree option because of the flexibility encouraged within the program. However, one possible sequence of courses is given below; variations from this example should be made in consultation with the program advisor.

Sample Program (120 cr. required)

Freshman Year

First Semester	
SCI-I 120 Windows on Science	1
BIOL-K 101 Concepts of Biology I	5
MATH-I 231 Calculus for Life Science I	3
PSY-B 110 Introduction to Psychology	3
ENG-W 131 Reading, Writing and Inquiry	3
Total	**15**
Second Semester	
COMM-R 110 Fundamentals of Speech Communication	3
BIOL-K 103 Concepts of Biology II	5
MATH-I 232 Calculus for Life Science II	3
CHEM-C 105 Principles of Chemistry I	3
CHEM-C 125 Experimental Chemistry I	2
Total	**16**

Sophomore Year

Third Semester	
CHEM-C 106 Principles of Chemistry II	3
CHEM-C 126 Experimental Chemistry II	2
2nd Written Communications Course	3
CSCI-N 207 Data Analysis Using Spreadsheets	3
NSCI-B 201 Foundations of Neuroscience	3
Arts & Humanities (choose from list)	3
Total	**17**
Fourth Semester	
BIOL-K 324 Cell Biology	3
CHEM-C 341 Organic Chemistry I Lecture	3
CHEM-C 343 Organic Chemistry I Laboratory	2
NSCI-B 301 Systems Neuroscience	3
Social Science (choose from list)	3
Cultural Understanding (choose from list)	3
Total	**17**

Junior Year

Fifth Semester	
NSCI-K 416 Cellular and Molecular Neuroscience	3
Major Upper-Level Laboratory Course (choose from list)	2
Statistical Research Methods course (choose from list)	3
Life and Physical Science (choose from list)	5
Elective/Minor course	3
Total	**16**
Sixth Semester	
Major Neuroscience Elective Course	3
Neuroscience Psychology Elective Course	3
Neuroscience General Elective Course	5
Elective	3
Total	**14**

Senior Year

Seventh Semester	
Neuroscience Biology Elective Course	3
Neuroscience Major Elective Course	3-5
Capstone course	1-3
Elective/Minor courses	6

Arts & Humanities/Social Science (choose from list)	3
Total	**13-17**
Eighth Semester	
Capstone course	1-3
Neuroscience Major Elective course	2-4
Elective/Minor courses	1-6
Total	**8-12**

Minor in Neuroscience Requirements

Minor in Neuroscience

The School of Science offers a minor in the field of neuroscience. Neuroscience is an interdisciplinary field, encompassing biology, chemistry, mathematics and psychology, as well as other disciplines. Students majoring in one of these areas may have a strong interest in neuroscience, but prefer to major in one of the specific disciplines.

Due to its interdisciplinary nature, a minor in neuroscience intentionally and transparently links different disciplines together. The minor will allow students to understand, apply and analyze the connections among disciplines. These abilities will help them apply their life sciences learning to the rest of their education, and better prepare them for graduate and/or professional studies in this new and expanding field.

Minor Requirements

The minor requires 15 credit hours (5 courses):

Core Courses

- NSCI-B 201 Foundations of Neuroscience (3 cr.) P: PSY-B 110 or BIOL-K 101
- NSCI-B 301 Systems Neuroscience (3 cr.) P: NSCI-B 201
- NSCI-K 416 / BIOL-K 416 Cellular and Molecular Neuroscience (3 cr.) P: BIOL-K 324

2 Neuroscience elective courses:

One course from the Biology Elective Course List (3 cr.)

- BIOL-K 322 Genetics and Molecular Biology P: BIOL-K 103 & CHEM-C 106 (This course is strongly recommended, as it serves as a prerequisite for other higher-level electives and generally is required for admission to graduate and professional programs.)
- BIOL-K 331 Developmental Biology P: BIOL-K 103 & BIOL-K 322
- BIOL-K 338 Introductory Immunology P: BIOL-K 103 & CHEM-C 106
- BIOL-K 384 Cellular Biochemistry P: CHEM-C 341 and BIOL-K 324 or BIOL-K 322
- BIOL-K 417 Neuroanatomy P: BIOL-K 416 or PSY-B 301
- BIOL-K 451 Neuropharmacology P: BIOL-K 324
- BIOL-K 483 Biological Chemistry P: CHEM-C 342
- NSCI-I 559 / BIOL-I 559 Endocrinology P: BIOL-I 556 or equivalent & CHEM-C 342
- BIOL-I 568 Regenerative Biology and Medicine P: BIOL-K 324 or BIOL-K 331 or a biochemistry course
- NSCI-I 571 / BIOL-I 571 Developmental Neurobiology P: consent of instructor (Not offered every semester.)

One course from the Psychology Elective Course List (3 cr.)

- PSY-B 334 Perception P: see below*
- PSY-B 340 Cognition P: PSY-B 110
- PSY-B 344 Learning P: see below*
- PSY-B 356 Motivation P: see below*
- PSY-B 365 Health Psychology P: see below*
- PSY-B 380 Abnormal Psychology P: see below*
- NSCI-B 394 / PSY-B 394 Drugs and Behavior P: see below*
- PSY-I 535 Developmental Neuroscience
- NSCI-I 545 / PSY-I 545 Psychopharmacology**
- NSCI-I 560 / PSY-I 560 Behavioral Genetics*

  - * P: Three (3) credit hours of introductory psychology
  - ** Requires permission of instructor

Apply for a minor

To qualify for minor certification, students must complete the online form. For more information on the Neuroscience program, please contact Cynthia Williams, neuroscience advisor, or call the science peer advisors at 317-274-6765.

Department of Physics

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Department Chair: Ricardo S. Decca, Ph.D.

Department Advisors:

- Undergraduate Programs: Rebecca Burris, MSW
- Graduate Programs: Horia Petrache, Ph.D.

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 problems by learning to analyze them in mathematical terms. Our department particularly focuses on the use of computational methods, so our majors graduate with highly developed skills for using computers to model, understand, and solve complex problems. 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 from Indiana University. In addition, the department offers courses in physics and astronomy for nonmajors. The department also offers graduate courses that lead to an Indiana University Master of Science and an Indiana University Ph.D. degree.

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 the Indiana University Center for Space Symmetries, the Center for Quantum Technologies and the IU School of Medicine. Student participation in these projects is welcomed and encouraged.

Students majoring in physics consolidate their undergraduate studies by putting what they have learned to use in a capstone experience in one of the department's research laboratories. Each student joins a faculty member in a project that provides experience in a professional setting. The student must obtain the approval of a faculty member and register for PHYS-I 490.

Guide to Service Courses

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

- AST-A 103 / AST-A105 / AST-A 205: General science courses for students in all majors.
- AST-A 130: Focused short courses for students in all majors.
- PHYS-I 140: Focused short courses for students in all majors.
- PHYS-I 100: For students in allied health, business, and liberal arts (a traditional survey course).
- PHYS-I 200: For students in education, SPEA, and liberal arts (a nontraditional course).
- PHYS-P 201 / PHYS-P 202: A noncalculus sequence for preprofessional students.
- PHYS-I 152 / PHYS-I 251 / PHYS-I 342: For students in science and mathematics requiring a calculus-based sequence.

Undergraduate Degree Options

- Bachelor of Science
- Bachelor of Science-Biophysics Option
- Bachelor of Science Physics and Mathematical Sciences
- Bachelor of Science in Physics Teaching
- Plan of Study
- Minor

Graduate Degree Option

- Graduate Program

Physics-Undergraduate Degree Options

Degree Requirements

Minimum requirements for the School of Science are given in this bulletin (see the School of Science requirements under "Undergraduate Programs").

First-Year Experience Course

Beginning freshmen and transfer students with fewer than 19 credit hours are required to take SCI-I 120 Windows on Science (1 cr.) or an equivalent first-year experience course.

Area I English Composition and Communication Competency

ENG-W 131 or ENG-W 140 Reading Writing and Inquiry (3 cr.) with a grade of C (2.00) or higher.

The second semester of English composition may be satisfied with ENG-W 230, ENG-W 231, ENG-W 250, ENG-W 270, ENG-W 331 or ENG-W 350 with a grade of C (2.00) or higher.

Area II World Language Competency

Proficiency in a world language is not required for a Bachelor of Science degree from the School of Science, with the exception of Mathematical Science degrees and the dual major Physics-Math degree.

Area IIIA Arts and Humanities, Social Sciences, and Cultural Understanding Competencies (12 cr.)

List H course: Choose one course (3 cr.) from this list. The list of course choices is located under the School of Science requirements "Undergraduate Programs" in this bulletin.

List S course: Choose one course (3 cr.) from this list. The list of course choices is located under the School of Science requirements "Undergraduate Programs" in this bulletin.

List C course: Choose one course (3 cr.) from this list. The list of course choices is located under the School of Science requirements "Undergraduate Programs" in this bulletin.

One additional course from either List H or List S.

For the most current list of courses in the areas of Arts and Humanities, Social Sciences and Cultural Understanding, please refer to the IU Indianapolis General Education Curriculum.

Area IIIC Life and Physical and Sciences Competency

Minimum requirements for the School of Science are given in this bulletin (see the School of Science requirements under "Undergraduate Programs").

Courses must include CHEM-C 105/CHEM-C 125 and CHEM-C 106/CHEM-C 126 with laboratory or their approved equivalent.

Students must have grades of C- or higher in Life and Physical Sciences courses. A grade of D or D+ will be allowed for one course only.

Area IIID Analytical Reasoning Competency

Minimum requirements for the School of Science are given in this bulletin (see the School of Science requirements under "Undergraduate Programs").

Twenty-four (24) credit hours of courses in mathematics are required, which must include MATH-I 165, MATH-I 166, MATH-I 171, MATH-I 261 and MATH-I 266 or MATH-I 366 and two (2) additional courses beyond MATH-I 261 (not including MATH-I 266 / MATH-I 366, which is required).

The computer programming requirement (3 - 4 cr.) of the School of Science may be satisfied with CSCI-C 200, CSCI-C 304 or any higher-level CSCI course (with advisor or department approval). Students with significant programming experience may request authorization to satisfy this requirement with other courses.

Note: Computer Science CSCI-N 241 and CSCI-N 299 do not count in Area IIID, but may count as a general elective.

Students must have grades of C- or higher in Analytical Reasoning courses. A grade of D or D+ will be allowed for one course only.

Area IV Physics Concentration

The Department of Physics offers four options for students pursuing the Bachelor of Science degree: a traditional physics program; a biophysics option; a program designed for students planning a career in physics teaching; and a B.S. dual accelerated major in physics and mathematics.

Students pursuing the traditional program must complete PHYS-I 152, PHYS-I 251, PHYS-I 299, PHYS-I 300, PHYS-I 310, PHYS-I 330, PHYS-I 342, PHYS-I 353, PHYS-I 400, PHYS-I 401, PHYS-I 418, PHYS-I 442, and PHYS-I 490. These students must complete 6 hours of mathematics above the level of MATH-I 261 in courses approved by the Department of Physics.

Students pursuing the biophysics option must complete: Introductory course sequence PHYS-P 201 or PHYS-I 152, PHYS-P 202 or PHYS-I 251, PHYS-I 299, PHYS-I 310, PHYS-I 330, PHYS-I 342, PHYS-I 353, PHYS-I 442, PHYS-I 585, and PHYS-I 490 Biophysics Capstone. In addition, a minimum of 13 credit hours of biology and 21 credit hours of chemistry is required. Please refer to the Biophysics Option section of the bulletin for detailed information. Note: For this option, students are NOT required to complete two (2) additional courses beyond MATH-I 261.

Students pursuing the teaching option must complete: PHYS-I 152, PHYS-I 251, PHYS-I 300, PHYS-I 310, PHYS-I 330, PHYS-I 342, PHYS-I 353, and PHYS-I 490. The Department of Physics may substitute other science courses for the 400-level courses and recommend education courses in order to meet teacher certification requirements. These students must complete 6 hours of mathematics above the level of MATH-I 261 in courses approved by the Department of Physics.

Students pursuing the program in physics and mathematical sciences must complete PHYS-I 152, PHYS-I 251, PHYS-I 299, PHYS-I 310, PHYS-I 330, PHYS-I 342, PHYS-I 353, PHYS-I 400, PHYS-I 401, PHYS-I 418 and PHYS-I 442. Students must complete the MATH sequence up to MATH-I 266 / MATH-I 366 and MATH-I 351, MATH-I 300, MATH-I 414, MATH-I 426 and MATH-I 444. Additionally, students must take nine (9) additional credit hours: three credit hours selected from MATH-I 353/MATH-I 354/MATH-I 453; three credit hours selected from mathematics courses at the 300 level or above and statistics courses numbered 350 or higher; three additional credit hours from mathematics or statistics or from physics courses numbered 300 level or above. Please refer to the dual degree Physics/Math section of the bulletin for detailed information.

No more than 6 credit hours of studio, clinical, athletic, or performing arts courses will be approved. See the departmental advisor for details.

Bachelor of Science Physics

Degree Requirements

First-Year Experience Course

Beginning freshmen and transfer students with fewer than 19 credit hours are required to take SCI-I 120 Windows on Science (1 cr.) or an equivalent first-year experience course.

Area I English Composition and Communication Competency

Written Communication (6 cr.)

ENG-W 131 or ENG-W 140 Reading Writing and Inquiry (3 cr.) with a grade of C (2.0) or higher.

The second semester of English composition may be satisfied with ENG-W 230, ENG-W 231, ENG-W 250, ENG-W 270, ENG-W 331 or ENG-W 350 with a grade of C (2.0) or higher.

Speech Communication Competency

COMM-R 110 Fundamentals of Speech Communication (3 cr.)

Area II World Language Competency

No world language proficiency is required for a Bachelor of Science degree from the School of Science with the exception of Mathematical Science majors.

Area IIIA Arts and Humanities, Social Sciences, and Cultural Understanding Competencies (12 cr.)

List H course: Choose one course (3 cr.) from this list. The list of course choices is located under the School of Science requirements “Undergraduate Programs” in this bulletin.

List S course: Choose one course (3 cr.) from this list. The list of course choices is located under the School of Science requirements “Undergraduate Programs” in this bulletin.

One additional course from either List H or List S.

List C course: Choose one course (3 cr.) from this list. The list of course choices is located under the School of Science requirements “Undergraduate Programs” in this bulletin.

For the most current list of courses in the areas of Arts and Humanities, Social Sciences and Cultural Understanding, please refer to the IU Indianapolis General Education Curriculum.

Area IIIC Life and Physical Sciences Competency Chemistry Courses

Complete CHEM-C 105/CHEM-C 125 (5 credits) and CHEM-C 106/CHEM-C 126 (5 credits) with a grade of C- or better in each course.

Science Electives

Complete two additional approved courses in biology, chemistry, forensic science, or geology (6 credits).

Students must have grades of C- or higher in Life and Physical Sciences courses. A grade of D or D+ will be allowed for one course only.

Area IIID Analytical Reasoning Competency (27 credits)

Required Math courses

Complete MATH-I 165, MATH-I 166, MATH-I 171, MATH-I 261, and MATH-I 266 / MATH-I 366 with a grade of C- or higher in each course.

Math Electives

Complete an additional 6 credits of mathematics beyond MATH-I 261 (not including MATH-I 266 / MATH-I 366, which are required). Please consult your advisor for approved courses.

Computer Programming course

The computer programming requirement (3-4 cr.) of the School of Science may be satisfied with CSCI-C 200, CSCI-C 304 or any higher-level CSCI course (with advisor or department approval). Students with significant programming experience may request authorization to satisfy this requirement with other courses.

Note: Computer Science CSCI-N 241 and CSCI-N 299 do not count in Area IIID, but may count as a general elective.

Students must have grades of C- or higher in Analytical Reasoning courses. A grade of D or D+ will be allowed for one course only.

Area IV Physics Major Requirements

Physics: A minimum of 40 credit hours of physics is required. No grade below C- is acceptable for courses within the major subject.

Introductory:

- PHYS-I 152 Mechanics (4 cr.)
- PHYS-I 251 Heat, Electricity & Optics (5 cr.)
- PHYS-I 299 Introduction to Computational Physics (2 cr.)

Intermediate/Advanced:

- PHYS-I 300 Introduction to Elementary Mathematical Physics (3 cr.)
- PHYS-I 310 Intermediate Mechanics (4 cr.)
- PHYS-I 330 Intermediate Electricity & Magnetism (3 cr.)
- PHYS-I 342 Modern Physics (3 cr.)
- PHYS-I 353 Advanced Physics Laboratory I: Modern Physics and Electronics (2 cr.)
- PHYS-I 400 Physical Optics (3 cr.)
- PHYS-I 401 Advanced Physics Laboratory II Modern Optics (2 cr.)
- PHYS-I 416 Honors Thermal & Statistical Physics (4 cr.) or PHYS-I 418 Thermal & Statistical Physics (3 cr.)
- PHYS-I 442 Quantum Mechanics (3 cr.)
- PHYS-I 490 Capstone Experience (3 cr.)

A minimum of 120 credits is required for graduation. this total must include at least 32 credits in courses at the 300-400 level taken at the IU Indianapolis campus. Residence of at least two semesters on the IU Indianapolis campus is also required for graduation.

No more than 6 credit hours of clinical, athletic, or performing arts courses will be approved. see the advisor for your field for details.

Biophysics Option

First-Year Experience Course

Beginning freshmen and transfer students with fewer than 19 credit hours are required to take SCI-I 120 Windows on Science (1 cr.) or an equivalent first-year experience course.

Area I English Composition and Communication Competency

Written Communication (6 cr.)

ENG-W 131 or ENG-W 140 Reading Writing and Inquiry (3 cr.) with a grade of C (2.0) or higher.

The second semester of English composition may be satisfied with ENG-W 230, ENG-W 231, ENG-W 250, ENG-W 270, ENG-W 331 or ENG-W 350 with a grade of C (2.0) or higher.

Speech Communication Competency

COMM-R 110 Fundamentals of Speech Communication (3 cr.).

Area II World Language Competency

No world language proficiency is required for a Bachelor of Science degree from the School of Science with the exception of Mathematical Science majors.

Area IIIA Arts and Humanities, Social Sciences, and Cultural Understanding Competencies (12 cr.)

List H course: Choose one course (3 cr.) from this list. The list of course choices is located under the School of Science requirements “Undergraduate Programs” in this bulletin.

List S course: **For the Biophysics Concentration students must complete PSY-B 110 Introduction to Psychology and SOC-R 100 Introduction to Sociology**. These courses will fulfill both the List S requirement and the requirement for an additional course from either List H or List S listed below.

The additional required course from A&H / SS is satisfied with one of the courses above under Social Sciences.

List C course: Choose one course (3 cr.) from this list. The list of course choices is located under the School of Science requirements “Undergraduate Programs” in this bulletin.

For the most current list of courses in the areas of Arts and Humanities, Social Sciences and Cultural Understanding, please refer to the IU Indianapolis General Education Curriculum.

Area IIIC Life and Physical and Sciences Competency

See requirements listed below under Area IV Physics (Biophysics) Concentration Requirements.

Students must have grades of C- or higher in Life and Physical Sciences courses. A grade of D or D+ will be allowed for one course only.

Area IIID Analytical Reasoning Competency (21 credits)

Eighteen (18) credit hours of courses in mathematics are required, which must include MATH-I 165, MATH-I 166, MATH-I 171, MATH-I 261, and MATH-I 266 or MATH-I 366.

The computer programming requirement (3-4 cr.) of the School of Science may be satisfied with CSCI-C 200, CSCI-C 304 or any higher-level CSCI course (with advisor or department approval). Students with significant programming experience may request authorization to satisfy this requirement with other courses.

Note: Computer Science CSCI-N 241 and CSCI-N 299 do not count in Area IIID, but may count as a general elective.

Students must have grades of C- or higher in Analytical Reasoning courses. A grade of D or D+ will be allowed for one course only.

Area IV Physics (Biophysics) Concentration Requirements

Chemistry: A minimum of 21 credit hours is required.

Introductory:

- CHEM-C 105 Principles of Chemistry I (3 cr.)
- CHEM-C 125 Experimental Chemistry I (2 cr.)
- CHEM-C 106 Principles of Chemistry II (3 cr.)
- CHEM-C 126 Experimental Chemistry II (2 cr.)

Intermediate:

- CHEM-C 341 Organic Chemistry I (3 cr.)
- CHEM-C 343 Organic Chemistry I Laboratory (2 cr.)
- CHEM-C 342 Organic Chemistry II (3 cr.)
- CHEM-C 360 Elementary Physical Chemistry (3 cr.) - OR - CHEM-C 361 Physical Chemistry of Bulk Matter (3 cr.)

CHEM-C 344 Organic Chemistry II (3 cr.) is not required, but is recommended.

Biology: A minimum of 13 credit hours of biology is required.

Introductory:

- BIOL-K 101 Concepts of Biology I (5 cr.)
- BIOL-K 103 Concepts of Biology II (5 cr.)

Advanced:

- BIOL-K 384 Biochemistry (3 cr.) (P: BIOL-K 322 or BIOL-K 324 and CHEM-C 341) -OR-
- CHEM-C 484 Biomolecules and Catabolism (3 cr.) (P: CHEM-C 342)

Physics: A minimum of 32 credit hours of physics is required.

Introductory:

- PHYS-P 201 General Physics I (5 cr.) and PHYS-P 202 General Physics II (5 cr.) -OR-
- PHYS-I 152 Mechanics (4 cr.) and PHYS-I 251 Heat, Electricity & Optics (5 cr.)
- PHYS-I 299 Introduction to Computational Physics (2 cr.)

Intermediate/Advanced:

- PHYS-I 310 Intermediate Mechanics (4 cr.)
- PHYS-I 330 Intermediate Electricity & Magnetism (3 cr.)
- PHYS-I 342 Modern Physics (3 cr.)
- PHYS-I 353 Electronics Laboratory (2 cr.)
- PHYS-I 442 Quantum Mechanics (3 cr.)
- PHYS-I 585 Introduction to Molecular Biophysics (3 cr.)
- PHYS-I 490 Capstone Experience (3 cr.)

A minimum of 120 credits is required for graduation. This total must include at least 32 credits in courses at the 300-400 level taken at the IU Indianapolis campus. Residence of at least two semesters on the IU Indianapolis campus is also required for graduation.

No more than 6 credit hours of clinical, athletic, or performing arts courses will be approved. See the departmental advisor for details.

Physics-Math Double Major

This option is for students intending to double major in physics and mathematics.

Degree Requirements

First-Year Experience Course

Beginning freshmen and transfer students with fewer than 19 credit hours are required to take SCI-I 120 Windows on Science (1 cr.) or an equivalent first-year experience course.

Area I English Composition and Communication Competency

ENG-W 131 or ENG-W 140 Reading Writing and Inquiry (3 cr.) with a grade of C (2.00) or higher.

The second semester of English composition may be satisfied with ENG-W 230, ENG-W 231, ENG-W 250, ENG-W 270, ENG-W 331 or ENG-W 350 with a grade of C (2.00) or higher.

Area II World Language Competency

Students must have first-year proficiency in a world language (first year sequence (131 & 132) or a 200-level world language course or 200-level world language proficiency.

Area IIIA Arts and Humanities, Social Sciences, and Cultural Understanding Competencies (12 cr.)

List H course: Choose one course (3 cr.) from this list. The list of course choices is located under the School of Science requirements “Undergraduate Programs” in this bulletin.

List S course: Choose one course (3 cr.) from this list. The list of course choices is located under the School of Science requirements “Undergraduate Programs” in this bulletin.

List C course: Choose one course (3 cr.) from this list. The list of course choices is located under the School of Science requirements “Undergraduate Programs” in this bulletin.

One additional course from either List H or List S.

For the most current list of courses in the areas of Arts and Humanities, Social Sciences and Cultural Understanding, please refer to the IU Indianapolis General Education Curriculum.

Area IIIC Life and Physical and Sciences Competency

Courses taken to satisfy the Area IIIC requirements must include PHYS-I 152, PHYS-I 251, CHEM-C 105, and CHEM-C 106.

Area IIID Analytical Reasoning Competency (21 credits)

Courses taken to satisfy the Area IIID requirements must include MATH-I 165, MATH-I 166, MATH-I 171, MATH-I 261, and MATH-I 366.

The computer programming requirement (3 cr.) of the School of Science will be satisfied with CSCI-C 200.

Note: Computer Science CSCI-N 241 and CSCI-N 299 do not count in Area IIID, but may count as a general elective.

The Area IV major requirements are as follows:

1. Additional physics requirements: PHYS-I 299, PHYS-I 310, PHYS-I 330, PHYS-I 342, PHYS-I 353, PHYS-I 400, PHYS-I 401, PHYS-I 418.
2. Foundational math sequence: MATH-I 165, MATH-I 166, MATH-I 171, MATH-I 261, MATH-I 366, and MATH-I 351.
3. Additional math requirements: MATH-I 300, MATH-I 414, MATH-I 426, MATH-I 444.
4. Twelve (12) additional credit hours: three credit hours selected from MATH-I 353/MATH-I 354/ MATH-I 453; three credit hours selected from mathematics courses at the 300 level or above and statistics courses numbered 350 or higher; three additional credit hours from mathematics or statistics, or from physics courses numbered three hundred or above; and PHYS -I 442.
5. Students planning on attending graduate school in mathematics or physics are advised to take MATH-I 445, MATH-I 453, and PHYS-I 442.
6. Laboratory courses CHEM-C 125 and CHEM-C 126.
7. Minimum of two credit hours of PHYS-I 490 Capstone Experience.

Plans of Study

Bachelor of Science Sample Program (120 cr. required)

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

Freshman Year

First Semester	
CHEM-C 105 Principles of Chemistry I	3
CHEM-C 125 Experimental Chemistry I	2
MATH-I 165 Analytic Geometry and Calculus I	4
MATH-I 171 Multidimensional Mathematics	3
ENG-W 131 Reading, Writing and Inquiry	3
SCI-I 120 Windows on Science	1
Total	**16**
Second Semester	
PHYS-I 152 Mechanics	4
CHEM-C 106 Principles of Chemistry II	3
CHEM-C 126 Experimental Chemistry II	2
MATH-I 166 Analytic Geometry and Calculus II	4
COMM-R 110 Fundamentals of Speech Communication	3
Total	**16**

Sophomore Year

Third Semester	
PHYS-I 251 Heat, Electricity & Optics	5
PHYS-I 299 Intro to Computational Physics	2
MATH-I 261 Multivariate Calculus	4
CSCI-C 200 Intro to Computers and Programming	4
Arts & Humanities (choose from list)	3
Total	**18**
Fourth Semester	
PHYS-I 300 Intro. to Elem. Math Physics	3
PHYS-I 342 Modern Physics	3
MATH-I 366 Ordinary Differential Equations	3
2nd Written Communication Course	3
Social Sciences (choose from list)	3
Total	**15**

Junior Year

Fifth Semester	
PHYS-I 310 Intermediate Mechanics	4
MATH Course (MATH-I 351 or MATH-I 511)*	3
Arts & Humanities/Social Sciences (choose from list)	3

Cultural Understanding (choose from list)	3
Elective	3
Total	**16**
Sixth Semester	
PHYS-I 330 Intermediate Electricity and Magnetism	3
PHYS-I 353 Electronics Laboratory	2
MATH Course Above 266 (MATH-I 351 or MATH-I 511)*	3
Life and Physical Science (approved elective)	3
Elective	3
Total	**14**

Senior Year

Seventh Semester	
PHYS-I 400 Physical Optics	3
PHYS-I 401 Physical Optics Laboratory	2
PHYS-I 442 Quantum Mechanics	3
Life and Physical Science (approved elective)	3
Elective	2
Total	**13**
Eighth Semester	
PHYS-I 418 Thermal & Statistical Physics	3
PHYS-I 490 Capstone Experience	3
Electives	6
Total	**12**

*MATH-I 351 Elem. Linear Algebra or MATH-I 511 Linear Algebra with Applications is strongly encouraged.

Biophysics Option Sample Program (minimum 120 cr. required)

Freshman Year

First Semester	
CHEM-C 105 Principles of Chemistry I	3
CHEM-C 125 Experimental Chemistry I	2
MATH-I 165 Analytic Geometry and Calculus I	4
ENG-W 131 Reading, Writing and Inquiry	3
COMM-R 110 Fundamentals of Speech Communication	3
SCI-I 120 Windows on Science	1
Total	**16**
Second Semester	
PHYS-P 201 General Physics I or PHYS-I 152 Mechanics	4-5
CHEM-C 106 Principles of Chemistry II	3
CHEM-C 126 Experimental Chemistry II	2
MATH-I 166 Analytic Geometry and Calculus II	4
MATH-I 171 Multidimensional Mathematics	3
Total	**16-17**

Sophomore Year

Third Semester	
PHYS-P 202 General Physics II or PHYS-I 251 Heat, Electricity & Optics	5
CHEM-C 341 Organic Chemistry I	3
CHEM-C 343 Organic Chemistry Laboratory I	2
MATH-I 261 Multivariate Calculus	4
PHYS-I 299 Intro to Computational Physics	2
Total	**16**
Fourth Semester	
BIOL-K 101 Concepts of Biology I	5
CHEM-C 342 Organic Chemistry II	3
CHEM-C 344 Organic Chemistry Laboratory II (recommended, not required)	2
PHYS-I 342 Modern Physics	3
PHYS-I 353 Electronics Laboratory	2
MATH-I 366 Ordinary Differential Equations	3
Total	**18**

Junior Year

Fifth Semester	
BIOL-K 103 Concepts of Biology II	5
PHYS-I 310 Intermediate Mechanics	4
Cultural Understanding (choose from list)	3
PSY-B 110 Introduction to Psychology	3
Total	**15**
Sixth Semester	

PHYS-I 330 Interm. Electricity & Magnetism	3
CHEM-C 360 Intro. Physical Chemistry or CHEM-C 361 Physical Chem Bulk Matter	3
SOC-R 100 Introduction to Sociology	3
ENG-W 270 Argumentative Writing	3
Total	**12**

Senior Year

Seventh Semester	
CHEM-C 484 Biomolecules and Catabolism	3
PHYS-I 442 Quantum Mechanics	3
PHYS-I 585 Intro to Molecular Biophysics	3
PHYS-I 490 Capstone Experience	3
Elective	3
Total	**15**
Eighth Semester	
Computer Programming (approved elective)	3
Arts and Humanities (choose from list)	3
Electives	9
Total	**15**

Physics-Math Double Major (minimum 123 cr. required)

Freshman Year

First Semester	
CHEM-C 105 Principles of Chemistry I	3
CHEM-C 125 Experimental Chemistry I	2
MATH-I 165 Analytic Geometry and Calculus I	4
MATH-I 171 Multidimensional Mathematics	3
ENG-W 131 Reading, Writing and Inquiry	3
SCI-I 120 Windows on Science	1
Total	**16**
Second Semester	
PHYS-I 152 Mechanics	4
CHEM-C 106 Principles of Chemistry II	3
CHEM-C 126 Experimental Chemistry II	2
MATH-I 166 Analytic Geometry and Calculus II	4
COMM-R 110 Fundamentals of Speech Communication	3
Total	**16**

Sophomore Year

Third Semester	
PHYS-I 251 Heat, Electricity & Optics	5
MATH-I 261 Multivariate Calculus	4
MATH-I 300 Logic & Foundations of Algebra	3
PHYS-I 299 Intro to Computational Physics	2
2nd Written Communication Course	3
Total	**17**
Fourth Semester	
MATH-I 366 Ordinary Differential Equations	3
MATH-I 351/MATH-I 511 Elementary Linear Algebra	3
PHYS-I 342 Modern Physics	3
CSCI-C 200 Intro to Computers and Programming	4
Social Science (choose from list)	3
Total	**16**

Junior Year

Fifth Semester	
PHYS-I 310 Intermediate Mechanics	4
MATH-I 444 Foundations of Analysis I	3
MATH-I 453 or MATH STAT Elective	3
Arts & Humanities (choose from list)	3
World Language	4
Total	**17**
Sixth Semester	
PHYS-I 330 Interm. Electricity & Magnetism	3
PHYS-I 353 Adv. Physics Laboratory I	2
MATH-I 353/MATH-I 354 or MATH/STAT Elective	3
MATH-I 426 Intro. to Applied Math/Modeling	3
World Language	4

Total	**15**

Senior Year

Seventh Semester	
PHYS-I 442 Quantum Mechanics	3
PHYS-I 400 Physical Optics	3
PHYS-I 401 Physical Optics Laboratory	2
MATH-I 414 Numerical Methods	3
Arts & Humanities or Social Science (choose from list)	3
Total	**14**
Eighth Semester	
PHYS-I 418 Thermal & Statistical Physics	3
PHYS-I 490 Capstone	3
MATH/STAT/PHYS Elective	3
General Elective	3
Total	**12**

Physics Teaching Major (minimum 120 cr. required)

Work with advisors in Physics and Education to develop a plan of study including placement in student teaching settings.

Minor in Astronomy and Minor in Physics

Astronomy Minor

The minor in astronomy is designed to enhance and broaden the student's knowledge of science. In particular, it provides an exposure to numerous elements of a STEM curriculum. The minor will benefit those students who are interested in learning the core elements of astronomy. This naturally includes an exposure to critical thinking, high-level problem-solving skills, and mathematics. In addition, it will be advantageous to those that intend to pursue careers benefiting from knowledge of astronomy, including: science teachers, technical journalism, computer programming, artificial intelligence, instrumentation, science writing, and careers in the aerospace industry.

- AST-A 100 The Solar System (3 cr.) (Fall semester)
- AST-A 105 Stars & Galaxies (3 cr.) (Spring semester)
- AST-A 205 Quasars, Pulsars, & Black Holes (3 cr.) (Fall semester)
- AST-A 250 General Astronomy (3 cr.) (P: AST-A 100 and AST-A 105 and MATH-I 231 or MATH-I 165) (Fall semester)
- AST-A 330 Introduction to Astrophysics (3 cr.) (P: AST-A 205 and AST-A 250 and PHYS-I 152 or PHYS-P 201 and two semesters of calculus MATH-I 231 / MATH-I 232 or MATH-I 165 / MATH-I 166) (Spring semester)
- AST-A 380 Cosmology (3 cr.) (P: AST-A 250 and AST-A 250 and PHYS-I 152 or PHYS-P 201 and two semesters of calculus MATH-I 231 / MATH-I 232 or MATH-I 165 / MATH-I 166) (Spring semester)

Residency:
Correspondence courses may not be used to fulfill requirements for the minor.

Grades:
No grade below C- (1.70) is acceptable for a course in the minor. A overall minimum grade point average of C (2.00) is required in the minor.

Physics Minor

- PHYS-I 152 (4 cr.) and PHYS-I 251 (5 cr.) introductory physics sequence
- PHYS-I 299 Intro to Computational Physics (2 cr.)
- PHYS-I 342 Modern Physics (3 cr.)
- Six (6) more credit hours chosen from PHYS-I 300, PHYS-I 310, PHYS-I 330, PHYS-I 400, PHYS-I 418, PHYS-I 442 or other courses approved by the department/advisor.

Residency:
Correspondence courses may not be used to fulfill requirements for the minor.

Grades:
No grade below C (2.00) is acceptable for a course in the minor. A minimum overall grade point average of C (2.00) is required in the minor.

Graduate Programs

Graduate Program

The Department of Physics offers graduate programs leading to Indiana University Master of Science and Doctor of Philosophy degrees. For master’s degree students, both thesis and nonthesis options are available.

Admission Requirements

Students who seek enrollment in the physics graduate program should have a baccalaureate degree from an accredited institution and have a background in the usual undergraduate courses in physics, mathematics, and other sciences. An average grade point average of 3.00 (B) or higher in physics courses is expected. Graduates from related fields of study in pure and applied science or engineering may be accepted on a probationary basis until they have completed any necessary undergraduate courses in physics. The Graduate Record Examination (GRE) and the GRE physics test are recommended, but not required.

Transfer Credit

The Department of Physics will normally accept, from approved institutions, a maximum of 9 transfer credit

hours of courses with a grade of B or higher that are in excess of undergraduate degree requirements.

Application for Admission

Application materials and information can be obtained online at www.physics.iupui.edu or by writing to the chairperson of the graduate committee, IU Indianapolis Department of Physics, Science Building, LD 154, 402 N. Blackford Street, Indianapolis, IN 46202-3273; phone (317) 274-6900. While the application is being processed, it is possible to enter IU Indianapolis as a temporary graduate student. Generally, only 12 hours of credit earned under this classification may be counted toward an advanced degree.

Financial Assistance

Most physics graduate students receive financial support. Types of support available include teaching and research assistantships, fellowships, and tuition remission.

Master of Science

The general requirements include admission to regular graduate status, completion of the English requirement, passing the core physics classes (PHYS-I 510, PHYS-I 517, PHYS-I 530, and PHYS-I 550 or equivalent) with a 3.00 grade point average and no grades below B-, satisfactory completion of an approved plan of study, and 30 hours of graduate credit as outlined below.

The English requirement for candidates whose native language is English is satisfied by having no undergraduate grades below B in English 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. Students whose native language is not English must pass the TOEFL examination with a grade of 79 or higher (with minimums of 18 in Writing, 18 in Speaking, 14 in Listening, and 19 in Reading) and take a diagnostic test when they arrive at IU Indianapolis. The score on this test will determine what English courses are required.

A placement test will be given to all new students in the week before the start of their first semester in our program. The purpose of the test is to identify problem areas in physics and mathematics and to decide a plan of study for each student. A second test might be given in the second semester on a case-by-case basis.

The student’s plan of study is worked out in cooperation with the student’s graduate advisor and committee. It must be submitted and accepted by the graduate school no later than the semester before the one in which the student plans to graduate. The English requirement must be satisfied before the plan of study may be filed.

The master’s degree requires the satisfactory completion of 30 credit hours of course work at the 500 and 600 level. Twenty-four (24) credit hours must be in physics and biophysics. In the thesis option, 6 of the physics credit hours will be earned by enrolling in PHYS-I 698 Research M.S. Thesis. This option requires a written thesis. In the non-thesis option, 6 of the physics credit hours will typically be earned through enrollment in PHYS-I 590 Reading and Research. This option requires a written report. Six (6) credit hours must be in mathematics, which may be replaced in part by PHYS-I 600 Methods of Theoretical Physics. The grade requirements are A or B in 500-level courses; A, B, or C in 600-level courses; A, B, or C in mathematics courses; and a minimum grade point average of 3.00 on the Plan of Study.

Doctor of Philosophy

The general requirements include admission to regular graduate status, completion of the English requirement, passing the qualifying examination, satisfactory completion of an approved plan of study, passing a preliminary exam, and 60 hours of graduate credit after the completion of an M.S. There are four core courses that must be completed: PHYS-I 617 Statistical Mechanics; PHYS-I 630 Advanced Theory of Electricity and Magnetism; PHYS-I 660 Quantum Mechanics I; PHYS-I 661 Quantum Mechanics II. The student must take three additional specialty courses approved by the Graduate Committee. These in general would be relevant to the student's area of interest. Additional courses may be taken based on the student's background and needs.

The English requirement for candidates whose native language is English is satisfied by having no undergraduate grades below B in English 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. Students whose native language is not English must pass the TOEFL examination with a grade of 79 or higher (with minimums of 18 in Writing, 18 in Speaking, 14 in Listening, and 19 in Reading) and take a diagnostic test when they arrive at IU Indianapolis. The score on this test will determine what English courses are required.

A placement test will be given to all new students in the week before the start of their first semester in our program. The purpose of the test is to identify problem areas in physics and mathematics and to decide a plan of study for each student. A second test might be given in the second semester on a case-by-case basis.

The preliminary exam is a certification exam where the student presents a plan of work to be followed to perform his/her research. It is defended in front the advisory committee. Besides the preliminary exam, students need to present annual progress reports to the advisory committee.

All students pursuing a Ph.D. in Physics also need to earn a minor in a sub-discipline different than the main area of research. The available options are Biophysics, Mathematical Physics, Molecular Physics, or Quantum Science.

Department of Psychology

IU Indianapolis
Science Building, LD 124

402 N. Blackford Street
Indianapolis, IN 46202-3275
Phone: (317) 274-6947; fax: (317) 274-6756
Web: click here

Interim Department Chair: Jane R. Williams, Ph.D.

Program Directors:

- Graduate Programs:
  - Jesse Stewart, Ph.D. (Director of Graduate Studies)
  - Cristine Czachowski, Ph.D. (Addiction Neuroscience)
  - Jane Williams, Ph.D. (Industrial/Organizational Psychology)
  - Kendra Stewart, Ph.D. (Clinical Psychology)
- Undergraduate Program:
  - Debora Herold, Ph.D. (Director of Undergraduate Studies)

Psychology is the study of behavior and mental processes. Psychologists apply the scientific method to a range of questions that are as varied as how eyes detect light energy and generate neural signals, how children develop a sense of morality, and under what conditions people help in emergencies. As an applied profession, psychologists use research results 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 a given area of interest. These include motivation and learning, child and adult development, social behavior of humans and animals, personality, thought processes, consumer behavior, and many more. Many psychologists, who function as research professionals, have academic positions in colleges and universities where they teach and conduct research. Psychologists who function as applied professionals specialize in areas that include clinical, counseling, health care, rehabilitation, human factors, and industrial psychology.

The Department of Psychology offers undergraduate programs leading to the Bachelor of Arts (B.A.) and Bachelor of Science (B.S.) degrees. Four recurring themes are emphasized throughout the curriculum. First, psychology is a science, and its purpose is to describe, explain, predict, and change behavior. Second, behavior is influenced by person variables (internal factors), environment variables (external factors), and their interaction. Third, psychology has evolved in a socio-historical context and its major theoretical perspectives reflect this phenomenon. Fourth, cultural contexts influence how psychological concepts are understood and applied by individuals.

The Department of Psychology offers graduate study in industrial/organizational psychology [Master of Science (M.S.) degree], addiction neuroscience [Doctor of Philosophy (Ph.D.) degree], applied social and organizational psychology (Ph.D. degree) and clinical psychology (Ph.D. degree).

Undergraduate Degree Programs

Bachelor of Arts and Bachelor of Science

Students are encouraged to consult with an academic advisor for determination of whether to pursue B.A. or a B.S. degree.

Degree Requirements

The School of Science Requirements for the Bachelor of Arts and Bachelor of Science degrees are listed in this bulletin (see Area and General Requirements under "Undergraduate Programs").

First-Year Experience Course

Beginning freshmen and transfer students with fewer than 19 credit hours are required to take SCI-I 120 Windows on Science (1 cr.) or an equivalent first-year experience course.

Transfer students with over 19 credit hours are not required to take SCI-I 120, but are strongly urged to take PSY-B 303 Career Planning for Psychology Majors (1 cr.) in their first semester on campus.

Area Requirements

Area I English Composition and Communication Competency

See the School of Science requirements under “Undergraduate Programs” in this bulletin.

All students are required to complete three courses, totaling 9 credit hours:

- ENG-W 131 Reading, Writing, and Inquiry I
- Second semester of English composition (ENG-W 231 is recommended or ENG-W 230 for a student with a research focused career path)
- COMM-R 110 Fundamentals of Speech Communication

Area II World Language Competency

See the School of Science Area Requirements under "Undergraduate Programs" for details

Bachelor of Arts students must have first-year proficiency in a world language: (first-year sequence or two 4-cr. courses); or exam placement into a second-year or third-year course.

Bachelor of Science students are not required to have first-year world language proficiency.

Area IIIA Arts and Humanities, Social Sciences, and Cultural Understanding Competencies

See the School of Science requirements under “Undergraduate Programs” in this bulletin for details.

All students are required to complete four courses, totaling 12 credit hours.

List H Arts and Humanities Competency: Choose one course from the list of course choices located in the School of Science Area requirements under "Undergraduate Programs" in this bulletin.

List S Social Sciences Competency: Choose one course from the list of course choices located in the School of

Science Area requirements "Undergraduate Programs" in this bulletin. The Social Sciences course cannot be a psychology course.

One additional course from either the Arts and Humanities or Social Sciences list of course choices.

List C Cultural Understanding Competency: Choose one course from the list of course choices located in the School of Science Area requirements under "Undergraduate Programs" in this bulletin. The Cultural Understanding course cannot be a psychology course.

For the most current list of courses in the areas of Arts and Humanities, Social Sciences and Cultural Understanding, please refer to the IU Indianapolis General Education Curriculum.

Area IIIC Life and Physical Sciences Competency
See the School of Science requirements under "Undergraduate Programs" in this bulletin for details.

Bachelor of Arts students are required to complete at least four science lectures courses (minimum of 12 credit hours), and at least one of the courses must have a laboratory component.

Bachelor of Science students are required to complete at least four science lectures courses (minimum of 12 credit hours), and at least one of the courses must have a laboratory component. Two of the required four courses must be biology and/or chemistry courses.

Students should consult with an academic advisor in the Department of Psychology to determine which courses are most appropriate to take based on their academic and career goals.

Note: There are science courses that do not count in Area IIIC, as well as overlapping courses with credit not being allowed for both of two overlapping courses / course sequences. A partial list can be found in the School of Science Area or General Requirements. If you have a question about whether a course is applicable or if it overlaps with a course that you have already taken, please consult with your academic advisor or the School of Science Peer Advising Office prior to registering to confirm.

Area IIID Analytical Reasoning Competency
See the School of Science requirements under "Undergraduate Programs" in this bulletin for details.

Bachelor of Arts students must have at least one 3-cr. course in mathematics and one 3-cr. course in computer programming. MATH-M 118 Finite Mathematics and CSCI-N 207 Data Analysis Using Spreadsheets are recommended to fulfill the IIID Analytical Reasoning Competency Requirement.

Bachelor of Science students must have at least two 3-cr. courses beyond college algebra and trigonometry (total of 6 credit hours). In addition, one 3-cr. computer programming course is required. MATH-M 118 Finite Mathematics, MATH-M 119 Brief Survey of Calculus, and CSCI-N 207 Data Analysis Using Spreadsheets are recommended to fulfill the IIID Analytical Reasoning Competency Requirement. However, some pre-professional programs require specific mathematics courses, so students should consult with an academic advisor.

Note: There are math and computer science courses that do not count for any credit toward a degree in the School of Science or do not count as a Baccalaureate requirement. A partial list can be found in the School of Science Area and General Requirements. If you have a question about whether a course counts toward your degree or fulfills the Baccalaureate requirement, please consult with your academic advisor or the School of Science Peer Advising Office prior to registering to confirm.

Area IV Major Requirements
See the following section, "Major in Psychology (B.A. or B.S.)."

Major in Psychology (B.A. or B.S.)

The Department of Psychology at IU Indianapolis has a program for majors that requires a minimum of 40 credit hours of selected course work. All 40 credit hours are to be completed under a PSY course designation.

Introductory Sequence (Three courses; 7 credit hours)
- PSY-B 110 Introduction to Psychology
- PSY-B 203 Ethics and Diversity in Psychology
- PSY-B 303 Career Planning for Psychology Majors

Research Methods Sequence (Two courses, one lab; 9 credit hours)
- PSY-B 305 Statistics (P: MATH-M 118 or other upper-level mathematics course)
- NOTE: Students majoring in Psychology are expected to complete PSY-B 305, the department's designated statistics course. In rare cases where a student completed a statistics course in another department *prior to declaring the psychology major*, they may request to have it evaluated for equivalency. If the course is approved as equivalent, it may fulfill the statistics requirement. However, the student must take an additional 3-credit Psychology course to meet the 40-credit hour requirement for the major.
- PSY-B 311 Research Methods in Psychology (P: PSY-B 305)
- PSY-B 312 Research Methods Lab in Psychology (P: PSY-B 305)

Psychology Foundation Courses (Four courses, 12 credit hours)
- PSY-B 310 Lifespan Development
- PSY-B 320 Behavioral Neuroscience*
- PSY-B 340 Cognition
- PSY-B 370 Social Psychology

*Students earning a double major in Psychology and Neuroscience or a minor in Neuroscience must replace PSY-B 320 with the NSCI-B 201/NSCI-B 301 sequence. Students will not receive credit for both PSY-B 320 and NSCI-B 301.

Psychology Content Courses (three courses; 9 credit hours)
Select three of the following courses:

- PSY-B 307 Tests and Measurement

- PSY-B 322 Introduction to Clinical Psychology
- PSY-B 334 Perception
- PSY-B 344 Learning
- PSY-B 346 Theories of Personality
- PSY-B 356 Motivation
- PSY-B 358 Introduction to Industrial/Organizational Psychology
- PSY-B 360 Child and Adolescent Psychology
- PSY-B 365 Health Psychology
- PSY-B 376 The Psychology of Women
- PSY-B 380 Abnormal Psychology
- PSY-B 385 Positive Psychology
- PSY-B 386 Introduction to Counseling
- PSY-B 394 Drugs and Behavior
- PSY-B 396 Alcoholism and Drug Abuse

Capstone (One course; 3 credit hours)

Select one of the following courses:

- PSY-B 433 Capstone Laboratory in Psychology
- PSY-B 454 Capstone Seminar in Psychology
- PSY-B 499 Capstone Honors Research*

*PSY-B 499 requires an application due in April for the following academic year and a two-semester commitment that begins in the fall semester. Ask your advisor for details.

Note: Students should discuss capstone options with an academic advisor to determine which is most appropriate for you based on your career and academic goals. Each option has a set of prerequisites that must be completed before enrolling in the capstone (including PSY-B 305 Statistics and PSY-B 311/PSY-B 312 Research Methods and Lab). Except under special circumstances, capstone courses are taken during the final semester of the senior year.

Elective Courses

Depending on your program, there will be approximately 40 credit hours of electives. These elective courses can be used to complete minor, certificate, or double major requirements. Students should talk to an advisor to determine which elective courses fit best with their academic and career goals.

Plans of Study

Although there is no single semester-by-semester plan of study for either the B.A. or the B.S. degree, one possible sequence of courses for each of these degrees is given below. Variations from these examples should be made, based on the student's academic history and career plans, through consultation with an academic advisor. For career and graduate school information related to psychology, please refer to relevant sections of the psychology department's website. To graduate in four years, a student generally must take an average of 15 credits per semester. Students with heavy outside commitments (e.g., work and/or family) may want to decrease their course load each semester. By taking additional courses each summer, it may still be possible to graduate in four years.

Bachelor of Arts Sample Program (120 cr. required)

Freshman Year

First Semester	
SCI-I 120 Windows on Science	1
PSY-B 110 Introduction to Psychology	3
ENG-W 131 Reading, Writing and Inquiry I	3
World Language I (Cultural Understanding)	4
MATH-M 118 Finite Mathematics*	3
Total	**14**
Second Semester	
PSY-B 203 Ethics and Diversity in Psychology	3
COMM-R 110 Fundamentals of Speech Communication	3
World Language II**	4
Life and Physical Sciences (choose from approved list)***	3
Arts and Humanities (choose from list)	3
Total	**16**

Sophomore Year

Third Semester	
PSY-B 303 Career Planning Psychology Majors	1
PSY-B 305 Statistics****	3
Psychology Foundations course (choose from approved list)	3
ENG-W 231 Professional Writing Skills	3
Life and Physical Sciences (choose from approved list)	4
Total	**14**
Fourth Semester	
PSY-B 311 Research Methods in Psychology	3
PSY-B 312 Research Methods Lab	3
Psychology Foundations Course (choose from approved list)	3
CSCI-N 207 Data Analysis Using Spreadsheets	3
Arts and Humanities/Social Sciences (choose from list)	3
Total	**15**

Junior Year

Fifth Semester	
Psychology Foundations course (choose from approved list)	3

Psychology Foundations course (choose from approved list)	3
Psychology Content course (choose from approved list)	3
Life and Physical Sciences (choose from approved list)	3
Elective/minor course	3
Total	**15**
Sixth Semester	
Psychology Content course (choose from approved list)	3
Social Science (choose from list)	3
Life and Physical Sciences (choose from approved list)	3
Elective/minor course	3
Elective/minor course	3
Total	**15**

Senior Year

Seventh Semester	
Psychology Content course (choose from approved list)	3
Elective/minor courses	12
Total	**15**
Eighth Semester	
Psychology Capstone course	3
Elective/minor courses	13
Total	**16**

* Students who do not test successfully into MATH-M 118 must complete one or more lower-level math classes to develop the skills necessary to perform well in MATH-M 118. Credits earned for these remedial math classes do not count as part of the required 120 credit hours to graduate.

** For students needing courses to establish first-year proficiency in a language other than English. Otherwise, other courses may be taken to fulfill area requirements or electives.

***Students should check with their Academic Advisor or the School of Science Peer Advising Office for the approved list.

****Students majoring in Psychology are expected to complete PSY-B 305, the department's designated statistics course. In rare cases where a student completed a statistics course in another department *prior to declaring the psychology major*, they may request to have it evaluated for equivalency. If the course is approved as equivalent, it may fulfill the statistics requirement. However, the student must take an additional 3-credit Psychology course to meet the 40-credit hour requirement for the major.

Bachelor of Science Sample Program (120 cr. required)

Freshman Year

First Semester	
SCI-I 120 Windows on Science	1
PSY-B 110 Introduction to Psychology	3
ENG-W 131 Reading, Writing and Inquiry I	3
MATH-M 119 Brief Survey of Calculus 1*	3
Life and Physical Science (choose from approved list)**	4
Total	**14**
Second Semester	
PSY-B 203 Ethics and Diversity in Psychology	3
COMM-R 110 Fundamentals of Speech Communication	3
Arts and Humanities (choose from list)	3
MATH-M 118 Finite Mathematics*	3
Life and Physical Science (choose from approved list)	3
Total	**15**

Sophomore Year

Third Semester	
PSY-B 303 Career Planning Psychology Majors	1
PSY-B 305 Statistics****	3
Psychology Foundations course (choose from approved list)	3
ENG-W 231 Professional Writing Skills	3
CSCI-N 207 Data Analysis Using Spreadsheets	3
Total	**13**
Fourth Semester	
PSY-B 311 Research Methods in Psychology	3
PSY-B 312 Research Methods Lab	3
Psychology Foundations course (choose from approved list)	3
Arts and Humanities/Social Sciences (choose from list)	3
Cultural Understanding (choose from list)	3
Total	**15**

Junior Year

Fifth Semester	
Psychology Foundations course (choose from approved list)	3
Psychology Content course (choose from approved list)	3
Psychology Content course (choose from approved list)	3
Life and Physical Science (choose from approved list)	3
Elective/minor course	3
Total	**15**
Sixth Semester	
Psychology Foundations course (choose from approved list)	3
Social Science (choose from list)	3
Life and Physical Sciences (choose from approved list)	3
Elective/experiential course	3
Elective/minor course	3
Total	**15**

Senior Year

Seventh Semester	
Psychology Content course (choose from approved list)	3
Elective/minor courses	12
Total	**15**
Eighth Semester	
Psychology Capstone course	3
Elective/minor courses	15
Total	**18**

* Students who do not test successfully into MATH-M 118/MATH-M 119 must complete one or more lower-level math courses to develop the skills necessary to perform well in MATH-M 118/MATH-M 119. Credits earned for the remedial math courses do not count as part of the required 120 credit hours to graduate.

** Students should check with their Academic Advisor or the School of Science Peer Advising Office for the approved list.

****Students majoring in Psychology are expected to complete PSY-B 305, the department's designated statistics course. In rare cases where a student completed a statistics course in another department *prior to declaring the psychology major*, they may request to have it evaluated for equivalency. If the course is approved as equivalent, it may fulfill the statistics requirement. However, the student must take an additional 3-credit Psychology course to meet the 40-credit hour requirement for the major.

Undergraduate and Graduate Minors in Psychology

Undergraduate Minors

Minor in Health Psychology

The Department of Psychology offers an undergraduate minor program in health psychology that requires a minimum of 15 credit hours of selected coursework. Course requirements are as follows:

Required Courses (Four courses: 12 credit hours)

- PSY-B 365 Health Psychology
- PSY-B 320 Behavioral Neuroscience*
- PSY-B 370 Social Psychology
- PSY-B 380 Abnormal Psychology

*The NSCI-B 201/NSCI-B 301 sequence will count in lieu of PSY-B 320.

Elective Courses (One course; 3 credit hours)

Select one course from the following:

- PSY-B 203 Ethics and Diversity in Psychology
- PSY-B 310 Lifespan Development
- PSY-B 386 Introduction to Counseling
- PSY-B 394 Drugs and Behavior
- PSY-B 396 Alcoholism and Drug Abuse
- SOC-R 321 Women and Health
- SOC-R 381 Social Factors in Health and Illness
- Other approved course (contact Psychology advisor)

PLEASE NOTE:

- No grade lower than C- is acceptable for any course in the minor.
- A minimum grade point average of 2.00 in minor courses is required.
- A minimum of 6 credit hours in the minor must be completed at IU Indianapolis.
- Students pursuing a Psychology major cannot earn a minor in Health Psychology.
- Students pursuing a minor from the department must select either Health Psychology or Psychology. They cannot earn both minors.

Note: PSY-B 110 Intro to Psychology or equivalent is a prerequisite for upper-level psychology courses.

Minor in Psychology

The Department of Psychology offers an undergraduate minor program in psychology that requires a minimum of 15 credit hours of selected coursework. Interested students should obtain information from the School of Science Peer Advising Office. Course requirements are as follows:

Psychology Foundation Courses (Two courses; 6 credit hours)

Select two courses from the following:

- PSY-B 310 Lifespan Development
- PSY-B 320 Behavioral Neuroscience*
- PSY-B 340 Cognition

- PSY-B 370 Social Psychology

*The NSCI-B 201/NSCI-B 301 sequence will count in lieu of PSY-B 320.
NOTE: Additional foundation courses will count towards required content courses.

Psychology Minor Content Courses (Three courses; 9 credit hours)

Select three additional psychology courses from the following:

- PSY-B 203 Ethics and Diversity in Psychology
- PSY-B 307 Tests and Measurement
- PSY-B 322 Introduction to Clinical Psychology
- PSY-B 334 Perception
- PSY-B 344 Learning
- PSY-B 346 Theories of Personality
- PSY-B 356 Motivation
- PSY-B 358 Introduction to Industrial/Organizational Psychology
- PSY-B 360 Child and Adolescent Psychology
- PSY-B 365 Health Psychology
- PSY-B 375 Psychology and Law
- PSY-B 376 The Psychology of Women
- PSY-B 380 Abnormal Psychology
- PSY-B 385 Positive Psychology
- PSY-B 386 Introduction to Counseling
- PSY-B 394 Drugs and Behavior
- PSY-B 396 Alcoholism and Drug Abuse

PLEASE NOTE:

- No grade lower than C- is acceptable for any course in the minor.
- A minimum grade point average of 2.00 in minor courses is required.
- A minimum of 6 credit hours of the minor must be taken at IU Indianapolis.
- Students pursuing a Psychology major cannot earn a minor in Psychology.
- Students pursuing a minor from the department must select either Psychology or Health Psychology. They cannot earn both minors.

Note: PSY-B 110 Intro to Psychology or equivalent is a prerequisite for upper-level psychology courses.

Doctoral Minors

Minor in Diversity Science

The Department of Psychology offers a Ph.D. minor program in diversity science that requires 6 credit hours of selected course work. Course requirements are as follows:

Required Courses (Two courses: 6 credit hours)

- PSY-I 579 Foundations of Diversity Science
- PSY-I 580 Translational Science & Health Equity Interventions

PLEASE NOTE:

- No grade lower than B is acceptable for any course in the minor (e.g., B- is not acceptable.)
- A minimum of 6 credit hours in the minor must be completed at IU Indianapolis.
- Students pursuing a Ph.D. degree from a Department of Psychology program can earn a minor in Diversity Science.
- Students pursuing a Ph.D. degree from a program outside of the Department of Psychology can earn a minor in Diversity Science.
- The doctoral minor is restricted to School of Science Ph.D. students.

Minor in Psychology of Teaching

The Department of Psychology offers a Ph.D. minor program in the psychology of teaching that requires 6 credit hours of selected course work. Course requirements are as follows:

Required Courses (Two courses: 6 credit hours)

- PSY-I 595 Seminar in Teaching Psychology
- PSY-I 596 Advanced Seminar in the Psychology of Teaching

PLEASE NOTE:

- No grade lower than B is acceptable for any course in the minor (e.g., B- is not acceptable.)
- A minimum of 6 credit hours in the minor must be completed at IU Indianapolis.
- Students pursuing a Ph.D. degree from a Department of Psychology program can earn a minor in Psychology of Teaching.
- Students pursuing a Ph.D. degree from a program outside of the Department of Psychology can earn a minor in Psychology of Teaching.
- The doctoral minor is restricted to School of Science Ph.D. students.

Minor in Statistics for Social and Behavioral Sciences

The Department of Psychology offers a Ph.D. minor program in statistics for social and behavioral sciences that requires 6 credit hours of selected course work. Course requirements are as follows:

Required Courses (Two courses: 6 credit hours)

- PSY-I 600 Statistical Inference
- PSY-I 601 Correlation and Experimental Design

PLEASE NOTE:

- No grade lower than B is acceptable for any course in the minor (e.g., B- is not acceptable.)
- A minimum of 6 credit hours in the minor must be completed at IU Indianapolis.
- Students pursuing a Ph.D. degree from a Department of Psychology program cannot earn a minor in Statistics for Social and Behavioral Sciences, as the courses for this minor are already required for their Ph.D. degree.
- Students pursuing a Ph.D. degree from a program outside of the Department of Psychology can earn a minor in Statistics for Social and Behavioral Sciences.

- The doctoral minor is restricted to School of Science Ph.D. students.

Psi Chi: The International Honor Society in Psychology

To become a member of Psi Chi, an undergraduate psychology major must have completed at least 36 credit hours, earned at least 9 credit hours in psychology courses, and possess an overall GPA of 3.30 and a GPA of 3.50 in psychology classes. Transfer students must have completed at least 12 of the 36 credit hours and 9 psychology credit hours at IU Indianapolis. Interested students should submit an application to the Psi Chi faculty advisor. There is a one-time, lifetime membership fee.

Graduate Programs

The department offers Indiana University Master of Science (M.S.) and Doctor of Philosophy (Ph.D.) degree programs. At the M.S. level, a program is offered in industrial/organizational psychology. At the Ph.D. level, programs are offered in addiction neuroscience and clinical psychology.

Transfer Credit

A maximum of 8 credit hours can be transferred into the M.S. program, and a maximum of 30 credit hours can be transferred into one of the Ph.D. programs. Transfer hours will be accepted only if they are appropriate and judged acceptable by the student's plan-of-study committee.

Temporary Student Status

A student may enroll in some graduate courses without formal admission into a Psychology graduate program. However, the student must be admitted by the IU Graduate School Indianapolis into the Graduate Non-Degree Program. No more than 12 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 12th credit hour as a non-degree registrant, all credits taken before and during that term will be eligible for inclusion in 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 (e.g., B-) has been received will be permitted in a plan of study if the course was taken while the student was enrolled as a non-degree registrant. Non-degree registrants may be required to secure consent from each of the departments in which they would like to register for courses.

Research Facilities

The Department of Psychology has extensive laboratory and computer facilities to support faculty and student research. More than 8,000 square feet of laboratory space in the School of Science complex is devoted to research in the areas of clinical psychology, industrial/organizational psychology, and social psychology. Separate animal quarters and modern laboratories are also available to support research in neuroscience. Internship and practicum sites are available at the Indiana University School of Medicine/Indiana University Health and numerous other organizations in the Indianapolis metropolitan area.

Research Interests of Faculty

Major research interests of faculty include social psychology, industrial/organizational psychology, diversity science, measurement theory and development, program planning and evaluation, clinical psychology, health psychology/behavioral medicine, psychiatric rehabilitation, psychopathology, behavioral and psychopharmacology, developmental neuroscience, behavioral genetics, neurochemistry, animal cognition, and substance use/addiction. A more detailed listing of faculty research interests is available from the Department of Psychology.

Financial Support

Financial support for eligible graduate students at both the M.S. and Ph.D. levels is available through teaching and research assistantships and fellowships. Full assistantships require 20 hours of work per week and include salary, full tuition remission, and health insurance.

Addiction Neuroscience, Ph.D. Program

The Addiction Neuroscience Ph.D. program is designed to promote a comprehensive understanding of the neurobiological bases of behavior, with an emphasis on the behavioral and neurobiological aspects of drugs of abuse and addictive behaviors. General goals of the Program are to develop knowledge and expertise in the neurobiological mechanisms of behavior, develop skills in applying methods of behavioral neuroscience research to the problems of alcohol and drug abuse and addiction, and train competence in communication and teaching of knowledge and research skills. Students will obtain broad training in the combined disciplines of the neurosciences (e.g., behavioral and developmental neuroscience, psychopharmacology, and neurobiology) and the behavioral sciences (e.g., experimental psychology, cognitive psychology, learning, experimental design and analysis, and animal models of drug abuse and addiction). A minimum of 85 credit hours (post-baccalaureate) are required, plus approval of the plan of study by the student's advisory committee. The Program intends to train students seeking careers in research and/or teaching in academic environments, medical institutions, pharmaceutical firms, and governmental agencies.

Addiction Neuroscience Admission Requirements

This Ph.D. Program is designed for individuals interested in academic or research careers studying addiction neuroscience. Successful applicants typically have: (a) an undergraduate and graduate grade point average of 3.20 or higher on a 4.00 scale, (b) three favorable letters of recommendation, and (c) a personal statement expressing an interest in addiction neuroscience. Students with undergraduate degrees in psychology or the life sciences (e.g., biology, chemistry, or neuroscience) are encouraged to apply, although other degrees along with appropriate coursework will be given full consideration on application.

Students are admitted only for Fall enrollment, and the deadline for receipt of application materials is specific to each graduate program:

- Addiction Neuroscience (Ph.D.): December 1

Students interested in information about admission to graduate programs in psychology should visit the Psychology Department webpage here for information on admission requirements and application instructions. Questions may be emailed to the graduate program coordinator at gradpsy@iu.edu.

Addiction Neuroscience Ph.D. Plan of Study

Core Curriculum (15 cr.):
PSY-I 570 Drugs of Abuse
PSY-I 590 Animal Models
PSY-I 600 Statistical Inference
PSY-I 601 Correlation and Experimental Design
PSY-I 615 Behavioral Neuroscience

Specialty Courses (18 cr.):
PSY-I 545 Psychopharmacology
PSY-I 560 Behavioral Genetics
PSY-I 590 Individual Research Problems (credit vary)
PSY-I 590 Understanding Neural Computation
PSY-I 591 Psychopathology
PSY-I 622 Animal Learning
PSY-I 657 Human Neuropsychology
ANAT-D 527 Neuroanatomy
BIOL-I 560 Clinical & Molecular Aspects of Neurodegenerative Diseases
BIOL-I 564 Molecular Genetics of Development

Seminar Course (1 cr. per course enrollment; enrollment required every semester):
PSY-I 590 Addiction Seminar

Minor Subject (6 cr.)

Approved minors may be taken within the School of Science as well as within any of the IU Indianapolis schools. A minor maybe selected as the result of conversations between the student and their advisor to meet the needs of the student.

Additional Requirements

- Every student is expected to serve in some teaching capacity for at least two semesters, either as a teaching assistant or as an instructor for an undergraduate psychology course.
- Thesis Requirement (3 credits minimum, 6 credits maximum)
- Dissertation Requirement
- Thesis Proposal and Defense, Preliminary Proposal and Defense, and Dissertation Proposal and Defense

Graduation Requirements
- Minimum Grade Per Course: Only grades of B or better are acceptable. Pass/Fail grades are unacceptable.
- Minimum GPA Requirement for Graduation: 3.00
- Total Credits Required for Graduation: 90 credit hours
- Residence Requirements: Students are required to be in residence for the duration of their degree.

Clinical Psychology, Ph.D. Program

The Clinical Psychology Ph.D. program is designed to integrate the assessment and intervention strategies of evidence-based clinical psychology with health/rehabilitation psychology's emphasis on optimizing the adaption of people with chronic, disabling medical conditions. The program addresses the psychological and social consequences of physical and mental conditions. As scientists, we study behaviors, experiences, and attitudes of people with disabilities and illness; develop and assess theoretical models that attempt to understand how behavior, health, and illness interact; and develop and evaluate treatment approaches. As practitioners, we assess individuals and their environment, plan and implement psychosocial interventions, and monitor their progress over time. The program emphasizes the acquisition of the methods, theories, and knowledge of behavioral science along with the practitioner skills of clinical psychology. As a program, we offer specialization training in three areas within clinical psychology: clinical health psychology, diversity science, and dual diagnosis (i.e., severe mental illness/psychiatric rehabilitation and substance use). Within these areas, there is a strong emphasis on research, and the program adheres to a clinical science model of training. Graduates of the Program will be qualified to assume positions as academics, evaluators, researchers, trainers, planners, consultants, and direct clinical service providers. Full-time study and a minimum of 90 credit hours (post-baccalaureate) are required, and it is expected that it will take six to seven years to complete the program. The program includes a diverse training in psychology, including a psychology core, statistics and measurement, ethics and diversity, clinical psychology internships and practica, and an empirical thesis and doctoral dissertation.

Clinical Psychology Admission Requirements

A bachelor’s degree from an accredited institution is required. Admission to the Ph.D. Program is competitive and only under unusual circumstances will students be considered for admission if they do not meet the following minimum standards: (a) an undergraduate and graduate grade point average of 3.20 or higher on a 4.00 scale, (b) three favorable letters of recommendation, and (c) a personal statement expressing an interest in the field of clinical psychology. Prior research experience is strongly recommended. Except in unusual circumstances, students admitted to the program are expected to have completed at least 15 credit hours in psychology. Although there are no specific undergraduate course prerequisites for program entry, students without coursework in research methods, statistics, and abnormal psychology will likely be at a disadvantage when taking some of the required courses and may be asked by their instructors to complete some remedial activity prior to enrolling in the graduate course (e.g., reading an undergraduate text or taking an undergraduate course).

Students are admitted only for Fall enrollment, and the deadline for receipt of application materials is specific to each graduate program:

- Clinical (Ph.D.): December 1

Students interested in information about admission to graduate programs in psychology should visit the Psychology Department webpage here for information on admission requirements and application instructions. Questions may be emailed to the graduate program coordinator at gradpsy@iu.edu.

Clinical Psychology Ph.D. Plan of Study

Core Course (3 cr.):
PSY-I 670 Ethical, Legal, & Cultural Issues in Psychology

Statistics and Research Methods Courses (6 cr.):
PSY-I 590 Meta-Analysis and Systematic Review (required)
PSY-I 590 Qualitative Methods in Psychology
PSY-I 605 Applied Multivariate Analysis
PSY-I 609 Multilevel Modeling

Professional Development Courses (5 cr.):
PSY-I 590 Advanced Professional Development Seminar (1 cr.)
PSY-I 691 Area Meeting (1 cr.)
PSY-I 590 Advanced Clinical Intervention (3 cr.)

Psychology Breadth and Advanced Integrative Knowledge in Scientific Psychology (6 cr.):
PSY-I 535 Developmental Neuroscience
PSY-I 565 Seminar in Cognitive, Affective, and Social Aspects of Behavior

Elective Courses (15 cr.)

Minor Subject (6 cr.)

Approved minors may be taken within the School of Science as well as within any of the IU Indianapolis schools. A minor maybe selected as the result of conversations between the student and their advisor to meet the needs of the student.

Industrial/Organizational Psychology, M.S. Program

The Industrial/Organizational Psychology M.S. program is designed to prepare individuals for positions in industry or for entry into an industrial/organizational doctoral program. Students are familiarized with the scientist-practitioner model, which emphasizes both research and the application of problem-solving skills to organizational problems. Students in the Program are taught analytic methods for diagnosing work-related problems, developing solutions, and evaluating the effectiveness of those solutions. The curriculum focuses on both the traditional personnel psychology areas of selection, training, compensation, and performance evaluation as well as topics of organizational psychology, such as decision-making, motivation, leadership, and organizational effectiveness. The M.S. degree must be completed on a full-time basis and typically takes two years to finish. A minimum of 30 credit hours is required, including departmental core, area core, and elective courses.

I/O Psychology Admission Requirements

Undergraduate training in psychology, mathematics, and the sciences is highly desirable though not required; we will consider applicants with bachelor's degrees in similar areas with coursework in social science statistics and research methods. To be competitive, applicants should have: (a) an undergraduate (and graduate if applicable) grade point average of 3.00 or higher on a 4.00 scale, (b) three favorable letters of recommendation, ideally from faculty or others who can speak to the applicant's preparation for graduate level work in psychology, (c) a personal statement expressing an interest in industrial/organizational psychology, and (d) relevant research experience, preferably in psychology or a related social science.

Students are admitted only for Fall enrollment, and the deadline for receipt of application materials is specific to each graduate program:

- Industrial/Organizational Psychology (M.S.): February 1

Students interested in information about admission to graduate programs in psychology should visit the Psychology Department webpage here for information on admission requirements and application instructions. Questions may be emailed to the graduate program coordinator at gradpsy@iu.edu.

I/O M.S. Non-Thesis Plan of Study

Statistics and Research Methods Courses (9 cr.):
PSY-I 600 Statistical Inference
PSY-I 601 Correlation and Experimental Design
PSY-I 681 Seminar in Research Methodologies of Industrial/Organizational Psychology

Core Courses (15 cr.):
PSY-I 570 Staffing
PSY-I 572 Organizational Psychology
PSY-I 576 Human Resources Development
PSY-I 682 Advanced Seminar in Industrial/Organizational Psychology
PSY-I 685 Professional Seminar in Industrial/Organizational Psychology

Elective Courses (6 cr.):
PSY-I 558 Industrial/Organizational Psychology
PSY-I 579 Foundations of Diversity Science
PSY-I 605 Applied Multivariate Modeling
PSY-I 657 Attitudes and Social Cognition
PSY-I 684 Practicum in Industrial/Organizational Psychology
SPEA-L 532 Advanced Leadership Theory & Practice
SPEA-L 552 Strategic Decision-Making for Leaders
SPEA-L 571 Advanced Project Management for Leaders
SPEA-L 579 Advanced Workforce Planning and Processes
SPEA-L 583 Advanced Coaching and Mentoring for Leaders
SPEA-L 584 Advanced Human Resource Development
SPEA-L 585 Advanced Leadership for Quality & Productivity
SPEA-L 586 Advanced Strategic Compensation and Benefits

Departments & Centers

- PREPs Careers
- Teaching Certification
- Pre-Professional Programs
- Honors Program
- Undergraduate Research
- Bachelor to MD

Pre-Professional Pathways

Preparation for a career in the graduate health professions (e.g., medicine, dentistry, pharmacy, *et. al.*) is a multi-

dimensional task. One important aspect is intellectual and academic development—the college education. The preprofessional student is urged to select a degree program that is of greatest interest to them. There is no preprofessional major. Most graduate health profession careers depend upon daily use of science, so a strong science foundation is critical in the student's preparation. These careers also require academic breadth and depth, so a balanced science/non-science curriculum is advised. While some health professional programs (dental, pharmacy, veterinary medicine) may not require an undergraduate degree for especially strong applicants, the vast majority of the successful applicants have an undergraduate degree. Having a bachelor's degree provides the necessary background, and serves as a backup plan if the student does not matriculate to a professional program.

Students may choose from a variety of majors while completing preprofessional requirements. Students are encouraged to consult with prospective major academic advisor, as well as the pre-professional advisor in the PREPs Office (if enrolled in a School of Science degree program; if not, see the health professions advisor in the Health and Life Sciences Advising Center).

Post-baccalaureate students may choose to take prerequisite courses through the School of Science for entry into professional health programs. These students should consult with the pre-professional advisor for help with the admission process and course selection.

Professional health programs generally require specific prerequisite courses, a strong GPA, and in many cases and entrance exam. Due to application timelines for prerequisite course completion, pre-professional students may complete degree and prerequisite course requirements in ways that deviate from the degree map. Students are strongly encouraged to plan their academic schedule in consultation with both their academic advisor and pre-professional advisor.

In addition, relevant experience including shadowing in the field, volunteering and leadership activities, undergraduate research, and paid clinical experience may be required. Students should see a pre-professional advisor to discuss opportunities and resources to build professional development skills.

Prerequisite Coursework

Each professional health program may require specific prerequisite coursework of their applicants. Science and math prerequisites are generally required to be of the level required for a science major's degree. Each program's Admissions Office is responsible for determining what coursework is required and whether individual courses completed will be accepted, including whether the program accepts AP, IB, or community college coursework. Students are encouraged to consult with the programs of their choice prior to applying for confirmation.

The courses listed below represent the prerequisite courses for most programs in the field. Students should consult the programs to which they plan to apply for any school-specific requirements not listed below.

Pre-Anesthesiologist Assistant

Course Requirement	IU Indianapolis Course
One year introductory biology with labs	BIOL-K 101 (or BIOL-K 102) and BIOL-K 103
One year introductory chemistry with labs	CHEM-C 105, CHEM-C 106, CHEM-C 125, and CHEM-C 126
One year organic chemistry with labs	CHEM-C 341, CHEM-C 342, CHEM-C 343, and CHEM-C 344
One year general physics with labs	PHYS-P 201 and PHYS-P 202 or PHYS-I 152 and PHYS-I 251
One semester human anatomy with lab	BIOL-N 261
One semester human physiology with lab	BIOL-N 217
One semester biochemistry	BIOL-K 384 or CHEM-C 484
One semester calculus	MATH-I 231 or MATH-I 165
One semester statistics (including descriptive and inferential)	STAT-I 301 or STAT-I 350 or PSY-B 305 or BIOL-L 337
Two semesters of English composition	ENG-W 131 and ENG-W 230 or ENG-W 231 or ENG-W 270

Pre-Dentistry

Course Requirement	IU Indianapolis Course
One year introductory biology with labs	BIOL-K 101 (or BIOL-K 102) and BIOL-K 103
One year introductory chemistry with labs	CHEM-C 105, CHEM-C 106, CHEM-C 125, and CHEM-C 126
One year organic chemistry with labs	CHEM-C 341, CHEM-C 342, CHEM-C 343, and CHEM-C 344
One year general physics with labs	PHYS-P 201 and PHYS-P 202 or PHYS-I 152 and PHYS-I 251
One semester human anatomy with lab	BIOL-N 261
One semester human physiology with lab	BIOL-N 217
One semester biochemistry	BIOL-K 384 or CHEM-C 484
One semester microbiology	BIOL-K 356

Two semesters of English composition	ENG-W 131 and ENG-W 230 or ENG-W 231 or ENG-W 270
One semester introductory behavioral sciences	PSY-B 110

Pre-Genetic Counseling

Course Requirement	IU Indianapolis Course
One year introductory biology with labs	BIOL-K 101 (or BIOL-K 102) and BIOL-K 103
One year introductory chemistry with labs	CHEM-C 105, CHEM-C 106, CHEM-C 125, and CHEM-C 126
One semester organic chemistry with lab	CHEM-C 341 and CHEM-C 343
One year general physics with labs	PHYS-P 201 and PHYS-P 202 or PHYS-I 152 and PHYS-I 251
One semester genetics	BIOL-K 322
One semester biochemistry	BIOL-K 384 or CHEM-C 484
One semester statistics (including descriptive and inferential)	STAT-I 301 or STAT-I 350 or PSY-B 305 or BIOL-L 337
One semester introductory behavioral sciences	PSY-B 110

Pre-Medicine

Course Requirement	IU Indianapolis Course
One year introductory biology with labs	BIOL-K 101 (or BIOL-K 102) and BIOL-K 103
One year introductory chemistry with labs	CHEM-C 105, CHEM-C 106, CHEM-C 125, and CHEM-C 126
One year organic chemistry with labs	CHEM-C 341, CHEM-C 342, CHEM-C 343, and CHEM-C 344
One year general physics with labs	PHYS-P 201 and PHYS-P 202 or PHYS-I 152 and PHYS-I 251
One semester biochemistry	BIOL-K 384 or CHEM-C 484
One semester statistics (including descriptive and inferential)	STAT-I 301 or STAT-I 350 or PSY-B 305 or BIOL-L 337
Two semesters of English composition	ENG-W 131 and ENG-W 230 or ENG-W 231 or ENG-W 270
One semester introductory behavioral sciences	PSY-B 110
One semester introductory social sciences	SOC-R 100

Pre-Occupational Therapy

Course Requirement	IU Indianapolis Course
One semester human anatomy with labs	BIOL-N 261
One semester human physiology with labs	BIOL-N 217
One semester statistics (including descriptive and inferential)	STAT-I 301 or STAT-I 350 or PSY-B 305 or BIOL-L 337
One semester introductory behavioral sciences	PSY-B 110
One semester lifespan human development	PSY-B 310
One semester abnormal psychology	PSY-B 380
One semester introductory social sciences	SOC-R 100
One semester medical terminology	HIM-M 330 or CLAS-C 210 or MHHS-M 325 or RADI-R 108

Pre-Optometry

Course Requirement	IU Indianapolis Course
One year introductory biology with labs	BIOL-K 101 (or BIOL-K 102) and BIOL-K 103
One year introductory chemistry with labs	CHEM-C 105, CHEM-C 106, CHEM-C 125, and CHEM-C 126
One semester organic chemistry with lab	CHEM-C 341 and CHEM-C 343
One year general physics with labs	PHYS-P 201 and PHYS-P 202 or PHYS-I 152 and PHYS-I 251
One semester microbiology with lab	BIOL-K 356 and BIOL-K 357
One semester biochemistry	BIOL-K 384 or CHEM-C 484
One semester calculus	MATH-I 231 or MATH-I 165

One semester statistics (including descriptive and inferential)	STAT-I 301 or STAT-I 350 or PSY-B 305 or BIOL-L 337
Two semesters of English composition	ENG-W 131 and ENG-W 230 or ENG-W 231 or ENG-W 270
One semester introductory behavioral sciences	PSY-B 110

Pre-Pharmacy

Course Requirement	IU Indianapolis Course
One year introductory biology with labs	BIOL-K 101 (or BIOL-K 102) and BIOL-K 103
One year introductory chemistry with labs	CHEM-C 105, CHEM-C 106, CHEM-C 125, and CHEM-C 126
One year organic chemistry with labs	CHEM-C 341, CHEM-C 342, CHEM-C 343, and CHEM-C 344
One semester general physics with lab	PHYS-P 201 and PHYS-P 202 or PHYS-I 152 and PHYS-I 251
One semester human anatomy with lab	BIOL-N 261
One semester human physiology with lab	BIOL-N 217
One semester upper-level biology (genetics, molecular biology, cell biology, or immunology)	BIOL-K 322 or BIOL-K 324 or BIOL-K 338
One semester microbiology with lab	BIOL-K 356 and BIOL-K 357
One semester biochemistry	BIOL-K 384 or CHEM-C 484
One semester calculus	MATH-I 231 or MATH-I 165
One semester statistics (including descriptive and inferential)	STAT-I 301 or STAT-I 350 or PSY-B 305 or BIOL-L 337
Two semesters of English composition	ENG-W 131 and ENG-W 230 or ENG-W 231 or ENG-W 270
One semester introductory social or behavioral sciences	PSY-B 110 or SOC-R 100
One semester speech communication	COMM-R 110
One semester economics	ECON-E 201 or ECON-E 202 or ECON-E 101

Pre-Physical Therapy

Course Requirement	IU Indianapolis Course
One semester introductory biology with lab	BIOL-K 101 (or BIOL-K 102)
One year introductory chemistry with labs	CHEM-C 105, CHEM-C 106, CHEM-C 125, and CHEM-C 126
One year general physics with labs	PHYS-P 201 and PHYS-P 202 or PHYS-I 152 and PHYS-I 251
One semester human anatomy with lab	BIOL-N 261
One semester human physiology with lab	BIOL-N 217
One semester statistics (including descriptive and inferential)	STAT-I 301 or STAT-I 350 or PSY-B 305 or BIOL-L 337
One semester introductory behavioral sciences	PSY-B 110
One semester lifespan human development	PSY-B 310
One semester medical terminology	HIM-M 330 or CLAS-C 210 or MHHS-M 325 or RADI-R 108

Pre-Physician Assistant

Course Requirement	IU Indianapolis Course
One year introductory biology with labs	BIOL-K 101 (or BIOL-K 102) and BIOL-K 103
One year introductory chemistry with labs	CHEM-C 105, CHEM-C 106, CHEM-C 125, and CHEM-C 126
One semester organic chemistry with lab	CHEM-C 341 and CHEM-C 343
One semester human anatomy with lab	BIOL-N 261
One semester human physiology with lab	BIOL-N 217
One semester upper-level biology (genetics, molecular biology, cell biology, or immunology)	BIOL-K 322 or BIOL-K 324 or BIOL-K 338
One semester microbiology with lab	BIOL-K 356 and BIOL-K 357
One semester calculus	MATH-I 231 or MATH-I 165

One semester statistics (including descriptive and inferential)	STAT-I 301 or STAT-I 350 or PSY-B 305 or BIOL-L 337
One semester introductory behavioral sciences	PSY-B 110
One semester additional social or behavioral sciences	SOC-R 100 or any PSY-B course
One semester medical terminology	HIM-M 330 or CLAS-C 210 or MHHS-M 325 or RADI-R 108

Pre-Veterinary Medicine

Course Requirement	IU Indianapolis Course
One year introductory biology with labs	BIOL-K 101 (or BIOL-K 102) and BIOL-K 103
One year introductory chemistry with labs	CHEM-C 105, CHEM-C 106, CHEM-C 125, and CHEM-C 126
One year organic chemistry with labs	CHEM-C 341, CHEM-C 342, CHEM-C 343, and CHEM-C 344
One year general physics with labs	PHYS-P 201 and PHYS-P 202 or PHYS-I 152 and PHYS-I 251
One semester genetics	BIOL-K 322
One semester microbiology with lab	BIOL-K 356 and BIOL-K 357
One semester biochemistry	BIOL-K 384 or CHEM-C 484
One semester statistics (including descriptive and inferential)	STAT-I 301 or STAT-I 350 or PSY-B 305 or BIOL-L 337
One semester speech communication	COMM-R 110
Three semesters humanities or social sciences	varies

IU Indianapolis Honors College and Science Honors

(NOTE: The following information is provided on behalf of the Honors College. Refer to their website for current requirements.)

The IU Indianapolis Honors College is open to students not directly admitted as freshmen. Continuing science students with an overall grade point average (GPA) of 3.50 after their first full academic year of work can apply. Entering freshmen applicants must have a cumulative high school GPA of 3.75 (weighted) and are required to provide ACT or SAT scores as part of their application materials. The deadline to apply for entering freshmen is November 15. Continuing students will apply via Science Honors Program. Applications for Science Honors are due mid-April each year. Students must have at least four semesters remaining after admission to complete the Science Honors program. Students with a GPA of more than 3.50 who are not enrolled in Honors College may be permitted to take honors courses. They should, however, discuss the matter with their academic advisor and the Honors College before doing so.

In general, students may take no more than 6 credit hours of honors coursework each semester. Students may earn honors credit by taking special Honors College courses (HON-H 398 or HON-H 499), by taking specially designed honors course sections, by doing special overseas or internship work, or by contracting for honors credit using an H-Option contract in conjunction with regular classes. HON-H 200 Introduction to Honors is required of all new Honors College students.

H-Option contracts 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., early in the semester. The contract is not merely an extension of the regular class work, but an opportunity not provided by regular assignments. The Honors College reviews all contracts prior to students beginning projects.

In order to receive an honors notation at graduation, students must complete 24 hours of honors coursework with at least a 3.30 cumulative GPA. For students entering the Honors College via Science Honors, 12 of the required 24 hours must be science courses. In order to remain in good honors academic standing, students also must maintain a 3.30 semester and cumulative GPA, enroll in honors coursework each semester, achieve a B or higher in all honors courses, and take honors coursework each Fall and Spring semester.

Students will develop an ePortfolio throughout their academic career and submit a completed ePortfolio in their final year as an Honors College student while enrolled in HON-H 496 for 0 or 1 credit hour. The 1-credit hour version of the course requires either a final presentation or participation in the Honors Showcase or campus Research Day. Students must complete HON-H 496 with a grade of B or better.

For additional information, contact the IU Indianapolis Honors College, 0124 University Library, 755 W. Michigan Street, Indianapolis, IN 46202-5164; phone (317) 274-2660; web.

Pre-Professional and Career Preparation for Science Students: PREPs

PREPs provides comprehensive career services and pre-professional advising for all School of Science undergraduate students, graduate students, and alumni. This includes individual appointments, walk-in advising, workshops, and classroom presentations. Our staff can help with each step of the career development process including career exploration, developing professional experience through internships, job shadowing and volunteering, and preparing for professional school, graduate school and the world of work. We help students learn to identify and articulate their unique skills and

strengths, particularly through creating effective résumés, cover letters, personal statements and preparing for interviewing and networking. Since most students seek higher education in order obtain good career prospects or to advance to graduate or professional school, PREPs should be a component of your academic and professional planning.

The PREPs Office is located in University Tower - 200. Get more information here.

Jaime Sperandio
Director
Office of Pre-Professional and Career Preparation (PREPs)
Email: jsperan@iu.edu

Hailey Allen
Assistant Director
Employer & Career Services
Email: haimorg@iu.edu

Mary Grace Mantica
Assistant Director
Career Advising
Email: maramsay@iu.edu

Anna Jessen
Assistant Director
Pre-Professional Advising
Email: anjessen@iu.edu

Undergraduate Research Experiences

IU Indianapolis has established undergraduate research experiences to encourage and recognize undergraduates who participate in research projects with faculty in the school.

Undergraduate research experiences enable students to develop important problem-solving skills and experience for their future career. Students will expand their professional network, present their work at national and international events, and have the opportunity to have their work published.

Further information about undergraduate research opportunities may be found here.

Teaching Certification

Becoming a Licensed Teacher

Top quality science and mathematics teachers are in high demand, and the IU School of Education at IU Indianapolis is recognized as a leader in urban education. Students who want to become teachers of middle school and/or high school science or mathematics must take specific programs of study aligned to the standards for teaching these subject areas. Teachers must fully understand the content they teach, the realities of schools, and methods for successfully teaching every child. This requires earning a major or a degree in the School of Science and completing a teacher preparation program in the School of Education.

Mathematics and science majors who want to become teachers need to seek advising from the School of Science as soon as possible so that they take the right courses as they complete their majors. Science majors typically complete their bachelor's degree in science and then enter the Transition to Teaching Program as post baccalaureate students, earning the first half of their master's degree in this 12-month teacher education program. The *Transition to Teaching* program is also an option for mathematics graduates or returning students.

Admission to the graduate T2T teacher education program is competitive. Students must complete a formal application and have most of the required courses in the major, passing PRAXIS test scores, a clear criminal history check, and at least a 2.50 overall GPA. Specific information about admission to each program is available on the School of Education Web site.

The *Transition to Teaching* program enables students to earn Rules 2002 Indiana Teacher Licenses. The T2T program is 18 credit hours (plus program fees) of graduate study done while practice teaching in schools everyday for one school year.

Note: Information about teacher education and licensing may change for many reasons, including legislative mandates and state policies. Students need to check for current information on the School of Education website and meet with School of Education advisors regularly.

Bachelor's to MD (B/MD) Pathway to Medicine Program

The B/MD Pathway to Medicine program is a conditional acceptance program for IU Indianapolis School of Science students to the IU School of Medicine. Incoming freshmen with a minimum unweighted high school GPA of 3.70 and a minimum combined math and verbal SAT score of 1400 (with a minimum 670 math) or a minimum ACT score of 30 are invited to apply.

Students accepted into the B/MD Pathway to Medicine program may choose to study any of the following degree programs:

- Biology (B.S. or B.A.)
- Chemistry (B.S. or B.A.)
- Forensic & Investigative Sciences (B.S.)
- Neuroscience (B.S.)
- Physics (B.S.)
- Psychology (B.S. only)

Upon admission to the B/MD program, students will be assigned an academic advisor in the School of Science and a B/MD program advisor in the School of Science Pre-Professional & Career Preparation (PREPs) Office.

Academic Tracks

Students will complete one of two academic tracks listed below. Students should consult with their B/MD advisor regarding academic plans and timeline for each track.

4+4 Track: This is the traditional pathway. Students will complete four years of undergraduate education in the School of Science and then four years of medical

education in the IU School of Medicine. Students will earn one of the bachelor's degrees listed above from IU Indianapolis upon completion of their undergraduate education. Students must complete all requirements for matriculation into the IU School of Medicine and apply after their third year of undergraduate studies.

3+4 Track: This is the accelerated pathway. Students will complete all general education core requirements, medical school prerequisite coursework for IU School of Medicine, and most degree requirements in three years at the School of Science. Students will then complete four years of medical education in the IU School of Medicine. After successful completion of the first year of medical education, students will earn a Bachelor of Science in Interdisciplinary Studies from IU Indianapolis. Students must complete all requirements for matriculation into the IU School of Medicine and apply after their second year of undergraduate studies.

Program Requirements

Each student in the baccalaureate stage of the B/MD program will be reviewed at the end of each academic year for promotion to the next year in the program by the Program Promotions and Mentoring Committee. To remain in good standing in the B/MD program, students must maintain minimum cumulative and science GPAs as calculated by the American Medical College Application Service® (AMCAS®).

End of Baccalaureate Year	3+4 Track	4+4 Track
1	3.50	3.40
2	3.60	3.50
3	3.70	3.60
4	N/A	3.70

At the end of the first year in the B/MD program, students recommended for promotion to the second year will complete an interview with the IU School of Medicine MD Admissions Committee. The Committee will determine if students are promoted to the second year of the program.

Students who have been dismissed from the B/MD program will remain enrolled in their degree program at the School of Science and will be eligible to apply to the IU School of Medicine as any other IU Indianapolis student.

Admission to the IU School of Medicine

To be eligible for admission to the IU School of Medicine, students in the B/MD program must complete the following prerequisite courses:

- One year of general and organic chemistry, physics, and biology—each with lab
- One semester of biochemistry
- One semester of social science
- One semester of behavioral science

Students must complete the MCAT exam no later than September of the year prior to beginning the IU School of Medicine with a minimum composite score of 512 and no individual sub-score below 125.

Students must complete a minimum of 40 hours of approved volunteer clinical service (medical service learning and clinical shadowing) no later than October 31 of the year prior to beginning the IU School of Medicine. Clinical experiences will be approved by the School of Science B/MD advisor.

Students must complete the AMCAS® application by no later than September 1 of the year prior to beginning the IU School of Medicine.

Students who meet these requirements and are approved to matriculate into the MD will be required to make a binding commitment by October 31 of the year prior to beginning the IU School of Medicine. Campus assignments for IU School of Medicine will be as for the Early Decision Program based on academic metrics.

Courses

Astronomy

AST-A 100 The Solar System (3 cr.) Fall, Spring, Summer. 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.

AST-A 103 Search for Life in the Universe (3 cr.) Fall, Spring. Explores the origin, nature, and history of life on Earth, prospects for life in our own and other planetary systems, extra solar planet detection, and the possibility of other technological civilizations.

AST-A 105 Stars and Galaxies (3 cr.) Spring. Survey of the universe beyond the solar system, including stars, pulsars, black holes, principles of spectroscopy and the H-R diagram, nebulae, the Milky Way, other galaxies, quasars, expanding universe, cosmology, and extraterrestrial life.

AST-A 130 Short Courses in Astronomy (1 cr.) Five-week short courses on a variety of topics in astronomy. Examples of topics include: the Big Bang, Black Holes, Astronomy from your Backyard, How to See Stars, and The Birth and Death of Our Sun.

AST-A 205 Quasars, Pulsars, Black Holes (3 cr.) P: Introductory High School mathematics. Fall, day. For both science and non-science majors interested in astronomy. Surveys stars of all types and their life cycles. Includes the H-R diagram, star clusters, and exploration of our own sun. Discussion of relativistic effects on certain astronomical objects and on human space exploration.

AST-A 250 General Astronomy (3 cr.) P: P: AST-A 100 and AST-A 105 and (MATH-I 165 or MATH-I 221

or MATH-I 231 or MATH-I 241). Minimum grade of C- required in all prerequisite courses. An introduction to the study of the universe. Coverage includes: orbital mechanics, planetary formation, terrestrial vs giant planets, stellar mechanics, stellar life cycles, HR diagram, variable stars, star clusters, black holes and relativity, galactic structure, interstellar medium, distance scale, quasars, and voids.

AST-A 330 Introduction to Astrophysics (3 cr.) P: P: AST-A 205 and AST-A 250 and (PHYS-I 152 or PHYS-P 201) and two semesters of calculus [(MATH-I 165 or MATH-I 221 or MATH-I 231 or MATH-I 241) and (MATH-I 166 or MATH-I 222 or MATH-I 232 or MATH-I 242)]. Minimum grade of C- required in all prerequisite courses. An introduction to astrophysics. Coverage includes: dynamics and structure of the sun, hydrostatic equilibrium, stellar nuclear fusion, interstellar medium, stellar birth, stellar evolution, variable stars, binary stars, stellar death, relativity, the distance ladder, dark matter, and galactic structure.

AST-A 380 Cosmology (3 cr.) P: P: AST-A 250 and (PHYS-I 152 or PHYS-P 201) and two semesters of calculus [(MATH-I 165 or MATH-I 221 or MATH-I 231 or MATH-I 241) and (MATH-I 166 or MATH-I 222 or MATH-I 232 or MATH-I 242)]. Minimum grade of C- required in all prerequisite courses. An introduction to the study of the universe. Coverage includes: Observational Data, Newton's Laws, Einstein's Special and General Theories, Robertson-Walker Metric, Einstein's Field Equation, Friedmann's Equation, Lambda, Big Bang Theory, Evolution of Possible Universes, Hubble's Cosmological Parameter, Dark Matter, CMBR, Dark Energy, Nucleosynthesis, Inflation, and Accelerated Expansion.

Biology

Undergraduate Level

BIOL-K 101 Concepts of Biology I (5 cr.) P: High school or college chemistry and math placement at MATH-I 153 or higher or completion of MATH-I 111 or MATH-M 118 or MATH-M 119 or MATH-I 153 with a minimum grade of C within last 3 terms. An introductory course emphasizing the principles of cellular biology; molecular biology; genetics; and plant anatomy, diversity, development, and physiology. Fall, Spring, Summer.

BIOL-K 102 Honors Concepts of Biology I (5 cr.) P: High school or college chemistry and math placement at MATH-I 153 or higher. For Honors Credit: Fall. An introductory course emphasizing the principles of cellular biology; molecular biology; genetics; and plant anatomy, diversity, development, and physiology. Faculty-supervised research projects and approved independent projects provide greater depth for honors students. This course carries honors credit.

BIOL-K 103 Concepts of Biology II (5 cr.) P: BIOL-K 101 or BIOL-K 102, with a grade of C- or higher. An introductory biology course emphasizing phylogeny, structure, physiology, development, diversity, evolution and behavior in animals. Fall, Spring, Summer.

BIOL-K 195 Introductory Topics in Biology (0-3 cr.) P: Freshman or sophomore standing or consent of instructor. Other prerequisites may be announced at the time of topic offering. Lectures on contemporary issues in biology. This course may also include reading assignments and special projects. Fall, Spring, Summer.

BIOL-K 295 Intermediate Topics in Biology (0-3 cr.) P: P: Freshman or sophomore standing; other prerequisites may be announced at the time of topic offering. Lectures on contemporary issues in biology. This course may also include reading assignments and special projects. Repeatable

BIOL-K 322 Genetics and Molecular Biology (3 cr.) P: BIOL-K 103 and CHEM-C 106. The course covers the principles of classical and molecular genetics including Mendelian inheritance, linkage, nucleic acids, gene expression, recombinant DNA, genomics, immunogenetics, and regulation. Fall, Spring.

BIOL-K 323 Genetics and Molecular Biology Laboratory (2 cr.) P: (BIOL-K 103 or BIOL-K 104) and CHEM-C 106 with a minimum grade of C- in each course. Applied principles of genetics and molecular biology using organisms of increasing complexity from viruses to fruit fly. Laboratory experiments include linkage analyses, deletion mapping, isolation of human chromosomes, mutagenesis, DNA extraction, restriction enzyme analysis, and PCR. Fall.

BIOL-K 324 Cell Biology (3 cr.) P: BIOL-K 103 and CHEM-C 106. Examination of the structure and activity of eukaryotic cells and subcellular structures. Emphasis is on regulation of and interactions among subcellular events, such as protein targeting, transmembrane signaling, cell movement, and cell cycle. Fall, Spring.

BIOL-K 325 Cell Biology Laboratory (2 cr.) P: or C: BIOL-K 324. Experiments on the molecular and biochemical basis of organization and function of eukaryotic cells. Spring.

BIOL-K 331 Developmental Biology (3 cr.) P: BIOL-K 322. The development of animal embryos from fertilization through organogenesis and some non-embryonic developmental phenomena. Spring.

BIOL-K 338 Introductory Immunology (3 cr.) P: BIOL-K 322, BIOL-K 324, and CHEM-C 106, all with a grade of C- or better. Principles of basic immunology with an emphasis on the cells and molecules underlying immunological mechanisms. Fall, Spring, Summer.

BIOL-K 339 Immunology Laboratory (2 cr.) P: BIOL-K 322 with a minimum grade of C-. Demonstration of immunological principles by experimentation. Exercises include cells and factors of the innate and the adaptive immune systems. Fall, Spring.

BIOL-K 341 Principles of Ecology and Evolution (3 cr.) P: BIOL-K 103. A study of the interactions of organisms with one another and with their non-biotic environments in light of evolution. Fall, Spring.

BIOL-K 342 Principles of Ecology and Evolution Laboratory (2 cr.) P: BIOL-K 103 with a minimum grade of C-. P: or C: BIOL-K 341. Application of ecology and evolution principles in laboratory and field experiments as well as demonstration of techniques of general ecology. Fall.

BIOL-K 350 Comparative Animal Physiology (3 cr.) P: BIOL-K 103 and CHEM-C 106. A comparative examination of principles of animal physiology from

molecular to organismal levels using homeostasis, regulation, and adaptation as central themes. Fall.

BIOL-K 356 Microbiology (3 cr.) P: BIOL-K 103, CHEM-C 341. Introduction to microorganisms: cytology, nutrition, physiology, and genetics. Importance of microorganisms in applied fields including infectious disease. Fall, Spring.

BIOL-K 357 Microbiology Laboratory (2 cr.) P: or C: BIOL-K 356. Laboratory experiments and demonstrations to yield proficiency in aseptic cultivation and utilization of microorganisms; experimental investigations of biological principles in relation to microorganisms. Spring.

BIOL-K 360 Computational Biology (1 cr.) P: BIOL-K 322 and MATH-I 153 or higher or consent of instructor. A minimum grade of C- required in all prerequisite courses. C: BIOL-K 361. STAT-I 301 is recommended as a prerequisite. This course will give a holistic view on collecting, visualizing, analyzing, and interpreting biological data by exploring a collection of public datasets. Topics covered will include introductory statistics, an overview of 'omics' (e.g., genomics, proteomics), and the tools that can be utilized to better understand the data. Spring.

BIOL-K 361 Computational Biology Laboratory (2 cr.) P: BIOL-K 322 and MATH-I 153 or higher or consent of instructor. A minimum grade of C- required in all prerequisite courses. C: BIOL-K 360. STAT-I 301 is recommended as a prerequisite. This course will give students hands-on experience to visualize, analyze, and interpret real-world biological datasets using Excel, R, and select online resources. topics covered will include introductory statistics, an overview of 'omics' (e.g., genomics, proteomics), and working with high performance clusters. Spring.

BIOL-K 384 Biochemistry (3 cr.) P: BIOL-K 322 or BIOL-K 324 or equivalent and CHEM-C 341 or equivalent. Biochemistry covering the fundamentals of the chemistry of life including biomolecule structure and function, the dependence of biological processes on chemical and physical principles, and pathways of carbohydrate and fatty acid metabolism. Recommended for pre-professional students. Fall, Spring.

BIOL-K 395 Advanced Topics in Biology (1-3 cr.) P: Junior or senior standing or consent of instructor; other prerequisites may be announced at the time of topic offering. Lectures on contemporary issues in biology. This course may also include reading assignments and special projects. Fall, Spring, Summer.

BIOL-K 411 Global Change Biology (3 cr.) P: BIOL-K 101 and BIOL-K 103 or GEOL-G 109 and one course in chemistry or consent of instructor. Examination of changes in earth's environment over history. In-depth study of effects of environmental change, including global warming, on the ecology of various organisms. Spring of odd-numbered years.

BIOL-K 416 Cellular Molecular Neuroscience (3 cr.) P: BIOL-K 324. This course is designed to provide an in-depth analysis of topics within the field cellular and molecular neuroscience. It will cover invertebrate and vertebrate neurobiology, cell and molecular biology of the neuron, neurophysiology, neuroanatomy, developmental neurobiology, regeneration and degeneration, learning and memory, and will include comparisons of neural mechanisms throughout the animal kingdom. Fall, Spring.

BIOL-K 451 Neuropharmacology (3 cr.) P: BIOL-K 324. Recommended completion of upper-level biochemistry course. This course focuses on the molecular underpinnings of neuropharmacology. In the first part of the course - Fundamentals of Neuropharmacology - we will look at basic principles of neuropharmacology including understanding how drugs bind to their targets. Also, we will evaluate how neurons communicate with each other and how those signals are transduced on a molecular level. Part 2 will evaluate where drugs act in the brain and some of the major neurotransmitters. Part 3 will focus on neuronal dysfunction in various disorders and how we can treat those disorders pharmacologically. Spring.

BIOL-K 483 Biological Chemistry (3 cr.) P: CHEM-C 342. P: or C: BIOL-K 324. Chemistry of biologically important molecules including carbohydrates, lipids, proteins, and nucleic acids. Special emphasis on chemistry of intermediary metabolism. Not offered on a regular basis.

BIOL-K 484 Cellular Biochemistry (3 cr.) P: BIOL-K 322 and CHEM-C 342. P or C: BIOL-K 324. Emphasis on selected topics in cellular biochemistry, including nucleic acid: protein interactions, protein: protein interactions, protein synthesis, biogenesis of membranes, and signal transduction. Current techniques for studying these processes in higher eukaryotes will be discussed. (not offered on a regular basis)

BIOL-K 488 Endocrinology in Health and Disease (3 cr.) P: BIOL-K 103, BIOL-K 324, and BIOL-K 322 or approved equivalent courses. Upper-level biochemistry or equivalent course recommended. An introduction to human endocrinology, including the biology of the major endocrine organs and the roles of the hormones that they release. Both normal endocrine function and common diseases involving hormone physiology are examined. In addition, the course examines how endocrinology impacts everyday life. Spring.

BIOL-K 490 Capstone (1 cr.) P: Senior standing. Faculty-directed or approved independent library research on an area of public, scientific interest or a community service activity in local industry, government, schools, or other public science-related groups or organizations. Fall, Spring, Summer.

BIOL-K 493 Independent Research (1-3 cr.) P: Consent of instructor. A course designed to give undergraduate students majoring in biology an opportunity to do research in fields in which they have a special interest. Fall, Spring, Summer.

BIOL-K 494 Senior Research Thesis (1 cr.) P: BIOL-K 493. A formally written report describing the results or accomplishments of BIOL-K 493. Fall, Spring, Summer.

BIOL-K 495 Special Topics in Biology (0-3 cr.) P: Junior or senior standing or consent of instructor; other prerequisites may be announced at the time of topic offering. Lectures on contemporary issues in biology. This course may also include reading assignments and special projects. Fall, Spring, Summer.

BIOL-S 323 Honors Genetics and Molecular Biology Laboratory (2 cr.) P: or C: BIOL-K 322. In this course, students will apply principles of genetics and molecular biology using organisms of increasing complexity from bacteria to the fruit fly. In this laboratory, students will learn many important genetics and molecular biology lab techniques such as: mutagenesis, DNA extraction, restriction enzyme analysis, primer design, bioinformatics applications, and PCR. There will be a major emphasis on primary research literature. Fall.

BIOL-S 325 Honors Cell Biology Laboratory (2 cr.) P: or C: BIOL-K 324. The goal of this course is to demonstrate the concepts of how fundamental cellular processes can be demonstrated in a laboratory setting. The course reflects a breadth of experimental approaches used in cell biology today and will allow students to develop a sense of how cells accomplish certain ends and why. There is a major emphasis on primary research literature. Spring (not offered every year).

BIOL-S 357 Honors Microbiology Lab (2 cr.) P: or C: BIOL-K 356. In this course, students will become proficient in techniques for cultivation and utilization of microorganisms, along with many assays for microorganism identification. There will be a major emphasis on primary research literature. Spring.

BIOL-K 370 Avian Form, Function, and Evolution (1 cr.) P: BIOL-K 341 Principles of Ecology and Evolution or equivalent with a C- or better. Birds are among the world's most captivating inhabitants. This course will explore avian diversity, anatomy, physiology, and evolutionary history. Topics will focus on special adaptations of birds for flight, how birds likely evolved from theropod dinosaurs and are the only remaining members of the dinosaur lineage, and global avian biodiversity.

BIOL-K 371 Avian Form, Function, and Evolution Laboratory (1 cr.) P: Prerequisite or Corequisite: BIOL-K 370 Avian Form, Function, and Evolution. The laboratory companion to BIOL-K 370 will offer students a hands-on approach to understanding avian anatomy, physiology, evolution, and biodiversity. Students will learn anatomy through dissection-based approaches, physiology and evolution through experimental approaches, and biodiversity by learning how to identify birds by sight with a focus on Indiana birds.

BIOL-K 372 Avian Ecology and Conservation (1 cr.) P: BIOL-K 341 Principles of Ecology and Evolution or equivalent with a C- or better. This course will explore avian foraging, mating and social behavior, vocal behavior, breeding biology, migration and dispersal, and avian population/community ecology. Students will learn about the perils that birds face from land use changes, climate change, disease, pollution, invasive species, anthropogenic pressures, how to preserve avian biodiversity into the future.

BIOL-K 373 Avian Ecology and Conservation Laboratory (1 cr.) P: Prerequisite or Corequisite: BIOL-K 372 Avian Ecology and Conservation. The laboratory companion to BIOL-K372 offers students a hands-on approach to understanding the basics of avian ecology and conservation. The ecology portion will cover avian foraging strategies, mating behaviors, migration/dispersal, and bird populations/communities. The conservation portion will consist of a small final project on a specific aspect of avian conservation.

BIOL-K 480 General Entomology (3 cr.) P: (BIOL-K 101 or BIOL-K 102) and BIOL-K 103 and BIOL-K 341 and CHEM-C 105 and CHEM-C 106 all with a minimum grade of C- (1.70) or higher. An equivalent freshman introductory sequence for biology or chemistry will be allowed. This course will introduce students to insect biology and cover their relationship with human societies. Insect morphology, evolution, classification, physiology, behavior, and ecology will be covered. The course will also cover how entomological principles are applied to improve society, including forensic, agricultural, and medical/veterinary entomology, and how society impacts insects.

BIOL-K 432 Animal Ecophysiology in Changing Environments (3 cr.) P: BIOL-K 103 and CHEM-C 106 or equivalent with a C- or better in each course. This course will take a systems level approach to look at how animals have adapted to different environmental conditions that impact their survival in various biomes and ecosystems.

Courses for the Nonmajor

BIOL-N 100 Contemporary Biology (3 cr.) Selected principles of biology with emphasis on issues and problems extending into everyday affairs of the student. Fall, day, night; Spring, day, online; Summer

BIOL-N 107 Exploring the World of Animals (4 cr.) Equiv. PU BIOL 10900. Not equivalent to BIOL-K 103. This course introduces students to animals and their native environments. It surveys individual ecosystems and highlights the interactions, features, and characteristics of the animals found there. Examples of discussion topics include unique features of animals, animal relationships, societies and populations, exotic species, and behavior, including mating, communication, feeding and foraging, and migration. Environmental issues including the effects of pollution on ecosystems are also discussed. Fall, Spring.

BIOL-N 115 Principles of Biomedical Sciences (3 cr.) Students investigate the human body systems and various health conditions including heart disease, diabetes, sickle-cell disease, hypercholesterolemia, and infectious diseases. They determine the factors that led to the death of a fictional person, and investigate lifestyle choices and medical treatments that might have prolonged the person's life. The activities and projects introduce students to human physiology, medicine, research processes and bioinformatics. This course is designed to provide an overview of all the courses in the Biomedical Sciences program and lay the scientific foundation for subsequent courses.

BIOL-I 116 Human Body Systems (3 cr.) P: BIOL-N 115. Students examine the interactions of body systems as they explore identity, communication, power, movement, protection and homeostasis. Students design data acquisition software to monitor body functions such as muscle movement, reflex and voluntary action, and respiration. Exploring science in action, students build organs and tissues on a skeletal manikin, work through interesting real world cases and often play the role of biomedical professionals to solve medical mysteries.

BIOL-N 117 Medical Interventions (3 cr.) P: BIOL-N 116. Students investigate the variety of interventions involved in the prevention, diagnosis and treatment of disease as they follow the lives of a fictitious family. The course is a "How-To" manual for maintaining overall health and homeostasis in the body as students explore: how to prevent and fight infection; how to screen and evaluate the code in human DNA; how to prevent, diagnose and treat cancer; and how to prevail when the organs of the body begin to fail. Through these scenarios, students are exposed to the wide range of interventions related to immunology, surgery, genetics, pharmacology, medical devices and diagnostics. Lifestyle choices and preventive measures are emphasized throughout the course as well as the important roles scientific thinking and engineering design play in the development of interventions of the future.

BIOL-N 118 Biomedical Innovation (3 cr.) P: BIOL-N 117. In this capstone course, students apply their knowledge and skills to answer questions or solve problems related to the biomedical sciences. Students design innovative solutions for the health challenges of the 21st century as they work through progressively challenging open-ended problems, addressing topics such as clinical medicine, physiology, biomedical engineering, and public health. They have the opportunity to work on an independent project and may work with a mentor or advisor from a university, hospital, physician's office, or industry. Throughout the course, students are expected to present their work to an adult audience that may include representatives from the local business and health care community.

BIOL-N 120 Topics in Biology (3 cr.)

BIOL-N 200 The Biology of Women (3 cr.) This course examines the biological basis for bodily functions and changes that take place throughout the life of females. Fall, Spring.

BIOL-N 207 Physiology for Healthcare Management (3 cr.) Spring, Summer. This course is designed to provide students with a beginning, but solid foundation in Physiology. This course will focus on the study of internal and external structures, and the physical relationships between these structures. Physiology in this course will be studied at many levels, from molecular through microscopic to whole body, and we will also analyze some physiological concepts from a pathophysiology perspective.

BIOL-N 211 Anatomy for Healthcare Management (3 cr.) This course focuses on internal and external structures and the physical relations between them. Anatomy is studied at many levels, from molecular through microscopic to gross anatomy, and anatomical concepts are studied from a developmental perspective. Models, slides, photographs, and dissections are used. Note: Cannot substitute for BIOL N261 Human Anatomy (5 cr.). Fall, Spring.

BIOL-N 212 Human Biology (3 cr.) Equiv. PU BIOL 20100. First course in a two-semester sequence in human biology with emphasis on anatomy and physiology, providing a solid foundation in body structure and function. Fall, day; Summer.

BIOL-N 213 Human Biology Laboratory (1 cr.) P: or C: BIOL-N 212. Accompanying laboratory for BIOL-N 212. Fall, Summer.

BIOL-N 214 Human Biology (3 cr.) P: BIOL-N 212. Equiv. PU BIOL 20200. Continuation of BIOL-N 212. Spring, Summer.

BIOL-N 215 Human Biology Laboratory (1 cr.) P: or C: BIOL-N 214. Accompanying laboratory for BIOL-N 214. Spring, Summer.

BIOL-N 217 Human Physiology (5 cr.) Equiv. IU PHSL-P 215. Fall, Spring, Summer. Lectures and laboratory work related to cellular, musculoskeletal, neural, cardiovascular, gastrointestinal, renal, endocrine, and reproductive function in humans.

BIOL-N 222 Special Topics in Biology (1-3 cr.) A variable-topic course dealing with current topics in biology. In a given semester, a topic such as disease, genetics, the environment, etc., will be dealt with as a separate course.

BIOL-N 225 Urban and Suburban Gardening (2 cr.) P: High School biology. Course is intended for both biology and non-biology majors. Designed to expand understanding of the science and techniques of gardening with emphasis on healthy soil and its impact on plant growth. After completing the course, students will be able to describe what makes plants grow and what makes plants grow healthy. No gardening experience is required. Spring, even years.

BIOL-N 251 Introduction to Microbiology (3 cr.) P: One semester general chemistry or one semester life science. This course includes a laboratory component. The isolation, growth, structure, functioning, heredity, identification, classification, and ecology of microorganisms; their role in nature and significance to humans. Fall, Spring, Summer.

BIOL-N 261 Human Anatomy (5 cr.) Equiv. IU ANAT-A 215. Fall, Spring, Summer. Lecture and laboratory studies of the histology and gross morphology of the human form, utilizing a cell-tissue-organ system-body approach.

BIOL-N 322 Introductory Principles of Genetics (3 cr.) P: BIOL-N 107 or BIOL-K 101. Basic principles of plant and animal genetics. Emphasis on transmission mechanisms as applied to individuals and populations. For students in health and agricultural sciences. Spring.

BIOL-N 400 Biological Skills for Teachers (3 cr.) P: Consent of instructor. 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. Fall, night.

BIOL-N 461 Cadaveric Human Anatomy (5 cr.) P: BIOL-N 261 Human Anatomy (minimum grade of B) or instructor approval. This course is designed for upper-level undergraduate students who desire an advanced understanding of Human Anatomy, especially those who intend to pursue a career in the health professions. Through the use of cadaveric dissection, prosected materials, and digital images, the student will explore the structural details of the human body, with a particular emphasis on functional anatomy and clinical correlations.

This course will be an intensive learning experience for motivated undergraduates. Spring.

Advanced Undergraduate and Graduate Level

BIOL-I 507 Principles of Molecular Biology (3 cr.) P: BIOL-K 322, CHEM-C 342, or consent of instructor. Molecular aspects of structure and function of nucleic acids and proteins, including recombinant DNA research. Prokaryotic and eukaryotic molecular biology are given equal weight. Spring.

BIOL-I 512 Advanced Cell Biology (3 cr.) P: BIOL-K 322, BIOL-K 324 and BIOL-K 331; all with a minimum grade of B. This course provides detailed analysis of cell biology, gene regulation and applications of cell biology and genetics. This is a lecture, literature and presentation driven course that utilizes an advanced graduate level textbook as a foundation to dive into recent primary literature on new and emerging topics in cell biology.

BIOL-I 516 Molecular Biology of Cancer (3 cr.) P: BIOL-K 322, CHEM-C 342 or a course in biochemistry. A detailed course examining the molecular mechanisms controlling the growth of animal cells. Emphasis on current experimental approaches to defining the molecular basis of growth regulation in developing systems and the uncontrolled proliferation of cells in metabolic disorders, such as cancer. Not offered on a regular basis.

BIOL-I 544 Sensory Systems (3 cr.) P: BIOL-K 324. The goal of Sensory Systems is to gain an understanding of the mechanisms that underlie sensory perception at the molecular, cellular, and systems level. This will be accomplished by examining how various forms of energy are transduced into the electrochemical messages of the nervous system, what pathways the information travels within the nervous system, and how this information is processed and perceived. Spring.

BIOL-I 548 Techniques in Biotechnology (3 cr.) P: BIOL-K 322, CHEM-C 342, or consent of instructor. Laboratory experience in techniques applicable to biotechnology: protein chemistry, molecular biology, and immunology. Not offered on a regular basis.

BIOL-I 556 Physiology I (3 cr.) P: BIOL-K 103, CHEM-C 342. Principles of physiology: nerve and muscle, temperature regulation, ion and water balance. Fall.

BIOL-I 557 Physiology II (3 cr.) P: BIOL-I 556 or consent of instructor. A study of human cardiovascular, pulmonary, blood, and gastrointestinal systems. Higher neuronal functions and intersystem interactions will be discussed. Not offered on a regular basis.

BIOL-I 559 Endocrinology (3 cr.) P: BIOL-I 556 or equivalent, and CHEM-C 342. The study of hormone function. Consideration will be given to the role of hormones in growth, development, metabolism, homeostasis, and reproduction. Fall.

BIOL-I 560 Clinical and Molecular Aspects of Neurodegenerative Diseases (3 cr.) P: BIOL-K 416 or BIOL-K 451 or instructor consent. This course focuses on the molecular and clinical aspects of neurodegenerative diseases. The first part of the course will briefly introduce critical brain structures, with a focus on neurons and glia and will evaluate molecular mechanisms that underlie protein aggregation and cell death. The remainder of the course will focus on the multiple aspects of specific neurodegenerative diseases. Fall. Not offered every year.

BIOL-I 561 Immunology (3 cr.) P: BIOL-K 103, CHEM-C 341. Introduction to basic principles and experimentation in cellular and humoral immunology. Fall.

BIOL-I 564 Molecular Genetics of Development (3 cr.) P: BIOL-K 322 or similar course or consent of instructor. The course examines the genetic and developmental bases as well as phenotypes of 40 genetic disorders. Chromosomal, single gene, complex and developmental genetic disorders are studied in detail. Emphasis is placed on molecular techniques and understanding current primary literature. Spring.

BIOL-I 566 Developmental Biology (3 cr.) P: BIOL-K 322. Principles of animal development. The emphasis is on concepts and underlying mechanisms of developing and regenerating systems and stem cell properties, including molecular and biochemical approaches. Fall.

BIOL-I 568 Regenerative Biology and Medicine (3 cr.) P: BIOL-K 324 or BIOL-K 331 or a biochemistry course. This course examines the mechanisms of natural regeneration (regenerative biology) and the application of these mechanisms to the development of therapies to restore tissues damaged by injury or disease (regenerative medicine). Not offered on a regular basis.

BIOL-I 571 Developmental Neurobiology (3 cr.) P: Consent of instructor. The major phases of nervous system development beginning with neurolation and 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. Not offered on a regular basis.

BIOL-I 573 Stem Cell Biology (3 cr.) P: BIOL-K 324. In this course, students will develop a clear understanding of stem cells' defining features, activities and potential utility. Stem cell research is pursued in nearly all areas of medicine. This course focuses on important definitions and characteristics of stem cells and develops a general overview of stem cell biology. The course builds on this overview of stem cell biology by examining specific examples of developmental biology, methodology and the potential applications of stem cell therapy. Spring.

BIOL-I 574 Molecular and Cellular Bone Biology (3 cr.) P: BIOL-K 101, BIOL-K 103, BIOL-K 324. This course is designed for graduate and senior undergraduate students. Concentration on basic cellular and molecular concepts of bone and cartilage with applications to engineering concepts. Topics include bone development and growth, cartilage and chondrocyte, signal transduction in bone cells, stem cells, skeletal regeneration, tissue engineering, gene therapy and cancer bone metastasis.

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

BIOL-T 585 Model Organisms in Research (3 cr.) Students will be introduced to the evolutionary similarities that allow study of human disease in certain organisms

and the differences that limit the conclusions that can be made from that research. Students will be introduced to the history of the use of these organisms and the characteristics that give these organisms the label or 'model' organism.

BIOL-T 586 Principles of Ornithology (3 cr.) This course provides an introduction and overview over the biology, ecology, evolution, behavior, and conservation of birds. Students will also learn to identify common birds by sight and sound. Regular independent bird watching trips are expected as well as a field research project on local bird diversity.

Graduate Level

BIOL-I 609 Scientific Research Bootcamp (1 cr.) P: Enrolled in an M.S. Thesis or Ph.D. program in the School of Science. This course introduces graduate students (Thesis Master and Ph.D.) to research approaches, research presentation skills, and the proper conduct of research. This bootcamp course fulfills the requirement for Responsible Conduct in Research training that is required for students with certain funding and paid from NIH/HSF grants.

BIOL-I 625 Immune System Disorders (3 cr.) P: BIOL-K 338. The aim of this course is to understand the underlying mechanisms that contribute to immune system dysfunction. We will discuss the genetic defects in the immune system, immune complex diseases, immune mediated hypersensitivity reactions and autoimmune diseases. This course covers fundamentals as well as current topics in the field of immunology. Spring.

BIOL-I 696 Seminar (1 cr.) Fall, Spring. Each semester there are several separate offerings. Oral presentations are required. May be repeated for credit.

BIOL-I 697 Special Topics (1-3 cr.) 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 subcellular 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. May be repeated for credit.

BIOL-I 698 Research M.S. Thesis (variable cr.) M.S. Thesis.

BIOL-I 699 Research Ph.D. Thesis (variable cr.) Research Ph.D. Thesis.

BIOL-G 901 Advanced Research (6 cr.)

Chemistry

Undergraduate

CHEM-C 100 The World of Chemistry (3 cr.) A topically oriented, nonmathematical introduction to the nature of matter. Topics covered include fossil fuel and nuclear sources of power; environmental issues involving chemistry such as recycling, acid rain, air and water pollution, climate change, ozone depletion; genetic modification of foods, DNA profiling, use of food additives and herbal supplements; and other public policy issues involving science.

CHEM-C 101 Elementary Chemistry I (3 cr.) P: At least one semester of high school algebra. C: CHEM-C 121. Fall, day, night; Spring, day, night; Summer II, day. Essential principles of chemistry, atomic and molecular structure, bonding, properties and reactions of elements and compounds, stoichiometry, solutions, and acids and bases. For students who are not planning careers in the sciences and for those with no previous course work in chemistry. Note: most degree programs that include CHEM-C 101 require the concurrent laboratory, CHEM-C 121.

CHEM-C 105 Principles of Chemistry I (3 cr.) P: Two years of high school algebra and one year of high school chemistry or CHEM-C 101 with a minimum grade of C. C: CHEM-C 125. A placement examination may be required for admission to this course. Fall, day, night; Spring, day; Summer I, day. Principles of inorganic and physical chemistry emphasizing physical and chemical properties, atomic and molecular structure, chemical bonding, and states of matter.

CHEM-C 106 Principles of Chemistry II (3 cr.) P: CHEM-C 105 with a minimum grade of C- or equivalent. C: CHEM-C 126. Fall, day; Spring, day, night; Summer II, day. Continuation of CHEM-C 105. Topics include condensed phases, solution chemistry, thermodynamics, equilibrium, and kinetics.

CHEM-C 110 The Chemistry of Life (3 cr.) High school chemistry recommended. Optional laboratory: CHEM-C 115. A nonmathematical introduction to organic molecules and their transformation to useful materials such as drugs and polymers. An emphasis is placed on the chemical features of biomolecules including hormones and neurotransmitters, proteins, lipids (fats), carbohydrates (sugars), and nucleic acids (DNA/RNA). The chemistry of enzymes, carcinogens, vitamins, antihistamines, anesthetics, genetic engineering, mental health, and other health-related topics.

CHEM-C 115 Laboratory for C110 The Chemistry of Life (2 cr.) P: or C: CHEM-C 110. Laboratory work illustrating topics covered in CHEM-C 110.

CHEM-C 121 Elementary Chemistry Laboratory I (2 cr.) P: or C: CHEM-C 101 (3 cr.) Fall, day, night; Spring, day, night; Summer II, day. Introduction to the techniques and reasoning of experimental chemistry. Emphasis is given to study of physical and chemical properties of inorganic compounds.

CHEM-C 125 Experimental Chemistry I (2 cr.) P: (Placement or CHEM-C101 equal to or greater that C) AND [(ALEKS score equal to or greater than 62) or (one of MATH-I 111 / MATH-I 153 / MATH-I 154 / MATH-I 159 equal to or greater than C in last 3 terms) or (one

of MATH-M 119 / MATH-I 165 / MATH-I 221 / MATH-I 231 equal to or greater than C- in last 3 terms)]. ALEKs compared against SAT/ACT Math. Additional testing may be required. Fall, day, night; Spring, day, night; Summer I, day. Laboratory work illustrating topics covered in CHEM-C 105.

CHEM-C 126 Experimental Chemistry II (2 cr.) P: CHEM-C 105 and CHEM-C 125 with a minimum grade of C- in both; P or C: CHEM-C 106 or equivalent. Fall, day, night; Spring, day, night; Summer II, day. Continuation of CHEM-C 125. Laboratory work illustrating topics covered in CHEM-C 105 and CHEM-C 106.

CHEM-C 209 Special Problems (1-2 cr.) P: Two semesters of college chemistry and consent of instructor. Every semester, time arranged. Individually supervised special problems of chemical interest, e.g., environmental problems, development of experiments, development of audiovisual materials, etc. May be repeated for credit, but maximum of 2 credit hours may be applied toward a chemistry degree.

CHEM-C 294 Cornerstone in Chemistry (1 cr.) P: CHEM-C 106. Fall, Spring. To engage sophomore chemistry majors in important educational and professional topics such as departmental research opportunities, career planning, library research skills, scientific communication, scientific ethics and science in society issues.

CHEM-C 301 Chemistry Seminar I (1 cr.) P: or C: CHEM-C 409 and consent of instructor. Fall, day. Topics in various areas of chemistry. Students are required to attend departmental seminars and prepare and present at least one seminar on their research. CHEM-C 301 and CHEM-C 302 may be elected three semesters for credit.

CHEM-C 302 Chemistry Seminar II (1 cr.) P: or C: CHEM-C 409 and consent of instructor. Spring, day. Content same as CHEM-C 301.

CHEM-C 309 Chemistry Career Development and Practice (0-3 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 credit hours, of which 3 may be used to satisfy an advanced chemistry elective.

CHEM-C 310 Analytical Chemistry (3 cr.) P: CHEM-C 106 with a minimum grade of C-. Fall, Spring. Fundamental analytical processes including solution equilibria, theory and applications of electrochemistry and spectrophotometry, and chemical methods of separation.

CHEM-C 311 Analytical Chemistry Laboratory (1 cr.) P: CHEM-C 126 with a minimum grade of C- . Fall, Spring. Laboratory instruction in the fundamental analytical techniques discussed in CHEM-C 310.

CHEM-C 325 Introduction to Chemistry Instrumentation (3 cr.) P: CHEM-C 310 with a minimum grade of C-. Spring. This course introduces students to the major instrumental analytical methods commonly used in analytical laboratories. The techniques covered include spectroscopy (UV-Vis, FTIR, Raman, AAS, AES, NMR, X-ray, and MS), separation methods, in particular, chromatography (TLC, HPLC, and GC), electrochemical analysis and surface analysis.

CHEM-C 326 Introduction to Chemistry Instrumentation Laboratory (2 cr.) P: CHEM-C 310 and CHEM-C 311 with a minimum grade of C- in each course. Spring. This course introduces students to the major instrumental analytical methods commonly used in analytical laboratories through practical learning. These techniques include spectroscopy in the ultraviolet, visible, and infrared ranges, and separation methods (liquid and gas chromatography). Students will prepare and analyze samples, collect, interpret and summarize data and findings.

CHEM-C 341 Organic Chemistry I (3 cr.) P: CHEM-C 106 with a minimum grade of C-. Fall, day, night; Spring, varies; Summer I, varies. Comprehensive study of organic compounds. Valence bond theory, stereochemistry, and physical properties of organic compounds are discussed in detail. Introduction to reaction mechanisms and to spectroscopic identification. Synthesis and reactions of selected compounds are also discussed.

CHEM-C 342 Organic Chemistry II (3 cr.) P: CHEM-C 341 with a minimum grade of C-. Fall, day; Spring, day, night; Summer II, varies. Continuation of CHEM-C 341. The chemistry of aromatic compounds and other major functional groups are discussed in detail. Multistep synthetic procedures and reaction mechanisms are emphasized. Introduction to biological chemistry.

CHEM-C 343 Organic Chemistry Laboratory I (2 cr.) P: CHEM-C 126 with a minimum grade of C-; P or C: CHEM-C 341. Fall, day, night; Spring, day, night; Summer I, varies. Fundamental laboratory techniques of organic chemistry, introduction to spectroscopic methods of compound identification, and general synthetic methods.

CHEM-C 344 Organic Chemistry Laboratory II (2 cr.) P: CHEM-C 343 with a minimum grade of C-. P: or C: CHEM-C 342. Fall, night; Spring, day, night; Summer II, varies. Preparation, isolation, and identification of organic compounds, spectroscopic methods of compound identification, qualitative organic analysis, multistep synthesis.

CHEM-C 360 Elementary Physical Chemistry (3 cr.) P: CHEM-C 106 with a minimum grade of C-, and MATH-I 232 or equivalent, and PHYS-P 202 or equivalent. Spring, day. Properties of gases and liquids, intermolecular forces, diffusion, chemical thermodynamics, ligand binding, kinetics, and introduction to quantum chemistry and spectroscopy. Includes topics in biophysical chemistry. For students who desire a survey course in physical chemistry.

CHEM-C 361 Physical Chemistry of Bulk Matter (3 cr.) P: CHEM-C 106 with a minimum grade of C, and MATH-I 166, and PHYS-P 202 or PHYS-I 251. C: MATH-I 261. Spring, day. Kinetic-molecular theory, gases, liquids, thermodynamics, statistical mechanics, solutions, transport properties, and phase and chemical equilibria.

CHEM-C 362 Physical Chemistry of Molecules (4 cr.) P: CHEM-C 106 with a minimum grade of C, and MATH 16600, and PHYS-P 202 or PHYS 25100. C: MATH 26100. Fall, day. Quantum chemistry, symmetry, atomic and molecular structure and spectra, solids, chemical

kinetics, photochemistry, and introduction to statistical thermodynamics.

CHEM-C 363 Experimental Physical Chemistry (2 cr.) P: CHEM-C 362 with a minimum grade of C and P or C: CHEM-C 361 Spring. Experimental work to illustrate principles of physical chemistry and to introduce research techniques.

CHEM-C 371 Chemical Informatics I (1 cr.) P: CHEM-C 106, Fall. Basic concepts of information representation, storage, and retrieval as they pertain to chemistry. Structures, nomenclature, molecular formulas, coding techniques for visualization of chemical structures and properties.

CHEM-C 372 Chemical Informatics II: Molecular Modeling (2 cr.) P: CHEM-C 341. Introduction to computer representation of molecular structure and simulation of chemical reactions; visualizing fundamental chemical concepts, such as reaction paths of standard organic reactions, molecular orbital diagrams, vibrations and conformational changes; quantitative structure activity relationships (QSAR), pharmacophore docking to biomolecules, and related methods for drug design.

CHEM-C 384 Biochemistry (3 cr.) P: CHEM-C 341 with a minimum grade of C-. P or C: CHEM-C 342 or equivalent. BIOL-K 101 or equivalent recommended. Summer. Biochemistry covering the fundamentals of the chemistry of life including biomolecule structure and function, the dependence of biological processes on chemical and physical principles, and pathways of carbohydrate and fatty acid metabolism. Recommended for pre-professional students. Course meets requirements for preprofessional students requiring a biochemistry course.

CHEM-C 409 Chemical Research (0-3 cr.) Every semester, time arranged. Chemical or literature research with a report. Can be elected only after consultation with research advisor and approval of program. A minimum of 3cr. may be used to satisfy the advanced chemical elective in the BS Chemistry program. May be taken for a total of 10cr., which count toward graduation.

CHEM-C 410 Principles of Chemical Instrumentation (3 cr.) P: CHEM-C 310 and CHEM-C 361 with a minimum grade of C in each course. P or C: CHEM-C 362. Fall. Modern methods of instrumental analysis, including spectroscopy, chromatography, and electrochemistry.

CHEM-C 411 Principles of Chemical Instrumentation Laboratory (2 cr.) P: CHEM-C 311 with a minimum grade of C. P or C: CHEM-C 410. Fall. Laboratory instruction in the instrumental analysis techniques discussed in CHEM-C 410.

CHEM-C 420 Environmental Chemistry (3 cr.) P: CHEM-C 341 and CHEM-C 310 with a minimum grade of C in each course. Spring. Environmental Chemistry provides a good understanding of sources, reactions, transport, effects, and fates of chemical species, including CO2, common organic pollutants, metals, and metalloids, found in the environment. Chemical processes involved in the environmental degradation of natural or man-made ecosystems, energy production, and remediation and abatement processes are introduced.

CHEM-C 421 Environmental Chemistry Laboratory (1 cr.) P: CHEM-C 311 with a minimum grade of C. Spring. This course is designed to illustrate principles, processes, and reactions found in terrestrial, aquatic and atmospheric chemistry. Quantitative analysis and identification of common chemical pollutants, including common volatile and semi-volatile organics, metals and metalloids will be undertaken. Some meetings may be short field trips to practice sampling techniques.

CHEM-C 430 Inorganic Chemistry (3 cr.) P: CHEM-C 362 with a minimum grade of C. Spring. Atomic structure; periodic trends and properties of the elements. Introduction to symmetry and group theory. Valence bond, molecular orbital and ligand field theories of bonding and their application to structure and properties of inorganic and organometallic compounds. Spectroscopic properties and acid-base, oxidation-reduction, and coordination reactions of inorganic compounds.

CHEM-C 435 Inorganic Chemistry Laboratory (1 cr.) P: or C: CHEM-C 430. Spring. Synthesis, characterization, and study of chemical and physical properties of inorganic and organometallic compounds.

CHEM-C 471 Chemical Information Sources (1 cr.) P: CHEM-C 341. Fall. Techniques for the storage and retrieval in both printed and computer-readable formats; sources of chemical information, including Chemical Abstracts; development of search strategies; and online searching of chemical databases.

CHEM-C 472 Computer Sources for Chemical Information (1 cr.) P: CHEM-C 471. Spring. Techniques for the utilization of the major computer-based information tools found in academic and industrial environments.

CHEM-C 475 Approaches in Chemical Biology (3 cr.) P: CHEM-C 484 and CHEM-C 410 with a minimum grade of C in each course. Spring. Chemical Biology is a broad discipline in which the concepts of chemistry and biology are used together to develop tools to study biological phenomena at the molecular level and to invent new technologies. In the field of Chemical Biology, biological problems are addressed with a chemical mindset. Approaches in Chemical Biology is an advanced course that introduces Chemical Biology as a discipline and, through the use of case studies, examines how chemical and biological techniques are used to study biological systems. Topics will be selected from the current literature and will cover technologies such as genomics, transcriptomics, proteomics, metabolomics, (combinatorial) synthesis of chemical probes, high throughput screening, synthetic biology, and bioorthogonal ligation. A blended didactic and project-based approach will enable students to develop skills in reading and understanding the scientific literature, oral presentation, illustration of scientific concepts, and scientific writing.

CHEM-C 484 Biomolecules and Catabolism (3 cr.) P: CHEM-C 342 with a minimum grade of C. Spring. Structure and function of cellular components and catabolism of glucose.

CHEM-C 485 Biosynthesis and Physiology (3 cr.) P: CHEM-C 484 or equivalent with a minimum grade of C. Fall. Mechanisms of biological catalysis, metabolism, biosynthesis.

CHEM-C 486 Biological Chemistry Laboratory (2 cr.) P: CHEM-C 484 or equivalent with a minimum grade of C. Fall. An introduction to the important laboratory techniques currently employed by practicing biological chemists, including biomolecule isolation, purification, enzyme kinetics, and biomolecule characterization by electrophoresis, centrifugation, and spectroscopic methods.

CHEM-C 488 Introduction to Medicinal and Agricultural Chemistry (3 cr.) P: CHEM-C 484 or equivalent with a minimum grade of C. Fall. Medicinal chemistry plays an integral role in drug discovery, providing the link between target identification and the development of a therapeutic agent. This course examines the role of chemistry in the discovery of bioactive molecules, highlighting the similarities and differences in the search for novel medicinal and agricultural chemicals.

CHEM-C 489 The Practice of Medicinal Chemistry (3 cr.) P: CHEM-C 488 with a minimum grade of C or consent of instructor. Spring. This course provides an introduction to many parameters involved in the drug discovery process, including how fundamental physico-chemical properties of molecules may be used to predict biological activity. Methods contributing to the drug discovery process will be discussed, including genomics, molecular biology, high-throughput screening, X-ray crystallography, and various computational approaches.

CHEM-C 495 Capstone in Chemistry (1 cr.) P: Senior standing, B.A. or B.S. program. Fall, day; Spring, day. Independent study, under the supervision of a chemistry faculty member or appropriate academic advisor can be earned by completion of: (a) a chemical research project; (b) a library research project in an area of current scientific investigation; (c) a research investigation in industry; or (d) a service activity in university, government, public schools, or other science-related groups or organizations. Students will report the results of their activities in both a formal written report and oral presentation, prepare portfolios of undergraduate work in chemistry, discuss recent scientific literature, and explore chemistry in society. Enrollment in the Capstone in Chemistry requires joint approval of the capstone instructor and the independent project advisor.

CHEM-C 496 Methods in Teaching Chemistry (1 cr.) P: CHEM-C 105. Fall; Spring. Designed for workshop leaders, this course offers continued support and training in group dynamics and learning theory. The larger goals for this course are to continue the development of leadership skills, foster ongoing communication among workshop leaders, and provide an environment for reviewing content knowledge.

Graduate

CHEM-I 520 Forensic Chemistry I (3 cr.) This course will focus on the analysis and identification of commonly abused chemicals such as ethanol, controlled substances and prescription drugs. The history, legal issues, synthesis, chemical/physical properties, and laboratory analysis of these materials will be discussed. Special topics of the students choosing will also be included as student presentations.

CHEM-I 533 Introductory Biochemistry (3 cr.) P: CHEM-C 342 or equivalent. A rigorous one-semester introduction to biochemistry.

CHEM-I 542 Inorganic Chemistry (3 cr.) P: CHEM-C 362 or equivalent or consent of instructor. Atomic structure; periodic trends and properties of the elements. Introduction to symmetry and group theory. Valence bond, molecular orbital, and ligand field theories of bonding and their application to structure and properties of inorganic and organometallic compounds. Spectroscopic properties and acid-base, oxidation-reduction, and coordination reactions of inorganic compounds. Advanced topics in main group or transition element chemistry.

CHEM-I 575 Intermediate Physical Chemistry (3 cr.) P: CHEM-C 362 or equivalent. Quantum theory of atoms and molecules, theories of chemical bonding, molecular spectroscopy, methods for determining molecular structure, and electrical and magnetic properties.

CHEM-I 590 Special Topics in Chemistry (3 cr.) Fall, Spring. Lecture courses offered on topic areas that are not part of the regular graduate curriculum. Repeatable up to 2 times.

CHEM-I 599 Special Assignments (0-4 cr.) P: Consent of instructor. Every semester including summer I and II, time arranged. Directed reading or special work not included in other courses.

CHEM-I 610 Synthetic Medicinal Chemistry (3 cr.) P: CHEM-C 342 Organic Chemistry Lectures II or equivalent with a C or better. This course bridges introductory undergraduate organic chemistry, advanced organic chemistry, and medicinal chemistry, covering classic organic reactions and their mechanisms. Application of these reactions to the synthesis of biologically active natural products and structurally complicated pharmaceuticals will be discussed along with the retro-synthetic strategy and their relevant mechanisms.

CHEM-I 613 Mass Spectrometry (3 cr.) A survey of mass spectrometry, including fundamentals of instrumentation, instrumentation types, and applications. Applications in biological and environmental chemistry are discussed.

CHEM-I 619 Electroanalytical Chemistry (3 cr.) This course is an introduction to the basic principles and theory of electrochemical phenomena and the methods used to study them. The course includes descriptive chemistry of electrochemical reactions and contemporary directions of research in electrochemistry.

CHEM-I 621 Advanced Analytical Chemistry (3 cr.) P: CHEM-C 310 and CHEM-C 410. A critical survey of recent developments in chemical and instrumental methods of analysis.

CHEM-I 629 Chromatographic Methods of Analysis (3 cr.) P: CHEM-C 410 or equivalent or consent of instructor. Principles and practice of modern gas and liquid chromatography and capillary electrophoresis are developed from an integrated point of view. Emphasis is placed both on theory and on features useful for practical analytical separations.

CHEM-I 632 Bioinorganic Chemistry (3 cr.) P: CHEM-C 430 Inorganic Chemistry or equivalent and CHEM-C 484 Biomolecules and Catabolism or equivalent. The role of essential metal ions in fundamental life processes ranges from structural, electron transfer to catalysis. This course will introduce techniques for probing the metal sites with

a focus on transition metals. This course will discuss the occurrence and the effect of exposure to toxic metals.

CHEM-I 634 Biochemistry: Structural Aspects (3 cr.) P: CHEM-C 310, CHEM-C 342, CHEM-C 361, and CHEM-C 362 or equivalent. Chemistry of materials of biochemical interest: carbohydrates, lipids, proteins, amino acids, nucleic acids, porphyrins, biochemistry of blood.

CHEM-I 636 Nucleic Acid Chemistry (3 cr.) Nucleic Acids Chemistry focuses on the properties of nucleic acids that are of concern to chemists and molecular-minded life scientists. Following a series of lectures that relate fundamental attributes, focused topics will be presented from the scientific literature to provide an understanding of current efforts concerning these vital biomolecules.

CHEM-I 641 Advanced Inorganic Chemistry (3 cr.) P: CHEM-C 430 or CHEM-I 542 or equivalent or consent of instructor. Applications of symmetry and group theory to structure, bonding and spectral properties of inorganic compounds. Advanced topics in main group and transition element chemistry including determination of structure from physical and spectroscopic properties, bonding in coordination, and organometallic compounds and inorganic reaction mechanisms.

CHEM-I 651 Advanced Organic Chemistry (3 cr.) P: CHEM-C 342 or equivalent. Modern structural organic chemistry. Introduction to bonding theory, stereochemistry, and computational chemistry.

CHEM-I 652 Synthetic Organic Chemistry (3 cr.) P: CHEM-I 651 or CHEM-I 657. An advanced treatment of methods for preparing major types of organic functionalities and bonds, stressing stereo- and regio-chemical control, and employing mechanistic organic chemistry for understanding choice of reagents and reactions conditions

CHEM-I 657 Reaction Mechanisms (3 cr.) P: CHEM-C 342 or equivalent or consent of instructor. Modern structural organic chemistry, introduction to physical organic chemistry, mechanisms of representative reactions, and methods used for understanding reactivity in organic transformations.

CHEM-I 672 Quantum Chemistry (3 cr.) P: One year of physical chemistry. Basic principles of classical and quantum mechanics, approximation methods, atomic structure, spectroscopy, application of group theory, and theory of molecular bonding.

CHEM-I 675 Chemical Kinetics (2-3 cr.) P: One year of physical chemistry. Experimental and theoretical considerations of chemical reaction rates and mechanisms.

CHEM-I 682 Statistical Thermodynamics (3 cr.) P: CHEM-C 362 or equivalent. Application of statistical mechanics to the description of imperfect gases, liquids, and solutions, and to order-disorder phenomena in solids and surfaces; Monte Carlo techniques and molecular dynamics.

CHEM-I 695 Seminar (0-1 cr.) Group 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/her major subject.

CHEM-I 696 Special Topics in Chemistry (1-3 cr.) P: Bachelor of Science in chemistry from an accredited institution or consent of instructor. Lectures on selected topics of current interest.

CHEM-I 696 Special Topics In Chemistry: Bioanalytical Chemistry (3 cr.) Modern techniques for the study of biological macromolecules, such as protein and peptides, carbohydrates, DNA, RNA, and lipids, including (1) spectroscopy (UV-Vis, Raman, NMR, mass spectrometry, and light scattering); (2) bioseparations (chromatography, electrophoresis, and microdialysis); (3) electrochemistry (sensors, electron transfer, and LCEC); and (4) miscellaneous topics (amino acid analysis, sequencing, microcalorimetry, and immunochemistry).

CHEM-I 696 Special Topics in Chemistry: Biochemistry-Dynamic Aspects (1-3 cr.) Mechanisms of biological catalysis, metabolism, biosynthesis, regulation of genetic information, and molecular biology.

CHEM-I 696 Special Topics in Chemistry: Bioelectrochemistry (1-3 cr.) Principles of electrochemical measurements including potentiometry, amperometry, and linear sweep and cyclic voltammetry and application to the study and utilization of biological molecules. Topics covered include redox transformations in biological systems, electron transfer between electrodes and biological molecules, and electrochemical sensors for detection and quantitation of biological analytes.

CHEM-I 696 Special Topics in Chemistry: Bioorganic Chemistry (1-3 cr.) Structure and reactivity of biological macromolecules, such as proteins, enzymes, and nucleic acids, and their relevance to bioorganic chemistry. Current experimental studies of enzymes, nucleic acids, and model systems.

CHEM-I 696 Special Topics in Chemistry: Biophysical Chemistry (1-3 cr.) The study of structure and properties of biologically important macromolecules in solution using physical techniques, with special emphasis on optical, fluorescence, and magnetic resonance spectroscopy to describe protein conformation, denaturation, catalytic center structure, thermodynamics of ligand binding, time dependent processes, and membrane properties.

CHEM-I 696 Special Topics in Chemistry: Chemical Information Technology (1-3 cr.) Overview of chemical informatics techniques, including chemical information and data systems, chemical structure and data representation and search systems, and bioinformatics techniques.

CHEM-I 696 Special Topics in Chemistry: Organometallics in Organic Synthesis (1-3 cr.) Recent developments in the use of transition metals in synthetic organic methodology. Emphasis is placed on applications of methods in the synthesis of complex organic molecules.

CHEM-I 696 Special Topics in Chemistry: Group Theory in Chemistry (1-3 cr.) This course is on molecular symmetry and how we obtain information about the quantum states of molecules through application of group theoretical techniques related to the symmetries of molecules.

CHEM-I 696 Special Topics in Chemistry: Solid-Phase Synthesis and Combinatorial Chemistry: Theory and Practice (1-3 cr.) This course will explore how the tools of solid-phase synthesis and combinatorial chemistry are

being used to solve a wide variety of problems requiring chemical solutions. Examples range from medicinal chemistry and drug discovery to new catalyst creation, from new "chiral selectors" to new biochemical probes. The course will focus on the rationale for employing a combinatorial approach in chemical discovery. It will teach the basics of solid-phase organic chemistry, and the methodology, equipment, and analytical technology employed to use it as a tool to rapidly and effectively carry out a combinatorial approach to problem solving.

CHEM-I 698 Research M.S. Thesis (variable cr.) Research M.S. Thesis

CHEM-I 699 Research Ph.D. Thesis (variable cr.) Research Ph.D. Thesis

CHEM-I 634 Biochemistry: Structural Aspects (3 cr.) P: CHEM-C 310, CHEM-C 342, CHEM-C 361, and CHEM-C 362 or equivalent. Chemistry of materials of biochemical interest: carbohydrates, lipids, proteins, amino acids, nucleic acids, porphyrins, biochemistry of blood.

CHEM-I 673 Biomaterials (3 cr.) The course provides an introduction into the fascinating world of biomaterials science. Students learn how concepts of polymer chemistry and interfacial chemistry are linked with those of materials science, biomedical engineering, and biology to develop biomaterials for various medical applications.

CHEM-I 674 Biomimetics (3 cr.) The course focuses on biomimetic systems and their role in biophysical and bioanalytical applications. The principle concepts of biomimetics are first outlined in a series of lectures before students are asked to review and discuss recent scientific literature related to this research field.

CHEM-I 611 Methods in Science Education Research (3 cr.) The course will explore the various research methods in science education research. Qualitative, quantitative, and mixed methods research designs will be introduced. Students will apply the knowledge obtained to design a study, collect, and analyze data using one of these methodologies.

CHEM-I 530 Instrumental Analysis of Trace Evidence (3 cr.) P: Prerequisite: FIS and Biology and Chemistry Graduate students. This course will focus on instrumental analysis of trace evidence. Mass spectrometry, chromatography, FT-IR, Raman, SEM-EDX, XRF, and microspectrophotometry will be covered. The application of these techniques to the analysis of toxicological samples and trace evidence (fibers, paint, ignitable liquids, explosives, gunshot residue, and glass) will also be covered.

CHEM-I 677 Computational Chemistry & Molecular Modeling (3 cr.) P: Undergraduate physical chemistry or consent of instructor. This course introduces essential theoretical background of computational chemistry. Molecular modeling tasks are used to solve chemical problems. Contents include molecular visualization, molecular mechanics, molecular orbital/density functional theory, geometry optimization, transition state theory, molecular dynamics, combined quantum mechanical/molecular mechanical (QM/MM) approach, structure-activity relationships, basic docking and introductory sequence alignment techniques.

CHEM-I 652 Organic Spectroscopy (3 cr.) Competence in organic chemistry at a sophomore level (CHEM-C 341 / CHEM-C 342) is essential, particularly the concepts of periodicity, structure, substituent effects, and acidity. Application of modern analytical techniques including 1-D and 2-D nuclear magnetic resonance (NMR) spectroscopy, infrared spectroscopy, and mass spectrometry to the rational identification of organic structures.

Earth and Environmental Sciences Undergraduate Courses

GEOL-G 107 Earth and Our Environment (3 cr.) 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, water resources, geologic hazards and problems, geology and health, and land use.

GEOL-G 109 Fundamentals of Earth History (3 cr.) Fall, Spring, Summer. Basic principles of earth history: geologic time, basic rock types, reconstructing past environments. Physical development of the earth: its interior, mountain formation, plate tectonics. Origin and development of life: evolution, the fossil record.

GEOL-G 110 How the Earth Works (3 cr.) Fall, Spring, Summer. Introduction to processes within and at the surface of the earth. Description, classification, and origin of minerals and rocks. The rock cycle. Internal processes: volcanism, earthquakes, crustal deformation, mountain building, plate tectonics. External processes: weathering, mass wasting, streams, glaciers, ground water, deserts, coasts.

GEOL-G 115 Oceanography (3 cr.) Fall, Spring, Summer. Nonmathematical introduction to the geology, biology, and physical characteristics of the ocean. Includes waves, tides, and currents of the world ocean, the adaptations and distribution of marine animals, pollution of the marine ecosystem, and an introduction to the global ocean/atmosphere system.

GEOL-G 117 Lab: Earth and Our Environment (1 cr.) P: or C: GEOL-G 107. Fall, Spring, Summer. Laboratory exercises in environmental aspects of the geosciences. To accompany GEOL-G 107.

GEOL-G 119 Fundamentals of Earth History Laboratory (1 cr.) P: or C: GEOL-G 109. Fall, Spring. Laboratory studies of rocks, fossils, and stratigraphic principles to reconstruct past environments and interpret Earth history. To accompany GEOL-G 109.

GEOL-G 120 Lab: How the Earth Works (1 cr.) P: or C: GEOL-G 110. Fall, Spring, Summer. Laboratory studies of minerals and rocks, landscapes, and earth structures. To accompany GEOL-G 110.

GEOL-G 130 Short Courses in Earth Science (topic varies) (1 cr.) Five-week 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; glaciers; water; gemstones; geology of art; earthquakes and volcanoes; dinosaurs. Each short course is one credit; no topic may be taken for credit more than once.

GEOL-G 132 Environmental Issues and Solutions (3 cr.) This course is offered via the Internet, and provides

experience in addressing some of the kinds of problems that arise in studies of the environment. Particular attention is given to developing skills in evaluating scientific articles; specifically, the relevance of the information in an article, the credibility of the author, and the accuracy and usefulness of the quantitative information provided. The kinds of problems considered in this course will vary from semester to semester, but will be chosen from a list that includes global warming, tropical rain forests, acid rain, water pollution, solid waste disposal, appropriate use of land, and the ability of regulations to protect the environment. Three or four such topics will be covered each semester.

GEOL-G 135 Indiana Rocks! (3 cr.) Fall, Spring, Summer. An in-depth investigation of Indiana's geology, including minerals and rocks, geologic time, mineral resources, fossils, topography, soil, water resources, and special geologic features such as the Falls of the Ohio River and Indiana Dunes.

GEOL-G 136 Lab: Indiana Rocks! (1 cr.) P: or C: GEOL-G 107 or GEOL-G 110, or GEOL-G 135. Fall, Spring, Summer. Field experiences and practical exercises in applying geologic principles and observing the geologic phenomena of Indiana. Topics may include sedimentary rocks and fossils, soils, mineral resources, hydrology, glacial history, and karst topography. Students will visit multiple park areas, complete problem solving or hands-on exercises, and submit written reports.

GEOL-G 185 Global Environmental Change (3 cr.) Fall. The scientific basis behind natural and human-induced global environmental changes. Geological perspective of the development of the earth. Human activities influencing the natural system including population, deforestation, water usage, acid rain, ozone depletion, smog, and global warming. Subsequent human reaction.

GEOL-G 180 Dinosaurs (3 cr.) Spring. Topics include: geologic time and the fossil record, preservation of vertebrate fossils, and how to "read" the fossil record. Dinosaur anatomy is surveyed in terms of evolutional changes. Controversies such as evolutionary paths are considered and extinction of dinosaurs is placed in the context of other mass extinctions.

GEOL-G 199 Service Learning in Geology (1 cr.) P: or C: GEOL-G 107, or GEOL-G 110, or GEOL-G 115, or GEOL-G 135. Students participate in community service projects. Completion of the project includes a paper reflecting on how the service experience contributed to their application of the principles of general education.

GEOL-G 205 Reporting Skills in Geoscience (3 cr.) P: GEOL-G 107 or GEOL-G 110 with a minimum grade of C- and ENG-W 131 with a minimum grade of C. C: P or C: COMM-R 110 . Spring and Fall. 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, proofreading, and editing. The oral report: effective presentation and response to audience questions, simulating a professional science meeting.

GEOL-G 221 Introductory Mineralogy (5 cr.) P: GEOL-G 110 or GEOL-G 107 and CHEM-C 105 with a minimum grade of C- in each course. Fall. Credit not given for both GEOL-G 221 and GEOL-G 306. The assembly of minerals from atoms in nature. Atomic bonding, structures and symmetry. Control of physical properties by symmetry. Interaction of light with crystals. Crystal fields and forces driving the growth of crystals from melts to aqueous solutions. The chemistry of silicates and other minerals.

GEOL-G 222 Introductory Petrology (5 cr.) P: GEOL-G 221 with a minimum grade of C-. Spring. Credit not given for both GEOL-G 222 and GEOL-G 306. Study of the principal representatives of the major chemical groups of minerals. Emphasis on rock-forming and useful minerals, their crystal structure, chemistry, physical properties, association, and occurrence. Study of major rock types.

GEOL-G 304 Principles of Paleontology (3 cr.) P: GEOL-G 109 or GEOL-G 110 or GEOL-G 335 with a minimum grade of C- or instructor consent. Spring. Biological principles applied to the fossil record. Examination of the quality of the fossil record, taxonomic principles and procedures, analytical techniques, evolutionary theory, evolution and paleoecology of species, populations and communities, diversification and extinction, paleogeography. Laboratories: systematics, stratigraphic distribution, and ecology of major fossilized invertebrate phyla.

GEOL-G 306 Earth Materials (4 cr.) P: GEOL-G 110 / GEOL-G 120 or GEOL-G 107 / GEOL-G 117, and CHEM-C 105. Spring. Credit not given for both GEOL-G 221 and GEOL-G 306 or GEOL-G 222 and GEOL-G 306. The physical and chemical properties of Earth materials, and the chemical processes that have altered them to cause Earth to evolve to its present state. This course covers properties of minerals and their identification, genesis of igneous, metamorphic and sedimentary rocks, interactions between solid Earth and the hydrosphere, and interactions between humans and the solid Earth.

GEOL-G 323 Structural Geology (5 cr.) P: GEOL-G 205 and GEOL-G 222, and GEOL-G 335 with a minimum grade of C- in each course. Fall. 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. Laboratory.

GEOL-G 334 Principles of Sedimentation and Stratigraphy (5 cr.) P: GEOL-G 205 and GEOL-G 222 or GEOL-G 306, and (GEOL-G 335 for Geology BA and Geology BS majors only). All prerequisite courses require a minimum grade of C-. Fall. Processes and factors influencing genesis of sedimentary particles and their deposition. Interpretation of depositional environments. Sedimentary facies and interpretation of stratigraphic record from outcrop, core sequence, and remote sensing. Laboratory. Field trip.

GEOL-G 335 Evolution of the Earth and Life (4 cr.) P: GEOL-G 110 / GEOL-G 120 or GEOL-G 107 / GEOL-G 117 with a minimum grade of C- in each course. Spring. Evidence for evolution of the Earth and life in the rock record, Sequence of events, time of occurrence, rates of change. Interrelationships of principal themes: chemical evolution of the planet, evolution of the biosphere, plate tectonics, mountain building, and sea level changes. Bearing of evolution on human welfare.

GEOL-G 403 Optical Mineralogy and Petrography (3 cr.) P: GEOL-G 205 and GEOL-G 222 with a minimum

grade of C- in each course. Identification of rock-forming minerals in fragments and thin sections using principles of optical crystallography and the petrographic microscope. Description of common igneous, sedimentary, and metamorphic rocks and interpretation of their genesis using hand specimens and thin sections.

GEOL-G 406 Introduction to Geochemistry (3 cr.) P: CHEM-C 106 with a minimum grade of C-, or consent of instructor. Fall. Interactions between geology, chemistry, and biology in natural systems. Explores biogeochemical processes on small scales and in terms of global cycles, as well as human impacts on biogeochemical cycling.

GEOL-G 410 Undergraduate Research in Geology (1-3 cr.) P: GEOL-G 205, junior standing, and consent of faculty mentor. Fall. Spring, Summer. Field and laboratory research in selected problems in geology. May be repeated. A total of 3 credit hours may be applied toward the degree. May be repeated. A total of 3 credit hours may be applied toward the degree.

GEOL-G 413 Introduction to Geophysics (3 cr.) Fall. Application of physics in the study of geologic and environmental problems. Theory and application of seismic, gravity, magnetic and electric methods in exploration of the Earth's subsurface, with emphasis on near-surface processes. May be repeated. A total of 3 credit hours may be applied toward the degree.

GEOL-G 415 Principles of Geomorphology (3 cr.) P: GEOL-G 205 and GEOL-G 334 and (GEOL-G 221 or GEOL-G 306) with a minimum grade of C- in each course. Spring. Natural processes that create landforms and land-scapes. Physics and chemistry of weathering and soil formation. Dynamics of mass wasting, streams, and glaciers. Includes field and laboratory investigations.

GEOL-G 416 Economic Geology (3 cr.) P: GEOL-G 205 and GEOL-G 222, or consent of instructor. Origin, geologic occurrence, distribution, use, and conservation of important geologic natural resources: metallic minerals; industrial minerals and rocks; coal, petroleum, natural gas, and other energy resources.

GEOL-G 418 Igneous and Metamorphic Petrology (3 cr.) P: GEOL-G 222 or equivalent. The petrogenesis of igneous and metamorphic rocks. Both lecture and laboratory portions of the course will stress the application of modern petrographic, mineralogic, geochemical, and phase equilibria techniques to the solution of relevant petrologic problems.

GEOL-G 420 Regional Geology Field Trip (1-3 cr.) P: Consent of instructor. Summer. Field trip to selected regions for study of mineralogic, lithologic, stratigraphic, structural, paleontologic, geomorphologic, or other geological relationships.

GEOL-G 430 Principles of Hydrology (3 cr.) P: GEOL-G 205 and GEOL-G 117 or GEOL-G 120 and MATH-I 154 or MATH-I 159 or MATH-I 165 (or equivalent course) with a minimum grade of C- in each course and an introductory Biology course. C: CHEM-C 106 and PHYS-P 201 or PHYS-I 152 or PHYS-I 218 with a minimum grade of C- in each course. Fall. An introduction to the hydrologic cycle, reviewing processes such as precipitation, evaporation and transpiration, infiltration, runoff, streamflow and watersheds, and groundwater.

GEOL-G 431 Wetland Ecosystems (3 cr.) P: GEOL-G 430 or GEOL-G 451 with a minimum grade of C-. Fall. Wetland ecosystems will explore wetlands and their role in ecosystem function. Topics will encompass wetland definitions, geomorphic setting, functions and values, hydrology, vegetation and soils, wetland biogeochemistry, and wetland mitigation and the regulatory framework in which wetlands are treated. The course evaluates the status and trends of Indiana wetlands and types of wetlands common in Indiana.

GEOL-G 432 Stream Ecosystems (3 cr.) P: GEOL-G 205 and GEOL-G 117 and MATH-I 154 or MATH-I 159 or MATH-I 165 (or equivalent) and PHYS-P 201 or PHYS-I 152 or PHYS-I 218 and an introductory Biology and CHEM-C 106 with a minimum grade of C- in each course. Fall. An examination of the physical, chemical, and biological components of stream ecosystems. Fundamentals of ecosystems science are introduced. Methods for measurement, characterization, and evaluation of the physical, chemical, and biological components of stream ecosystems are taught in field and laboratory applications. Topics include fluvial geomorphology, streamflow, stream chemistry, ecosystem dynamics, water use and management, human impacts, and stream restoration.

GEOL-G 436 Earth Observation from Space (3 cr.) P: PHYS-P 202 with a minimum grade of C- or consent of instructor. Fall. This course is designed to introduce Earth observation with remote sensing. Basic knowledge and history of remote sensing are described. Elements of airborne and satellite remote sensing images necessary for basic data analysis and qualitative image interpretation are covered. Remaining lectures are dedicated to classical applications of airborne and satellite remote sensing in exploring natural world and physical Earth. The class explores in greater detail how space observation can be used to monitor and assess environmental change and to address society need. The class includes lab assignments on basic remote sensing and data interpretation.

GEOL-G 447 Planetary Geology (3 cr.) P: GEOL-G 110 with a minimum grade of C- or consent of instructor. Origin and evolution of planets. The roles of impacts and volcanism in surface dynamics, and the role of water in planetary climates.

GEOL-G 451 Principles of Hydrogeology (3 cr.) P: GEOL-G 205 and GEOL-G 117 or GEOL-G 120 and MATH-I 166 or MATH-I 232 (or equivalent) and PHYS-P 201 or PHYS-I 152 or PHYS-I 218 and CHEM-C 106 with a minimum grade of C- in each course. Spring. Physical and chemical properties of water; chemical equilibria and stable isotopes in groundwaters; acid drainage, landfills, and agricultural pollution; Darcy's Law, fluid potential, unsaturated flow; fluid and aquifer properties affecting groundwater flow; fluid mass-balance equation and its application; contaminant transport.

GEOL-G 457 Paleoclimatology (3 cr.) P: GEOL-G 110 or GEOL-G 107 or GEOL-G 115 or equivalent introductory Geology course and GEOL-G 334. GEOL-G 406 is recommended. Fall. A firm understanding of Earth's climatic history, including the range of natural variability and forces that drive climatic change, has

become increasingly important as anthropogenic activities continue to affect this delicate system. In this class, we will learn about the fundamentals of the global climate system, how and why Earth's climate has changed through time, and the tools and methods that paleoclimatologists use to reconstruct past climates and environmental change.

GEOL-G 460 Internship in Geology (3 cr.) P: GEOL-G 205 and junior or senior standing, and consent of faculty mentor. Fall, Spring, Summer. Industrial or similar experiences in geologically oriented employment. Projects jointly arranged, coordinated, and evaluated by faculty and industrial/governmental supervisors.

GEOL-G 467 Medical Geology (3 cr.) P: Senior or Graduate-Level standing in Environmental Science, Geology, Public Health, Public and Environmental Affairs, Medical Fields, Chemistry or Biology and Instructor consent. Spring. Medical Geology is the study of the interrelationship between earth processes and human health. The spatial distribution and specific processes that can change exposure to certain materials can affect human health, this class will take a detailed look at these scientific issues.

GEOL-G 477 Climate Change and Society (3 cr.) P: GEOL-G 107 or GEOL-G 110 and GEOL-G 205 or COMM-R 110 with a minimum grade of C- in each course. Spring. This course will introduce observations, physical mechanisms and consequences of climate change. Particularly, we will discuss the impacts of climate change on the nexus of food, energy and water systems.

GEOL-G 482 Environmental Microbiology (3 cr.) P: BIOL-K 101, BIOL-K 103 or consent of instructor. Spring. This class will cover basic concepts in microbiology, such as the taxonomy and cell structure of Bacteria and Archaea, microbial growth and energetics, biochemical pathways essential for the metabolism of carbon and nutrients by heterotrophs and autotrophs, and how these pathways then control global biogeochemical cycling of carbon, nitrogen, sulfur and various metals in terrestrial and aqueous environments.

GEOL-G 483 Isotope Geochemistry (3 cr.) P: CHEM-C 106 with a minimum grade of C- or consent of instructor. Spring. Introduction to the theory and application of radiogenic and stable isotopes to a variety of subdisciplines in the earth sciences. Topics include geochronology, tracers, mass balance and mixing, hydrology and environmental applications, water-rock interaction, and biogeochemical cycles.

GEOL-G 486 Soil Biogeochemistry (3 cr.) P: CHEM-C 106 with a minimum grade of C- or consent of instructor. Fall. Biological and geochemical processes controlling the cycling of elements in soils and freshwater sediments with emphasis on cycles of carbon, nitrogen and phosphorous.

GEOL-G 487 Remote Sensing of Global Change (3 cr.) P: PHYS-P 202 (or equivalent) with a minimum grade of C- or instructor consent. Spring. This course is designed to introduce the methods and strategies underlying the application of hyperspectral remote sensing in solving environmental problems in the context of global change. Basic physics for remote sensing is described. Terminologies for spectroscopic analysis and image interpretation of environment changes variables with visible and near-infrared wavelengths and thermal infrared data are introduced. Classical examples on applications of hyperspectral remote sensing in agricultural and forest ecology, hydrology and soil sciences, terrestrial and aquatic ecology, atmosphere and urban landscapes will be discussed.

GEOL-G 488 Global Cycles (3 cr.) P: GEOL-G 205 and GEOL-G 221 or GEOL-G 306 and BIOL-K 101 or BIOL-K 102 or BIOL-K 103 or BIOL-K 104 or BIOL-N 107 or BIOL-N 251 or BIOL-K 341 with a minimum grade of C- in each course. Spring. The global environment is dominated by interlinking cycles of earth materials, chemicals, and biological components. This course will explore the major elements of the geochemical cycles found in the atmosphere, land, lakes, river, biota, and oceans, as well as the human impacts on these cycles. This course will take a global approach to geochemistry and environmental problems and will introduce fundamental concepts of meteorology, surficial geology (weathering, erosion, and sedimentation), biogeochemistry, limnology, and oceanography.

GEOL-G 490 Undergraduate Seminar in Geology (1-3 cr.) P: GEOL-G 205 with a minimum grade of C- and 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 credit hours.

GEOL-G 495 Senior Thesis in Geology (1 - 3 cr.) P: GEOL-G 205 with a minimum grade of C- and senior standing and consent of faculty mentor. Capstone experience involving a research project. Written report required.

GEOL-G 499 Honors Research in Geology (3 cr.) P: Approval of departmental Honors Committee.

Graduate Courses

GEOL-G 502 Trace Element and Isotope Geochemistry (3 cr.) P: CHEM-C 360 or CHEM-C 361 or GEOL-G 406, or consent of instructor. Principles governing the distributions of trace elements, radioisotopes, and stable isotopes in igneous, metamorphic, or sedimentary environments. Emphasis on applications to petrology and geochronology.

GEOL-G 519 Principles of Geomorphology (3 cr.) P: GEOL-G 110 or GEOL-G 107 or GEOL-G 115 or equivalent introductory Geology course, and GEOL-G 334. GEOL-G 406 is recommended. Spring. An understanding of surficial processes is critical to understanding the interaction between humans and their environment. In addition, an understanding of the connection between modern processes and modern deposits is essential to deciphering the geologic record. This course explores the link between geomorphic processes landforms and deposits. Using the scientific method, we will systematically consider fluvial (river), colluvial, aeolian, glacial, slope, weather, tectonic and karst processes; the landforms that they produce and the deposits left behind. The lab component of the course will include a mixture of in-clas and field assignments. When appropriate, students are required to process their field data, make graphs and interpret their results. A final fieldtrip will be conducted toward the end of the semester as a capstone experience.

GEOL-G 525 Glacial Geology (3 cr.) P: GEOL-G 415 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. Field investigations and a student research project required.

GEOL-G 527 Geological Oceanography (3 cr.) P: Graduate standing, GEOL-G 334, or consent of instructor. Geological features and processes operating in the oceans; continental shelf, slope and ocean-basin geomorphology, sedimentology, structure, and composition; origin and geologic history of seawater and ocean basins; tools applied to marine geological studies.

GEOL-G 535 Quaternary Geology (3 cr.) P: GEOL-G 415 or consent of instructor. Characteristics, distribution, and origin of Pleistocene and recent deposits, stratigraphy and chronology; formation of associated landforms, landscapes, paleosols, and soils; Quaternary environments and paleoclimatic interpretation.

GEOL-G 536 Earth Observation from Space (3 cr.) P: GEOL-G 222 and GEOG-G 336 and PHYS-P 202. This course is designed to introduce undergraduate/graduate students to the physical principles and strategies underlying the spectrocsopic analysis of remotely-sensed data. Spectral characteristcs of geologic materials at visible, near-infrared and shortwave infrared wavelengths are covered. Imaging spectroscopy is introduced and examples of appling hyperspectral remote sensing data for geologic mapping are decribed. The course includes lab assignments on reflectance spectrocsopy and image processing.

GEOL-G 545 Applied Analytical Techniques in Geology (3 cr.) P: GEOL-G 221, CHEM-C 105 and CHEM-C 106, and consent of instructor. Principles of advanced analytical techniques, including X-ray analysis, electron beam imaging and analysis, and mass spectrometry, with applications in geosciences. Lectures on theory followed by laboratory exercises. Students will complete individual or collaborative research projects.

GEOL-G 546 Planetary Remote Sensing (3 cr.) P: Previous course work in remote sensing, or consent of instructor. Application of multi-spectral data for exploration and mapping of planetary surfaces.

GEOL-G 550 Surface-Water Hydrology (3 cr.) P: GEOL-G 430 or GEOL-G 451. In-depth analysis of surface water components of hydrologic cycle: hydrometeorology, evaporation/transpiration, rainfall-runoff relationships, open-channel flow, flood hydrology, and statistical and probabilistic methods in hydrology.

GEOL-G 551 Advanced Hydrogeology (3 cr.) P: GEOL-G 430 or GEOL-G 451. Advanced treatment of concepts fundamental to subsurface hydrologic processes. Applications to groundwater resource development and environmental protection such as aquifer mechanics and well hydraulics, heterogeneity and anisotropy, ground water and surface water interactions, unsaturated flow, and tracer and contaminant transport.

GEOL-G 557 Paleoclimatology (3 cr.) P: GEOL-G 110 or GEOL-G 107 or GEOL-G 115 or equivalent introductory geology course and GEOL-G 334. GEOL-G 406 is recommended. Fall. A firm understanding of Earth's climatic history, including the range of natural variability and the forces that drive climatic change, has become increasingly important as anthropogenic activities continue to affect this delicate system. In this class, we will learn about the fundamentals of the global climate system, how and why Earth's climate has changed through time, and the tools and methods that paleoclimatologists use to reconstruct past climates and environmental change.

GEOL-G 567 GeoHealth: When our Health Collides with our Environment (3 cr.) P: Senior or graduate level standing and instructor consent. GeoHealth: When our Health Collides with our Environment is the study of the interrelationship between earth processes and human health. The spatial distribution and specific processes that can change exposure to certain materials can affect human health; this class will take a detailed look at these scientific issues.

GEOL-G 583 Isotope Geochemistry (3 cr.) Introduction to the theory of radiogenic and stable isotopes to a variety of subdisciplines in the earth sciences. Topics include geochronology, tracers, mass balance and mixing, hydrology and environmental applications, water-rock interaction, and biogeochemical cycles.

GEOL-G 585 Environmental Geochemistry (3 cr.) P: GEOL-G 406 or consent of instructor. Aquatic and environmental geochemistry, including freshwater and marine systems, natural and human-induced changes to geochemical systems, and the geochemical record of paleoceanographic and paleoclimatic variations.

GEOL-G 595 Data Analysis Techniques in Geoscience (3 cr.) P: STAT-I 301 and CSCI-N 207, or equivalent. Application of statistical and numerical analysis techniques to geoscience data, including sampling methods, confidence intervals, least squares methods, correlation, time series analysis, and multivariate techniques. Emphasis on using a computer to solve geoscience problems.

GEOL-G 596 Topics in Applied Environmental Geology (3 cr.) P: Consent of instructor. Application of geologic principles to common environmental problems. Topics covered include waste site assessment, flood hazard analysis and mitigation, slope stability, and hydrogeology. Application of principles to problems pertaining to urban planning, earthquake-resistant design, and waste site/landfill development.

GEOL-G 621 Modeling Hydrological Systems (3 cr.) P: GEOL-G 430 or GEOL-G 451 and consent of instructor. Introduction to groundwater flow and solute transport modeling. Includes development of equations describing ground water flow and applied ground water/contaminant transport modeling, using a variety of current software packages.

GEOL-G 635 Soil Geomorphology (3 cr.) P: GEOL-G 415. Application of geomorphic principles in evaluation of weathering and soil formation; systems analysis of soil-landscape models; paleogeomorphology and paleopedology. Lectures and discussion; field and laboratory problems.

GEOL-G 640 Fluvial Geomorphology (3 cr.) P: GEOL-G 415 or consent of instructor. Survey of fluvial processes including sediment transport, bed and bank erosion, and river metamorphosis. Examination of the controls

on channel form. Analysis of landform genesis with an emphasis on feature sedimentology and stratigraphy. Application of fluvial geomorphic principles to land management and restoration of riparian ecosystems.

GEOL-G 645 Carbonate Sedimentology (3 cr.) P: GEOL-G 334 or consent of instructor. Spring. Course focuses on origin and generation of carbonate grains, description of modern carbonate depositional environments, interpretation of ancient limestone and dolomite sequences, and carbonate diagensis.

GEOL-G 677 Climate Change and Society (3 cr.) Spring. This course will introduce observations, physical mechanisms and consequences of climate change. Particularly, we will discuss the impacts of climate change on the nexus of food, energy and water systems.

GEOL-G 686 Advanced Soil Biochemistry (3 cr.) P: GEOL-G 406. Fall. This course examines the chemical, biological and physical factors controlling the weathering of minerals and the formation of soils. Topics covered include: biological and chemical properties of soils, soil classification, carbon, nitrogen and phosphorus cycling in relation to food production and environmental quality.

GEOL-G 690 Advanced Geology Seminar (variable cr.) P: Consent of instructor.

GEOL-G 700 Geologic Problems (1-5 cr.) P: Consent of faculty mentor. Consideration of special geologic problems.

GEOL-G 810 Thesis Research (6 cr.) P: Consent of faculty mentor. Thesis Research.

GEOL-G 547 Planetary Geology (3 cr.) The course Planetary Geology is designed to introduce geological features and processes on planets and discuss how these geological processes shaped planets and governed the evolution of planets.

GEOL-G 610 Learning Theories in Science Education Research (3 cr.) Students are introduced to the learning theories and frameworks that inform discipline-based education research and the methods therein. Students will consider how cognitive science, philosophy of science, and sociological/cultural perspectives influence and contribute to learning in science and science education research.

GEOL-G 688 Global Cycles (3 cr.) This course will explore the major elemental cycles of the atmosphere, land, lakes, biota, and oceans, as well as the human impacts on these cycles. This course will take a global approach to geochemistry and environmental problems and will introduce fundamental concepts of meteorology, surficial geology, biogeochemistry, limnology, and oceanography.

Forensic and Investigative Sciences Undergraduate

FIS-N 100 Investigating Forensic Science Lecture (1 cr.) Fall, Spring, Summer. Forensic science is the application of scientific methods to matters involving the public. Crime scene investigation will be taught so students will have general knowledge on techniques used in the field. Students will also be exposed to basic understanding of common forensic science concepts and learn how analysis of specific types of evidence is analyzed in a forensic science laboratory. Topics will include but are not limited to crime scene, hairs, explosives, fire debris, serology, DNA, illicit drugs, fingerprints, footwear, questioned documents, inks, glass, paints, blood spatter, and soils.

FIS-N 101 Investigating Forensic Science (2 cr.) Fall, Spring, Summer. Forensic science is the application of scientific methods to matters involving the public. One of its principle applications is the scientific analysis of physical evidence generated by criminal activity. During this laboratory course you will learn basic techniques used to analyze forensic evidence. This will start with concepts in evidence documentation and collection. You will then learn concepts used in pattern recognition, forensic chemistry and biology, and trace evidence. There will be hands on activities in all these disciplines. Topics will include but are not limited to crime scene, fibers, hairs, explosives, fire debris, serology, DNA, illicit drugs, fingerprints, footwear, questioned documents, inks, glass, paints, blood spatter, and soils.

FIS-I 205 Concepts of Forensic Science I (3 cr.) Fall, Spring. Forensic science is the application of scientific methods to matters involving the public. One of its principle applications is the scientific analysis of physical evidence generated by criminal activity. During this course students will learn basic concepts in forensic science and criminal justice system and apply the basic concepts towards evidence collection and analysis. Topics will include fingerprints, impression evidence, firearms, questioned documents, pathology, entomology, anthropology, and forensic science and the law and ethics.

FIS-I 206 Concepts of Forensic Science II (3 cr.) P: FIS-I 205 with a C or better; and either CHEM-C 101 or CHEM-C 105 or FIS-N 101, with a C or better. Spring, Fall. Continuation of FIS-I 205. Students will learn basic concepts in forensic chemistry and forensic biology and apply the basic concepts towards evidence analysis. Students will learn instrumental procedures and methods used in forensic chemistry and forensic biology to analyze and evaluate evidence. Topics will include microscopy, spectroscopy, chromatography, hairs and fibers, arson and explosions, soils, glass, paints and inks, serology and DNA, blood splatter, illicit drugs and toxicology.

FIS-I 300 Forensic Microscopy Lecture (1 cr.) P: FIS-I 205 and FIS-I 206, both with a C or better. Fall, Spring. Discuss techniques used in the analysis of forensic trace evidence, such as impressions, glass, biological materials, hairs, and fibers. Topics include properties of light, compound microscopy, micrometry, refraction, dispersion, stereomicroscopy, and polarizing light microscopy.

FIS-I 301 Forensic Microscopy Laboratory (2 cr.) P: FIS-I 205 and FIS-I 206 and CHEM-C 126, all with a C or better. C: FIS-I 300. Fall, Spring. Students will learn techniques in the analysis of forensic microscopic evidence. Topics include the use of common forensic microscopes such as compound microscopy, stereomicroscopy, and polarizing light microscopy. Students will also prepare and examine multiple types of trace evidence such as impressions, glass, hairs, biological materials, and fibers.

FIS-I 305 Professional Issues in Forensic Science (3 cr.) P: FIS-I 205 and FIS-I 206, both with a C or

better. Fall, Spring. Students explore ethical principles, codes of conduct, and professional issues confronting forensic scientists. Topics include status and credibility of forensic science, issues in criminal investigations and courtroom proceedings, crime laboratory culture, and whistleblowing. Students analyze real case studies to develop understanding of ethical behavior and challenges in the forensic science.

FIS-I 400 Forensic Chemistry I (3 cr.) P: CHEM-C 310, CHEM-C 311, CHEM-C 325, CHEM-C 326, CHEM-C 342, and CHEM-C 344 all with a C or better.. Fall. This course will cover the major techniques and instruments used in the analysis of chemical and pattern evidence commonly encountered at crime scenes. The techniques of instrumental microscopy, gas, thin layer and liquid chromatography, and UV-visible and infrared spectrophotometry will be studied and used extensively. There will be lecture components for each of the type of instrumental analysis covered in the course.

FIS-I 401 Forensic Chemistry I Laboratory (1 cr.) P: CHEM-C 310, CHEM-C 311, CHEM-C 325, CHEM-C 326, CHEM-C 342, CHEM-C 344, or instructor consent. P: or C: FIS-I 400. Fall. This course will cover the major techniques and instruments used in the analysis of chemical and pattern evidence commonly encountered at crime scenes. The techniques of instrumental microscopy, gas, thin layer and liquid chromatography, and UV-visible and infrared spectrophotometry will be studied and used extensively. There will be lab components for each of the type of instrumental analysis covered in the course.

FIS-I 420 Forensic Biology (3 cr.) P: BIOL-K 322 and BIOL-K 324, both with a C or better. Fall. This course is an introduction to the use of biological materials to assign identity to persons associated with a crime. The course will introduce methods for the preliminary detection of biological evidence and introduce the use of DNA. The materials learned will encompass broader topics such as immunology, molecular biology, and genetics.

FIS-I 421 Forensic Biology Laboratory (1 cr.) P: or C: FIS-I 420. Only open to students admitted to the FIS Program. Fall. This laboratory section includes practical exercises that reflect common practice in forensic science laboratories, including but not limited to collection and preservation of biological evidence, presumptive and confirmatory tests, DNA extraction, and PCR amplification.

FIS-I 430 Forensic Genetics (3 cr.) P: FIS-I 420 with a C or better, or instructor consent. Spring. This course is a continuation of FIS-I 420 and will go into more detail about the structure of DNA, the application of molecular biology techniques for the determination of individual identity. The materials learned will encompass broader topics such as immunology, molecular biology, genetics, population genetics and statistics.

FIS-I 410 Forensic Chemistry II (3 cr.) P: FIS-I 400 or instructor consent. Spring. Continuation of FIS-I 400. This course will cover the major techniques used in the analysis of chemical and trace evidence commonly encountered at crime scenes. This course will be broken down into 2 modules. The overall course will cover techniques used during the analysis of trace and chemical evidence in a forensic laboratory.

FIS-I 450 Forensic Science Research (1-4 cr.) P: Requires application and approval of faculty member supervising the research. Forensic science or literature research with a report.

FIS-I 415 Forensic Science and the Law (3 cr.) Fall, Spring. Application of various laws and rules of evidence to the forensic sciences and how the admission of evidence derived from forensic sciences can impact the administration of justice in the United States. Topics include preparation for testimony, expert testimony, subpoenas, basic judicial processes, admissibility of scientific evidence.

FIS-I 440 Population Genetics (3 cr.) P: BIOL-K 322 and BIOL-K 323 and STAT-I 301, all with a grade of C or better. Spring. This course will serve as an introduction to the principles of population genetics. The course will cover the theory behind population genetics that includes a historical perspective to the current accepted models of population theory; examine the relationships between allele and genotype frequencies, and the fundamentals of molecular evolutionary genetics.

FIS-I 380 Forensic Science Professional Capstone I (1 cr.) P: Forensic and Investigative Science majors only. This course for Forensic Science majors only is preparation for the next professional step. We will examine skills needed to become a forensic scientist including resume, cover letter, personal statements, interviewing practices, letters of recommendation, references, professional workplace behavior, employer expectations during the interview process, and job searching.

FIS-I 480 Forensic Science Capstone II (1 cr.) P: Forensic and Investigative Science majors only. Fall. This course will serve as a culminating research project surpervised and mentored by FIS faculty and requires a final paper and presentation.

FIS-I 431 Forensic Biology Practical Capstone III (1 cr.) P: Forensic and Investigative Science majors only. C: FIS-I 430. Spring. This laboratory section includes practical exercises that reflect common practice in forensic science laboratories. This laboratory is a continuation of FIS-I 421.

FIS-I 411 Forensic Chemistry Practical Capstone III (1 cr.) P: Forensic and Investigative Science majors only. C: FIS-I 410. Spring. This laboratory (taken with the lecture course FIS-I 410) is a continuation FIS-I 401 laboratory course, with additional instruction in advanced instrumentation for the analysis of trace and chemical evidence, and their interpretation. The laboratory course is capped with a mock case that includes report writing and testimony to culminate practical experiences for a forensic scientist with a concentration in forensic chemistry.

FIS-I 495 Internship in Forensic Science (0 - 5 cr.) P: Completion of application and permission of instructor. The internship experience is designed to bring together the diverse areas of knowledge that the student has gained during the pursuit of a Bachelor of Science in Forensic Science. It is a synthesis of knowledge; where the student takes what they learn in the classroom and translates that to the real world of forensic science. This is usually completed at the end of the student's undergraduate career in Forensic Science. The experience of an internship can aid with the transition to a crime laboratory. However, students have the

opportunity to complete an internship at any time during their undergraduate career. The internships should be related to forensics and have ranged from a variety of experiences. Internship location must be approved by the instructor.

FIS-I 496 Special Topics in Forensic Science (1 - 6 cr.) This is a variable topic course. Repeatable with different topics.

Graduate

FIS-I 500 Crime Scene Investigation and Quality Assurance (2 cr.) This course will cover material on crime scene investigation, blood spatter analysis, and various quality assurance/control procedures and recommendations that allow labs to maintain a high degree of confidence in their analyses.

FIS-I 505 Overview of Forensic Biology (1 cr.) This course will cover material on serology, an overview of DNA processing and analysis, and how DNA profiles can be identified via DNA databases.

FIS-I 510 Advanced Forensic Microscopy Lecture (1 cr.) P: FIS-I 300 and FIS-I 301, with a grade of C or better or previous microscopy experience. P: Previous microscopy experience or FIS-I 300. Spring. Discussion of advanced topics in forensic microscopy. This will include review of common forensic laboratory microscopes such as, stereomicroscope, compound light microscope, and polarizing light microscope. The course will include the fundamentals of light, matter, and optics common to microscopy. Introduction to the application of spectroscopy to microscopy will be examined as well as thermal microscopy and comparison microscopy. Discussion on advanced trace evidence analysis will be covered, including impression evidence, plant material, feathers, polymers, and minerals.

FIS-I 511 Advanced Forensic Microscopy Laboratory (2 cr.) C: FIS-I 510. This will be a hands-on laboratory course. During this course, students will perform analysis of trace evidence. This will include a more complex use of light and comparison microscopes and instrumental microscopes. Topics will include mineral content in soil, dispersion of glass particles, physical matches and impressions of trace evidence, polymer identification and microspectrophotoscopy. Students will also participate in a mock case and trial at the conclusion of the course.

FIS-I 515 Overview of Forensic Chemistry (1 cr.) This course will cover the theory and application of forensic chemistry techniques such as spectroscopy, chromatography, spectrometry, and toxicology.

FIS-N 580 Forensic Science Laboratory Management (2 cr.) Fall. This course focuses on management of forensic science laboratories: various organizational models, budgeting, and common laboratory policies. Differences in the management style for public and private sector laboratories, strategies for employee recruitment, training, and retention, managing workflow and maintaining compliance with accreditation bodies.

FIS-I 520 Chemical Analysis of Alcohol and Drugs (3 cr.) P: Forensic and Investigative Science graduate student or Chemistry graduate student. Fall. This course will focus on the analysis and identification of commonly abused chemicals such as ethanol, controlled substances, and prescription drugs. The history, legal issues, synthesis, chemical/physical properties, and laboratory analysis of these materials will be discussed. Special topics of the students' choosing will also be included in the form of student presentations. A separate laboratory section will also be offered in which students will complete practical exercises utilizing spectroscopy, chromatography and mass spectrometry that reflect common practice in forensic science laboratories.

FIS-I 521 Forensic Chemistry I Lab (1 cr.) P: Forensic and Investigative Science graduate student or Chemistry graduate student. Pre- or Co-requisite: FIS-I 520 or consent of instructor. Fall. This laboratory section includes practical exercises utilizing spectroscopy, chromatography and mass spectrometry that reflect common practice in forensic science laboratories.

FIS-I 530 Forensic Chemistry II (3 cr.) P: FIS-I 520. Spring. This course will focus on instrumental analysis of trace evidence. Mass spectrometry, chromatography, FT-IR, Raman, SEM-EDX, XRF, and microspectrophotometry will be covered. The application of these techniques to the analysis of toxicological samples and trace evidence (fibers, paint, ignitable liquids, explosives, gunshot residue, and glass) will also be covered.

FIS-I 531 Forensic Chemistry II Lab (1 cr.) P: FIS-I 521 or consent of instructor. Pre- or Co-requisite: FIS-I 530. Spring. This laboratory section will include practical laboratory exercises utilizing spectroscopy, chromatography and mass spectrometry that reflect common practice in forensic science laboratories.

FIS-I 550 Forensic Science and the Law (3 cr.) P: Forensic and Investigative Science majors only. Application of various laws and rules of evidence to the forensic sciences and how the admission of evidence derived from forensic sciences can impact the administration of justice in the United States. Topics include preparation for testimony, expert testimony, subpoenas, basic judicial processes, admissibility of scientific evidence.

FIS-I 540 Forensic Biology I (3 cr.) P: Forensic and Investigative Science graduate student or Biology graduate student. Fall. This course is an introduction to the use of biological materials to assign identity to persons associated with a crime. The course will introduce methods for the preliminary detection of biological evidence and introduce the use of DNA. The materials learned will encompass broader topics such as immunology, molecular biology, and genetics.

FIS-I 541 Forensic Biology I Lab (2 cr.) P: or C: FIS-I 540. Fall. This laboratory section includes practical exercises that reflect common practice in forensic science laboratories, including but not limited to collection and preservation of biological evidence, presumptive and confirmatory tests, DNA extraction, and PCR amplification. Open only to graduate students in the Forensic and Investigative Sciences program or by instructor permission.

FIS-I 560 Population Genetics (3 cr.) P: Prerequisite: FIS-I 430; and must be statistics or graduate student in FIS or Biology. Spring. This course will serve as an introduction to the principles of population genetics. The course will cover the theory behind population genetics

that includes a historical perspective to the current accepted models of population theory; examine the relationships between allele and genotype frequencies, and the fundamentals of molecular evolutionary genetics.

FIS-I 596 Special Topics: Forensic and Investigative Sciences (1-6 cr.) Lecture or lecture/lab courses offered on topic areas that are not part of the regular M.S. #curriculum. These topics may include firearms and tool marks, questioned documents, forensic #pathology, fingerprints, and others. They are electives in the M.S. in Forensic Sciences program.

FIS-I 595 Internship to Forensic Science (1-6 cr.) The internship provides students with an opportunity to experience the workings of a practicing forensic science laboratory. Although a research project is usually the centerpiece of the internship experience, students will be given an exposure to all sections of the laboratory including case management. Students will also have an opportunity to attend a crime scene as an observer and to attend court to observe a forensic scientist offer expert testimony.

FIS-N 570 Laboratory Project Design (2 cr.) P: Forensic and Investigative Science majors only. Design of a laboratory study to include a literature search into a forensic science topic, experimental plan, and final presentation, and a grant proposal.

FIS-I 590 Seminar (1 cr.) Spring. Weekly seminars presented by FIS faculty, visiting faculty and FIS graduate students. Required for graduate students admitted into the M.S. in Forensic Science Program.

FIS-I 698 Research M.S. Thesis (1-10 cr.) P: Consent of instructor. Credit hours arranged.

FIS-N 520 Death Investigation (3 cr.) This course will provide an overview of forensic death investigations and introduce various techniques to conduct a death investigation. Topics will include forensic taphonomy, forensic entomology, forensic anthropology, forensic archeology, forensic odontology, and forensic pathology. Students will examine traumatic death investigations and perform a mock death investigation.

FIS-N 515 Law & Ethics in Forensic Science (3 cr.) This course will cover an overview of ethical standards required in forensic science. Students will learn about ethical issues in the laboratory and courtroom, be introduced to key court cases influencing forensic research and evidence analysis, and participate in documenting a case involving unethical behavior in the forensic field.

FIS-N 510 Comparative Sciences (3 cr.) This course will cover the history and general concepts of comparative science relating to forensic science. Students will be introduced to comparative science disciplines, such as fingerprints, bullets, impressions, questioned documents, and physical matches, utilized in the forensic field through techniques, procedures, analysis, and evaluation.

FIS-N 505 Criminalistics (3 cr.) This course will introduce the history and investigative methods utilized in forensic science. Cases significant to the evolution of forensic science will be evaluated, discussed. Students will analyze functions and multiple disciplines within a laboratory. Conclusions derived from analysis of evidence will be compared and results conveyed in lay terms.

FIS-N 500 Crime Scene Investigation (3 cr.) This course will introduce students to the investigative techniques used to conduct a crime scene investigation. Topics include securing and processing a crime scene, collection and preservation of physical evidence, and crime scene reconstruction. Students will develop and gain skills to perform and document a systematic crime scene search.

FIS-N 509 Forensic Microscopy Lecture (1 cr.) P: Open only to FIS graduate students. Discuss techniques used in the analysis of forensic trace evidence, such as impressions, glass, biological materials, hairs, and fibers. Topics include properties of light, compound microscopy, micrometry, refraction, dispersion, stereomicroscopy, and polarizing light microscopy.

Mathematical Sciences

Undergraduate

Lower-Division

MATH-I 001 Introduction to Algebra (4 cr.) Covers the material taught 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. This course is no longer offered at IU Indianapolis, but is retained in the catalog for historical purposes, as well as equating transfer credit as needed.

MATH-I 110 Fundamentals of Algebra (4 cr.) Intended primarily for liberal arts and business majors. 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, and inequalities. This course satisfies the prerequisites needed for MATH-M 118, MATH-M 119, MATH-I 130, MATH-I 136, and STAT-I 301.

MATH-I 111 Algebra (4 cr.) Real numbers, linear equations and inequalities, systems of equations, polynomials, exponents, and logarithmic functions. Covers material in the second year of high school algebra. This course satisfies the prerequisites needed for MATH-M 118, MATH-M 119, MATH-I 130, MATH-I 136, MATH-I 153, and STAT-I 301. MATH-I 001 (with a minimum grade of C) or placement.

MATH-M 118 Finite Mathematics (3 cr.) P: MATH-I 111 or MATH-I 110 (with a minimum grade of C-) or placement. Set theory, logic, permutations, combinations, simple probability, conditional probability, Markov chains.

MATH-M 119 Brief Survey of Calculus I (3 cr.) P: MATH-I 111 or MATH-I 110 (with a minimum grade of C-) or placement. Sets, limits, derivatives, integrals, and applications.

MATH-I 123 Elementary Concepts of Mathematics (3 cr.) Mathematics for liberal arts students; experiments and activities that provide an introduction to inductive and deductive reasoning, number sequences, functions and curves, probability, statistics, topology, metric measurement, and computers.

MATH-I 130 Mathematics for Elementary Teachers I (3 cr.) P: MATH-I 110 or MATH-I 111 taken within the

last 3 terms with a grade of C- or better or an appropriate ALEKS placement score taken within last 12 months. Numeration systems, mathematical reasoning, integers, rationals, reals, properties of number systems, decimal and fractional notations, and problem solving.

MATH-I 131 Mathematics for Elementary Teachers II (3 cr.) P: MATH-I 130 or MATH-I 136 taken within the last 3 terms with a grade of C- or better or an appropriate ALEKS placement score taken within last 12 months. Number systems: numbers of arithmetic, integers, rationals, reals, mathematical systems, decimal and fractional notations; probability, simple and compound events, algebra review.

MATH-I 132 Mathematics for Elementary Teachers III (3 cr.) P: MATH-I 130 taken within the last 3 terms with a minimum grade of C- or better or an appropriate ALEKS placement score taken within last 12 months. Rationals, reals, geometric relationships, properties of geometric figures, one-, two-, and three-dimensional measurement, and problem solving.

MATH-I 136 Mathematics for Elementary Teachers (6 cr.) P: MATH-I 110 or MATH-I 111 taken within the last 3 terms with a grade of C- or better or an appropriate ALEKS placement score taken within last 12 months. MATH-I 136 is a one-semester version of MATH-I 130 and MATH-I 132. Not open to students with credit in MATH-I 130 or MATH-I 132.

MATH-I 153 College Algebra (3 cr.) P: MATH-I 111 (not MATH-I 110) taken within last 3 terms with a grade of C or better or an appropriate ALEKS placement score taken within last 12 months. MATH-I 153 / MATH-I 154 is a two-semester version of MATH-I 159. Not open to students with credit in MATH-I 159. This course covers college-level algebra and, together with MATH-I 154, provides preparation for MATH-I 165, MATH-I 221, MATH-I 231, and MATH-I 241.

MATH-I 154 Trigonometry (3 cr.) P: MATH-I 153 with a grade of C or better taken within the last 3 terms. MATH-I 153 / MATH-I 154 is a two-semester version of MATH-I 159. Not open to students with credit in MATH-I 159. This course covers college-level trigonometry and, together with MATH-I 153, provides preparation for MATH-I 165, MATH-I 221, MATH-I 231, and MATH-I 241.

MATH-I 159 Precalculus (5 cr.) P: MATH-I 111 (not MATH-I 110) taken within the last 3 terms with a grade of B or better or an appropriate ALEKS placement score taken within the last 12 months. MATH-I 159 is a one-semester version of MATH-I 153 / MATH-I 154. Not open to students with credit in MATH-I 153 or MATH-I 154. This course covers college-level algebra and trigonometry and provides preparation for MATH-I 165, MATH-I 221, MATH-I 231, and MATH-I 241.

MATH-I 165 Analytic Geometry and Calculus I (4 cr.) P: MATH-I 159 (or MATH-I 153 and MATH-I 154) taken within the last 3 terms with a grade of C or better or an appropriate ALEKS placement score taken within last 12 months. Introduction to differential and integral calculus of one variable, with applications.

MATH-S 165 Honors Analytic Geometry and Calculus I (4 cr.) P: MATH-I 159 or MATH-I 153 and MATH-I 154 and consent of instructor. This course covers the same topics as MATH-I 165. However, it is intended for students having a strong background in mathematics who wish to study the concepts of calculus in more depth and who are seeking mathematical challenge.

MATH-I 166 Analytic Geometry and Calculus II (4 cr.) P: MATH-I 165 taken within the last 3 terms with a grade of C- or better. Continuation of MATH-I 165. Inverse functions, exponential, logarithmic, and inverse trigonometric functions. Techniques of integration, applications of integration, differential equations, and infinite series.

MATH-S 166 Honors Analytic Geometry and Calculus II (4 cr.) P: MATH-S 165 (with a minimum grade of B-) or MATH-I 165 (with a minimum grade of A-), and consent of instructor. This course covers the same topics as MATH-I 166. However, it is intended for students having a strong interest in mathematics who wish to study the concepts of calculus in more depth and who are seeking mathematical challenge.

MATH-I 171 Multidimensional Mathematics (3 cr.) P: MATH-I 159 or (MATH-I 153 and MATH-I 154) taken within the last 3 terms with a grade of C or better or an appropriate ALEKS score taken within last 12 months. An introduction to mathematics in more than two dimensions. Graphing of curves, surfaces and functions in three dimensions. Two and three dimensional vector spaces with vector operations. Solving systems of linear equations using matrices. Basic matrix operations and determinants.

MATH-I 190 Topics in Mathematics for First Year Students (1-3 cr.) P: Prerequisites and course material vary with the topics. Treats topics in mathematics at the freshman level.

MATH-I 221 Calculus for Technology I (3 cr.) P: MATH-I 159 (or MATH-I 153 and MATH-I 154) taken within last 3 terms with a grade of C or better or an appropriate ALEKS score taken within last 12 months. Analytic geometry, the derivative and applications, and the integral and applications.

MATH-I 222 Calculus for Technology II (3 cr.) P: MATH-I 221 or equivalent taken within the last 3 terms with a grade of C- or better. Differentiation of transcendental functions, methods of integration, power series, Fourier series, and differential equations.

MATH-I 231 Calculus for Life Sciences I (3 cr.) P: MATH-I 159 (or MATH-I 153 and MATH-I 154) taken within the last 3 terms with a grade of C or better or an appropriate ALEKS placement score taken within last 12 months. Limits, derivatives and applications. Exponential and logarithmic functions. Integrals, antiderivatives, and the Fundamental Theorem of Calculus. Examples and applications are drawn from the life sciences.

MATH-I 232 Calculus for Life Sciences II (3 cr.) P: MATH-I 231 or equivalent taken within the last 3 terms with a grade of C- or better. Matrices, functions of several variables, differential equations and solutions with applications. Examples and applications are drawn from the life sciences.

MATH-I 241 Calculus for Data Science I (3 cr.) P: MATH-I 153 and MATH-I 154 or MATH-I 159, with a grade of C or better, taken within the past 12 months; or a recent proficiency/placement test indicating placement

into a trigonometry-based calculus course This is the first course in a three-course sequence for data science majors. Topics include: functions, limits, epsilon-delta argument, differentiation and applications to data science, anti-derivatives, Fundamental Theorem of Calculus, introduction to integration, and inverse functions.

MATH-I 242 Calculus for Data Science II (3 cr.) P: MATH-I 241 or equivalent Calculus I course with a grade of C- or better. This is the second course in a three-course sequence for data science majors. Topics include: transcendental functions, techniques of integration, improper integrals, applications to data science, probability and expected value, introduction to differential equations, infinite series and power series, partial derivatives, and multiple integrals.

MATH-I 243 Linear Algebra for Data Science (3 cr.) P: MATH-I 153 and MATH-I 154 with a grade of C or better or MATH-I 159 with a grade of C or better or an appropriate ALEKS placement score taken within last 12 months. This is the third course in a three-course sequence for data science majors. Topics include: vectors, systems of linear equations, matrices, vector spaces, linear transformations, determinants, eigenvalues and eigenvectors, and applications to data science.

MATH-I 261 Multivariate Calculus (4 cr.) P: MATH-I 165, MATH-I 166 and MATH-I 171 taken within the last 3 terms with grades of C- or better. Spatial analytic geometry, vectors, space curves, partial differentiation, applications, multiple integration, vector fields, line integrals, Green's theorem, Stokes' theorem, and the Divergence Theorem. An honors option may be available in this course.

MATH-S 261 Honors Multivariate Calculus (4 cr.) P: MATH-I 166 or MATH-S 166 with a minimum grade of B and MATH-I 171 and permission of the instructor. This is an honors level version of third semester calculus (MATH-I 261). It is intended for students who have strong motivation and a desire for additional challenge. The theory of multivariate calculus is developed as rigorously as possible and studied in greater depth than in MATH-I 261.

MATH-I 266 Ordinary Differential Equations (3 cr.) P: MATH-I 165, MATH-I 166 and MATH-I 171 taken within the last 3 terms with grades of C- or better. First order equations, second and n-th order linear equations, series solutions, solution by Laplace transform, systems of linear equations.

MATH-I 276 Discrete Math (3 cr.) P: MATH-I 165 or MATH-S 165 or MATH-I 166 or MATH-S 166 or MATH-I 221 or MATH-I 231 or MATH-I 241 or MATH-I 261 with a grade of C or better, or consent of instructor. Sets and functions. Counting techniques. Binomial coefficients and the binomial theorem. Sequences and recurrence relations. Mathematical induction. Introduction to graph theory.

MATH-I 290 Topics in Mathematics for Sophomores (1-3 cr.) P: Prerequisites and course material vary with the topics. Treats topics in mathematics at the sophomore level.

SCI-M 100 Strategies for Success in College Mathematics (3 cr.) P: Enrollment is this class is by authorization and is based on mathematics placement test scores and grades in high school mathematics classes. It is expected that students have an ALEKS placement score of below 20 within the last 12 months or a math SAT score of below 500 (or comparable ACT score). Students will develop strategies for learning and retaining college level mathematical concepts and procedures. Techniques for overcoming math anxiety and test anxiety will also be learned. Appropriate mathematical content will be taught to provide the students the opportunity to practice their new learning strategies and test-taking techniques.

SCI-M 100 Strategies for Success in College Mathematics (3 cr.) P: Enrollment is this class is by authorization and is based on mathematics placement test scores and grades in high school mathematics classes. It is expected that students have an ALEKS placement score of below 20 within the last 12 months or a math SAT score of below 500 (or comparable ACT score). Students will develop strategies for learning and retaining college level mathematical concepts and procedures. Techniques for overcoming math anxiety and test anxiety will also be learned. Appropriate mathematical content will be taught to provide the students the opportunity to practice their new learning strategies and test-taking techniques.

Upper-Division

MATH-I 300 Logic and the Foundations of Algebra (3 cr.) P: MATH-I 166 and MATH-I 171 with a grade of C or better, and MATH-I 276. Logic and the rules of reasoning, theorem proving. Applications to the study of the integers; rational, real, and complex numbers; and polynomials. Bridges the gap between elementary and advanced courses. This is a prerequisite for 300-level and 400-level pure mathematics courses.

MATH-I 321 Elementary Topology (3 cr.) P: MATH-I 261. Introduction to topology, including metric spaces, abstract topological spaces, continuous functions, connectedness, compactness, curves, Cantor sets, continua, and the Baire Category Theorem. Also, an introduction to surfaces, including spheres, tori, the Mobius band, the Klein bottle and a description of their classification.

MATH-I 333 Chaotic Dynamical Systems (3 cr.) P: MATH-I 166 or MATH-I 222 or MATH-I 232. The goal of the course is to introduce some of the spectacular new discoveries that have been made in the past twenty years in the field of mathematics known as dynamical systems. It is intended for undergraduate students in mathematics, science, or engineering. It will include a variety of computer experiments using software that is posted on the Web.

MATH-I 351 Elementary Linear Algebra (3 cr.) P: MATH-I 166 and MATH-I 171. Not open to students with credit in MATH-I 511. Systems of linear equations, matrices, vector spaces, linear transformations, determinants, inner product spaces, eigenvalues, and applications.

MATH-I 353 Linear Algebra II with Applications (3 cr.) P: MATH-I 351 or MATH-I 511. This course involves the development of mathematics with theorems and their proofs. This course also includes several important applications, which will be used to create a mathematical model, prove theorems that lead to the solution of

problems in the model, and interpret the results in terms of the original problem.

MATH-I 354 Linear Algebra II for Data Science (3 cr.) P: MATH-I 243 or MATH-I 351 or MATH-I 511 or consent of instructor. In this course, we will explore a number of contemporary applications of linear algebra (all of which have arisen since the dawn of the Internet Age and most are still under development) in information retrieval, website ranking, text processing, community detection, pattern recognition, and recommender systems for e-commerce, all largely based on matrix factorizations, that should be of interest to students in pure and applied mathematics, actuarial science, computer & information science, and engineering.

MATH-I 366 Ordinary Differential Equations (3 cr.) P: Prerequisites: MATH-I 165 and MATH-I 166 and MATH-I 171 with a grade of C or better in each course. C: Corequisite: MATH-I 351. Introduction to differential equations for students majoring in Mathematics. Ordinary differential equations, first and second order equations, linear systems, series solutions, existence and uniqueness, numerical methods, applications to physical problems. Will be required of majors in Pure and Applied Mathematics Concentrations starting Fall 2024.

MATH-I 373 Financial Mathematics (3 cr.) P: MATH-I 261. Fundamental concepts of financial mathematics and economics, and their application to business situations and risk management. Valuing investments, capital budgeting, valuing contingent cash flows, modified duration, convexity, immunization, financial derivatives. Provides preparation for the SOA/CAS Exam FM/2.

MATH-I 390 Topics in Mathematics for Juniors (1-3 cr.) P: Prerequisites and course material vary with the topics. Treats topics in mathematics at the junior level.

MATH-I 398 Internship in Professional Practice (0-3 cr.) P: Approval of Department of Mathematical Sciences. Professional work experience involving significant use of mathematics or statistics. Evaluation of performance by employer and Department of Mathematical Sciences. May count toward major requirements with approval of the Department of Mathematical Sciences for a total of 6 credits.

MATH-I 414 Numerical Methods (3 cr.) P: MATH-I 266 or MATH-I 366 and a course in a high-level programming language. Error analysis, solution of nonlinear equations, direct and iterative methods for solving linear systems, approximation of functions, numerical differentiation and integration, and numerical solution of ordinary differential equations.

MATH-I 421 Linear Programming and Optimization Techniques (3 cr.) P: MATH-I 266 or MATH-I 366, and MATH-I 351. This course covers a variety of topics in operations research, including solution of linear programming problems by the simplex method, duality theory, transportation problems, assignment problems, network analysis, dynamic programming.

MATH-I 423 Discrete Modeling (3 cr.) P: MATH-I 266 or MATH-I 366, and MATH-I 243 or MATH-I 351 or MATH-I 511, or consent of instructor. Discrete time mathematical modeling, linear and nonlinear difference equations, Markov processes and their long run behavior. Applications to dynamical phenomena in various disciplines, including biology and economics.

MATH-I 425 Elements of Complex Analysis (3 cr.) P: MATH-I 261. Complex numbers and complex-valued functions; differentiation of complex functions; power series, uniform convergence; integration, contour integrals; elementary conformal mapping.

MATH-I 426 Introduction to Applied Mathematics and Modeling (3 cr.) P: MATH-I 266 or MATH-I 366, and PHYS-I 152. Introduction to problems and methods in applied mathematics and modeling. Formulation of models for phenomena in science and engineering, their solutions, and physical interpretation of results. Examples chosen from solid and fluid mechanics, mechanical systems, diffusion phenomena, traffic flow, and biological processes.

MATH-I 444 Foundations of Analysis (3 cr.) P: MATH-I 261 and MATH-I 300. Set theory, mathematical induction, real numbers, completeness axiom, open and closed sets in Rm, sequences, limits, continuity and uniform continuity, inverse functions, differentiation of functions of one and several variables.

MATH-I 445 Foundations of Analysis II (3 cr.) P: MATH-I 444. Continuation of differentiation, the mean value theorem and applications, the inverse and implicit function theorems, the Riemann integral, the fundamental theorem of calculus, point-wise and uniform convergence, convergence of infinite series, and series of functions.

MATH-I 453 Beginning Abstract Algebra (3 cr.) P: MATH-I 351 and MATH-I 300. Basic properties of groups, rings,and fields, with special emphasis on polynomial rings.

MATH-I 454 Galois Theory (3 cr.) P: MATH-I 453. An introduction to Galois Theory, covering both its origins in the theory of roots of polynomial equation and its modern formulation in terms of abstract algebra. Topics include field extensions and their symmetries, ruler and compass constructions, solvable groups, and the solvability of polynomial equations by radical operations.

MATH-I 456 Introduction to the Theory of Numbers (3 cr.) P: MATH-I 261. Divisibility, congruences, quadratic residues, Diophantine equations, and the sequence of primes.

EDUC-M 457 Methods of Teaching Senior High/Junior High/Middle School Mathematics (3 cr.) P: 30 credit hours of mathematics. Study of methodology, heuristics of problem solving, curriculum design, instructional computing, professional affiliations, and teaching of daily lessons in the domain of secondary and/or junior high/ middle school mathematics.

MATH-I 462 Elementary Differential Geometry (3 cr.) P: MATH-I 351. Calculus and linear algebra applied to the study of curves and surfaces. Curvature and torsion, Frenet-Serret apparatus and theorem, and fundamental theorem of curves. Transformation of R2, first and second fundamental forms of surfaces, geodesics, parallel translation, isometries, and fundamental theorem of surfaces.

MATH-I 463 Intermediate Euclidean Geometry for Secondary Teachers (3 cr.) P: MATH-I 300. History

of geometry. Ruler and compass constructions, and a critique of Euclid. The axiomatic method, models, and incidence geometry. Presentation, discussion and comparison of Hilbert's, Birkhoff's, and SMSG's axiomatic developments. Discussion of the teaching of Euclidean geometry.

MATH-I 490 Topics in Mathematics for Undergraduates (1-5 cr.) P: By arrangement. Open to students only with the consent of the department. Supervised reading and reports in various fields.

MATH-I 491 Seminar in Competitive Math Problem-Solving (1-3 cr.) P: Approval of the director of undergraduate programs is required. This seminar is designed to prepare students for various national and regional mathematics contests and examinations such as the Putnam Mathematical Competition, the Indiana College Mathematical Competition and the Mathematical Contest in Modeling (MCM), among others. May be repeated twice for credit.

MATH-I 492 Capstone Experience (1-3 cr.) By arrangement. Must submit Course Request Form.

MATH-I 495 TA Instruction (0 cr.) For teaching assistants. Intended to help prepare TAs to teach by giving them the opportunity to present elementary topics in a classroom setting under the supervision of an experienced teacher who critiques the presentations.

MATH-M 445 Probability Theory for Risk Management (3 cr.) P: P: MATH-M 360 or MATH-M 463, with a minimum grade of C (2.00). Single and multivariate probability distributions, functions of random variables, mixed distributions, probability inequalities, basic concepts of risk management and insurance, probability models and methods for quantitative risk assessment, preparation for SOA/CAS Exam P/1.

MATH-M 463 Introduction to Probability I (3 cr.) P: (MATH-M 301 or MATH-M 303 or MATH-I 351 or MATH-I 511) and (MATH-M 311 or MATH-I 261 or MATH-S 261). Counting techniques, the meaning of probability. Random experiments, conditional probability, independence. Random variables, expected values and standard deviations, moment generating functions, important discrete and continuous distributions. Poisson processes. Multivariate distributions, basic limit laws such as the central limit theorem.

MATH-M 466 Introduction to Mathematical Statistics (3 cr.) P: MATH-M 463 or consent of instructor. Rigorous mathematical treatment of problems in sampling and statistical inference. Method of maximum likelihood, efficiency, sufficient statistics, exponential family distributions, likelihood ratio tests, most powerful tests, minimum variance unbiased estimators, shortest confidence intervals, linear models and analysis of variance, nonparametric methods.

MATH-M 303 Linear Algebra for Undergraduates (3 cr.) P: MATH-M 230 or MATH-M 216 or equivalent. Introduction to the theory of real vector spaces. Coordinate systems, linear dependence, bases. Linear transformations and matrix calculus. Determinants and rank. Eigenvalues and eigenvectors.

MATH-M 320 Theory of Interest (3 cr.) P: P: MATH-I 165 or equivalent, with a grade of C or better. Measurement of interest; accumulation and discount; equations of value; annuities; perpetuities; amortization and sinking funds; yield rates; bonds and other securities; installment loans; depreciation, depletion, and capitalized cost.

MATH-M 446 Financial Mathematics (3 cr.) P: P: MATH-M 320 with a minimum grade of C-. This course is a continuation of a first semester in Theory of Interest and prepares students for the second professional actuarial examination. Topics include the rate of return of an investment, term structure of interest rates, cash flow duration, cash flow convexity and immunization.

Advanced Undergraduate and Graduate

MATH-I 504 Real Analysis (3 cr.) P: MATH-I 444. Completeness of the real number system, basic topological properties, compactness, sequences and series, absolute convergence of series, rearrangement of series, properties of continuous functions, the Riemann-Stieltjes integral, sequences and series of functions, uniform convergence, the Stone-Weierstrass theorem, equicontinuity, and the Arzela-Ascoli theorem.

MATH-I 505 Intermediate Abstract Algebra (3 cr.) P: MATH-I 453. Group theory with emphasis on concrete examples and applications. Field theory: ruler and compass constructions, Galois theory, and solvability of equations by radicals.

MATH-I 510 Vector Calculus (3 cr.) P: MATH-I 261. Calculus of functions of several variables and of vector fields in orthogonal coordinate systems. Optimization problems, implicit function theorem, Green's theorem, Stokes's theorem, divergence theorems, and applications to engineering and the physical sciences.

MATH-I 511 Linear Algebra with Applications (3 cr.) P: MATH-I 261. Not open to students with credit in MATH-I 351. Matrices, rank and inverse of a matrix, decomposition theorems, eigenvectors, unitary and similarity transformations on matrices.

MATH-I 514 Numerical Analysis (3 cr.) P: MATH-I 266 or MATH-I 366, and MATH-I 351 or MATH-I 511, or consent of instructor and familiarity with one of the high-level programming languages: Fortran 77/90/95, C, C++, Matlab. Numerical Analysis is concerned with finding numerical solutions to problems, especially those for which analytical solutions do not exist or are not readily obtainable. This course provides an introduction to the subject and treats the topics of approximating functions by polynomials, solving linear systems of equations, and of solving nonlinear equations. These topics are of great practical importance in science, engineering and finance, and also have intrinsic mathematical interest. The course concentrates on theoretical analysis and on the development of practical algorithms.

MATH-I 518 Advanced Discrete Mathematics (3 cr.) P: MATH-I 266 or MATH-I 366. This course covers mathematics useful in analyzing computer algorithms. Topics include recurrence relations, evaluation of sums, integer functions, elementary number theory, binomial coefficients, generating functions, discrete probability, and asymptotic methods.

MATH-I 520 Boundary Value Problems of Differential Equations (3 cr.) P: MATH-I 261, and MATH-I 266 or MATH-I 366. Sturm-Liouville theory, singular boundary

conditions, orthogonal expansions, separation of variables in partial differential equations, and spherical harmonics.

MATH-I 522 Qualitative Theory of Differential Equations (3 cr.) P: MATH-I 266 and MATH-I 351. Nonlinear ODEs, critical points, stability and bifurcations, perturbations, averaging, nonlinear oscillations and chaos, and Hamiltonian systems.

MATH-I 523 Introduction to Partial Differential Equations (3 cr.) P: MATH-I 266 or MATH-I 366, and MATH-I 261 or MATH-I 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, and Poisson integral method for elliptic equations.

MATH-I 525 Introduction to Complex Analysis (3 cr.) P: MATH-I 261, and MATH-I 266 or MATH-I 366. Instructor consent required for any undergraduate student. Complex numbers and complex-valued functions; differentiation of complex functions; power series, uniform convergence; integration, contour integrals; and elementary conformal mapping.

MATH-I 526 Principles of Mathematical Modeling (3 cr.) P: MATH-I 266 or MATH-I 366, and MATH-I 426. 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-I 528 Advanced Mathematics for Engineering and Physics II (3 cr.) P: MATH-I 537. Divergence theorem, Stokes' Theorem, complex variables, contour integration, calculus of residues and applications, conformal mapping, and potential theory.

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

MATH-I 531 Functions of a Complex Variable II (3 cr.) P: MATH-I 530. Compactness and convergence in the space of analytic functions, Riemann mapping theorem, Weierstrass factorization theorem, Runge's theorem, Mittag-Leffler theorem, analytic continuation and Riemann surfaces, and Picard theorems.

MATH-I 535 Theoretical Mechanics (3 cr.) P: MATH-I 266 or MATH-I 366, and MATH-I 351 or MATH-I 511, or consent of the instructor. Continuum mechanics deals with the analysis of the motion of materials modeled as a continuous mass rather than as discrete particles. Applications of continuum mechanics are ubiquitous in science and engineering, and are getting more and more popular in medicine too. The goal of this course is to study the basic principles of continuum mechanics for deformable bodies, including conservation laws and constitutive equations, while discussing the mathematical challenges in solving these equations analytically and/or numerically.

MATH-I 537 Applied Mathematics for Scientists and Engineers I (3 cr.) P: MATH-I 261, and MATH-I 266 or MATH-I 366. Covers theories, techniques, and applications of partial differential equations, Fourier transforms, and Laplace transforms. Overall emphasis is on applications to physical problems.

MATH-I 544 Real Analysis and Measure Theory (3 cr.) P: MATH-I 444. Algebras of sets, real number system, Lebesgue measure, measurable functions, Lebesgue integration, differentiation, absolute continuity, Banach spaces, metric spaces, general measure and integration theory, and Riesz representation theorem.

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

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

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

MATH-I 549 Applied Mathematics for Secondary School Teachers (3 cr.) P: MATH-I 266 or MATH-I 366, and MATH-I 351. Applications of mathematics to problems in the physical sciences, social sciences, and the arts. Content varies. May be repeated for credit with the consent of the instructor. Course is offered on an as needed basis.

MATH-I 552 Applied Computational Methods II (3 cr.) P: MATH-I 559 and consent of instructor. The first part of the course focuses on numerical integration techniques and methods for ODEs. The second part concentrates on numerical methods for PDEs based on finite difference techniques with brief surveys of finite element and spectral methods.

MATH-I 553 Introduction to Abstract Algebra (3 cr.) P: MATH-I 453. Group theory: finite abelian groups, symmetric groups, Sylow theorems, solvable groups, Jordan-Holder theorem. Ring theory: prime and maximal ideals, unique factorization rings, principal ideal domains, Euclidean rings, and factorization in polynomial and Euclidean rings. Field theory: finite fields, Galois theory, and solvability by radicals.

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

MATH-I 555 Introduction to Biomathematics (3 cr.) P: MATH-I 266 or MATH-I 366, MATH-I 351 or MATH-I 511, MATH-I 426, or consent of instructor. The class will explore how mathematical methods can be applied to study problems in life-sciences. No prior knowledge of life-sciences is required. Wide areas of mathematical biology will be covered at an introductory level. Several selected topics, such as dynamical systems and partial

differential equations in neuroscience and physiology, and mathematical modeling of biological flows and tissues, will be explored in depth.

MATH-I 559 Applied Computational Methods I (3 cr.) P: MATH-I 266 or MATH-I 366, and MATH-I 351 or MATH-I 511. Computer arithmetic, interpolation methods, methods for nonlinear equations, methods for solving linear systems, special methods for special matrices, linear least square methods, methods for computing eigenvalues, iterative methods for linear systems; methods for systems of nonlinear equations.

MATH-I 561 Projective Geometry (3 cr.) P: MATH-I 351. Projective invariants, Desargues' theorem, cross-ratio, axiomatic foundation, duality, consistency, independence, coordinates, and conics.

MATH-I 562 Introduction to Differential Geometry and Topology (3 cr.) P: MATH-I 351 and MATH-I 445. Smooth manifolds, tangent vectors, inverse and implicit function theorems, submanifolds, vector fields, integral curves, differential forms, the exterior derivative, DeRham cohomology groups, surfaces in E3, Gaussian curvature, two-dimensional Riemannian geometry, and Gauss-Bonnet and Poincare theorems on vector fields.

MATH-I 563 Advanced Geometry (3 cr.) P: MATH-I 300 or consent of instructor. Topics in Euclidean and non-Euclidean geometry.

MATH-I 567 Dynamical Systems I (3 cr.) P: MATH-I 545 and MATH-I 571. Covers the basic notions and theorems of the theory of dynamical systems and their connections with other branches of mathematics. Topics covered include fundamental concepts and examples, one-dimensional systems, symbolic dynamics, topological entropy, hyperbolicity, structural stability, bifurcations, invariant measures, and ergodicity.

MATH-I 571 Elementary Topology (3 cr.) P: MATH-I 444. Topological spaces, metric spaces, continuity, compactness, connectedness, separation axioms, nets, and function spaces.

MATH-I 572 Introduction to Algebraic Topology (3 cr.) P: MATH-I 571. Singular homology theory, Ellenberg-Steenrod axioms, simplicial and cell complexes, elementary homotopy theory, and Lefschetz fixed point theorem.

MATH-I 574 Mathematical Physics I (1-3 cr.) P: MATH-I 530 and MATH-I 545. Covers the basic concepts and theorems of mathematical theories that have direct applications to physics. Topics to be covered include special functions ODEs and PDEs of mathematical physics, groups and manifolds, mathematical foundations of statistical physics.

MATH-I 578 Mathematical Modeling of Physical Systems I (3 cr.) P: MATH-I 266 or MATH-I 366, PHYS-I 152, PHYS-I 251, and consent of instructor. Linear systems modeling, mass-spring-damper systems, free and forced vibrations, applications to automobile suspension, accelerometer, seismograph, etc., RLC circuits, passive and active filters, applications to crossover networks and equalizers, nonlinear systems, stability and bifurcation, dynamics of a nonlinear pendulum, van der Pol oscillator, chemical reactor, etc., introduction to chaotic dynamics, identifying chaos, chaos suppression and control, computer simulations, and laboratory experiments.

MATH-I 581 Introduction to Logic for Teachers (3 cr.) P: MATH-I 351. Logical connectives, rules of sentential inference, quantifiers, bound and free variables, rules of inference, interpretations and validity, theorems in group theory, and introduction to set theory.

MATH-I 583 History of Elementary Mathematics (3 cr.) P: 26100. A survey and treatment of the content of major developments of mathematics through the eighteenth century, with selected topics from more recent mathematics, including non-Euclidean geometry and the axiomatic method.

MATH-I 585 Mathematical Logic I (3 cr.) P: MATH-I 351 or an undergraduate proof course; MATH-I 587 recommended. Formal theories for propositional and predicate calculus with study of models, completeness, and compactness. Formalization of elementary number theory; Turing machines, halting problem, and the undecidability of arithmetic.

MATH-I 587 General Set Theory (3 cr.) P: MATH-I 351 or equivalent proof course in Linear Algebra. An introduction to set theory, including both so-called "naive" and formal approaches, leading to a careful development using the Zermelo-Fraenkel axioms for set theory and an in-depth discussion of cardinal and ordinal numbers, the Axiom of Choice, and the Continuum Hypothesis.

MATH-I 588 Mathematical Modeling of Physical Systems II (3 cr.) P: MATH-I 578. Depending on the interests of the students, the content may vary from year to year. Emphasis will be on mathematical modeling of a variety of physical systems. Topics will be chosen from the volumes Mathematics in Industrial Problems by Avner Friedman. Researchers from local industries will be invited to present real-world applications. Each student will undertake a project in consultation with one of the instructors or an industrial researcher.

MATH-I 598 Topics in Mathematics (1-6 cr.) By arrangement. Directed study and reports for students who wish to undertake individual reading and study on approved topics.

Graduate

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

MATH-I 612 Methods of Applied Mathematics II (3 cr.) P: MATH-I 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-I 626 Mathematical Formulation of Physical Problems I (3 cr.) P: Advanced calculus or vector calculus, partial differential equations, linear algebra. Nature of applied mathematics, deterministic systems and ordinary differential equations, random processes and partial differential equations, Fourier analysis, dimensional analysis and scaling.

MATH-I 627 Mathematical Formulation of Physical Problems II (3 cr.) P: MATH-I 626. Theories of continuous fields, continuous medium, field equations of continuum mechanics, inviscid fluid flow, viscous flow, turbulence. Additional topics to be discussed include application of the theory of dynamical systems, methods for analysis of nonlinear ordinary and partial differential equations, and others. This course is an advancement of topics covered in MATH-I 626.

MATH-I 646 Functional Analysis (3 cr.) P: MATH-I 546. Advanced topics in functional analysis, varying from year to year at the discretion of the instructor.

MATH-I 667 Dynamical Systems II (3 cr.) P: MATH-I 567. Continuation of MATH-I 567. Topics in dynamics.

MATH-I 672 Algebraic Topology I (3 cr.) P: MATH-I 572. Continuation of MATH-I 572. Cohomology, homotopy groups, fibrations, and further topics.

MATH-I 673 Algebraic Topology II (3 cr.) P: MATH-I 672. A sequel to MATH-I 672 covering further advanced topics in algebraic differential topology such as K-theory and characteristic classes.

MATH-I 674 Mathematical Physics II (3 cr.) P: MATH-I 574. Continuation of MATH-I 574 Mathematical Physics I. Students will learn more advanced notions and theorems of various mathematical theories that have direct applications to physics.

MATH-I 692 Topics in Applied Mathematics (1-3 cr.) Research topics of current interest in applied mathematics to be chosen by the instructor.

MATH-I 693 Topics in Analysis (1-3 cr.) P: Department consent required. Research topics in analysis and their relationships to other branches of mathematics. Topics of current interest will be chosen by the instructor.

MATH-I 694 Topics in Differential Equations (1-3 cr.) P: MATH-I 554 and MATH-I 530. Department consent required. Research topics in differential equations related to physics and engineering. Topics of current interest will be chosen by the instructor.

MATH-I 697 Topics in Topology (1-3 cr.) Research topics in topology and their relationships to other branches of mathematics. Topics of current interest will be chosen by the instructor.

MATH-I 699 Research Ph.D. Thesis (variable cr.)

MATH-I 698 Research M.S. Thesis (1-6 cr.) Students conduct original research under the direction of a member of the graduate faculty leading to a Masters Thesis. This course is eligible for a deferred grade. Course may be repeated for credit.

Neuroscience

NSCI-B 101 Exploring the Brain (3 cr.) This course will help students understand normal brain function and the diseased, drug affected, damaged or cognitively compromised brain. Emphasis is placed on maintaining healthy brain function and maximizing performance. NSCI-B 101 is a non-majors introductory course for first-year and sophomore students. Students planning to major/minor in neuroscience must take NSCI-B 201.

NSCI-B 201 Foundations of Neuroscience (3 cr.) P: PSY-B 110 or BIOL-K 101. An introduction to Neuroscience that explores how our brains develop, how they work and how they are changed by life experiences. Topics include neural communication, localization of brain function, neural systems and control behavior.

NSCI-B 301 Systems Neuroscience (3 cr.) P: PSY-B 201 or NSCI-B 201. This course will focus on how our brains allow us to sense, move, feel, and think, with an emphasis on modern concepts and methods in integrative neuroscience. Topics include sensory and motor systems, motivation and emotion, brain rhythms, language, brain development, and learning and memory.

NSCI-B 394 Drugs and Behavior (3 cr.) P: PSY-B 110 or equivalent. An introduction to the use and abuse of alcohol and other psychoactive drugs. Topics include theories of alcohol and other drug use, neurobiology and the factors that influence use, abuse, and addiction. Addiction assessment, recovery, treatment, relapse and prevention are also covered.

NSCI-B 398 Brain Mechanisms of Behavior (3 cr.) P: PSY-B 301 or PSY-B 320 or equivalent. An advanced topical survey of the neurobiological basis of behavior, focusing on the neural substrates and the cellular and neurochemical processes underlying emotions, motivation and goal-directed behavior, hedonic experience, learning, and cognitive function. Integrates experimental research across different levels of analysis (genetic, molecular, cellular, neural systems).

NSCI-I 535 Clinical Neuroscience (3 cr.) P: Consent of instructor. Course will examine how psychology, neuroscience, pharmacology, and medicine come together to manage mental illness. Systematic examination of mental illness and the nature of how biological alterations lead to aberrant behaviors that define psychopathology. The course will heavily discuss the ethics involved in the field of Clinical Neuroscience.

NSCI-I 545 Psychopharmacology (3 cr.) P: PSY-I 615 or consent of instructor. A survey of the effects of drugs on behavior, cognitive functioning and emotions. Emphasis on the practical advantages of understanding how psychotropic drugs work, and on how the brain functions in health and disease. Students will be exposed to the most current theories and research in the field.

NSCI-K 416 Cellular and Molecular Neuroscience (3 cr.) P: BIOL-K 324. Course provides an in-depth analysis of topics within the field of cellular and molecular neuroscience. It will cover invertebrate and vertebrate neurobiology, cell and molecular biology of the neuron, neurophysiology, neuroanatomy, developmental neurobiology, regeneration and degeneration, learning and memory, and will include comparisons of neural mechanisms throughout the animal kingdom.

NSCI-K 417 Neuroanatomy Laboratory (2 cr.) P: BIOL-K 101 with a C or better. Recommended: NSCI-B 301, BIOL-N 261, and BIOL-N 217 (recommended, but not required). The course goal is to cover general principles of development, gross anatomical structures, blood supply, ventricles and cerebrospinal fluid flow, sensory and motor systems, major nuclei and tracts and histological features. Students will pair anatomical with functional

knowledge and supplement with relevant clinical case studies throughout the course.

NSCI-K 451 Neuropharmacology (3 cr.) P: BIOL-K 324 recommended or completion of upper-level biochemistry course. Focuses on molecular underpinnings of neuropharmacology. Basic principles of neuropharmacology. How drugs bind to their targets. Evaluate how neurons communicate with each other and how those signals are transduced on a molecular level. Evaluate drugs actions in the brain and major neurotransmitters. Neuronal dysfunction in various disorders and pharmacological treatments.

NSCI-K 488 Endocrinology in Health and Disease (3 cr.) P: BIOL-K 103 and BIOL-K 324 and BIOL-K 322 or equivalent. An introduction to human endocrinology, including the biology of the major endocrine organs and the roles of the hormones that they release. Both normal endocrine function and common diseases involving hormone physiology are examined. In addition, the course examines how endocrinology impacts everyday life.

NSCI-N 195 Introductory Topics in Neuroscience (0-3 cr.) P: Consent of instructor. Other prerequisites may be announced at the time of the topic offering. Lectures on topics in Neuroscience.

NSCI-N 295 Intermediate Topics in Neuroscience (0-3 cr.) P: Consent of instructor. Other prerequisites may be announced at the time of the topic offering. Lectures on topics in Neuroscience.

NSCI-N 395 Advanced Topics in Neuroscience (0-3 cr.) P: Consent of instructor. Other prerequisites may be announced at the time of the topic offering. Lectures on topics in Neuroscience.

NSCI-N 397 Understanding Drug Culture Study Abroad (0-3 cr.) C: PSY-B 394. Introduction to issues surrounding substance use and mental health in a host country. Emphasis on low-and middle-income countries. Investigate barriers to solving problems of alcohol/drug abuse, mental health treatment and economic and social causal factors. Research addiction issues, examine roles of local and national governments, international agencies, and third-party interventionists.

NSCI-N 490 Capstone Independent Library Research (3-10 cr.) P: Senior Standing and (NSCI-K 416 or BIOL-K 416). Library Research is done with a faculty member on contemporary issues in neuroscience. This course may include research of a topic agreed upon by the student and the faculty member. A well-written paper between 15-17 pages centered on the topic must be turned in at the end of the semester. Repeatable.

NSCI-N 491 Capstone Laboratory in Behavioral Neuroscience (3 cr.) P: NSCI-B 201 or NSCI-B 301. Senior neuroscience majors. Enhance critical thinking skills in experimental approaches to behavioral neuroscience, understand translational neuroscience through model systems, advance understanding of quantitative and analytic approaches studying the links between brain and behavior, ability to evaluate and communicate knowledge about neuroscience, develop skills in collaborative learning, generate career development tools.

NSCI-N 492 Capstone in Computational Neuroscience (3 cr.) P: (NSCI-B 301 or PSY-B 301) and PSY-B 305 and (MATH-I 166 or MATH-S 166 or MATH-I 222 or MATH-I 232 or MATH-I 242) and (CSCI-N 200 or CSCI-N 201 or CSCI-N 207 or CSCI-C 200). How does the brain perform the computations necessary to facilitate the vast array of experiences and cognitive functions that we are capable of? Discussion of approaches used to measure neural activity and an introduction to neural computation. Topics will have broad application across numerous scientific fields from medicine to computing.

NSCI-N 493 Capstone Independent Laboratory Research (3 cr.) P: PSY-B 305 and NSCI-K 416 or BIOL-K 416 and senior standing. Laboratory Research is done with a faculty member on contemporary issues in neuroscience. This course may include lecture, laboratory, reading assignments and special projects. A senior thesis in the format of a research article or e-portfolio centered on the research must be turned in at the end of the project.

NSCI-N 495 Special Topics in Neuroscience (0-3 cr.) P: Consent of instructor. Other prerequisites may be announced at the time of the topic offering. Lectures on topics in Neuroscience.

NSCI-I 544 Sensory Systems (3 cr.) P: BIOL-K 324. Students will gain an understanding of the mechanisms that underlie sensory perception at the molecular, cellular, and systems level. Examination of how forms of energy are transduced into the electrochemical messages of the nervous system, pathways the information travels within the nervous system and how this information is processed/perceived.

NSCI-I 559 Endocrinology (3 cr.) P: BIOL-I 556 or equivalent and CHEM-C342. The study of hormone function. Consideration will be given to the role of hormones in growth, development, metabolism, homeostasis, and reproduction.

NSCI-I 560 Clinical and Molecular Aspects of Neurodegenerative Diseases (3 cr.) P: BIOL-K 416 or BIOL-K 451 or equivalent or consent of instructor. The molecular and clinical aspects of neurodegenerative diseases. Introduction of critical brain structures, with a focus on neurons and glia and evaluation of molecular mechanisms that underlie protein aggregation and cell death. The remainder of the course will focus on the multiple aspects of specific neurodegenerative diseases.

NSCI-I 561 Immunology (3 cr.) P: BIOL-K 103 and CHEM-C 341. Introduction to the basic principles and experimentation in cellular and humoral immunology.

NSCI-I 571 Developmental Neurobiology (3 cr.) P: Consent of instructor. The major phases of nervous system development beginning with neurulation and 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.

NSCI-N 496 Clinical Experiential Neuroscience Capstone (1-3 cr.) P: NSCI-B 301 or BIOL-K 324 or NSCI-K 416 with a grade of C- or better and senior standing. Fall. This capstone is designed for students

who are interested in health-related professional careers. Students participate in a clinical setting to combine knowledge of neuroscience with internship experience. Students will be evaluated by participation, presentations, and an e-portfolio that integrates undergraduate and capstone experiences with career goals.

NSCI-N 494 Capstone Teaching Practicum in Neuroscience (3 cr.) P: NSCI-B 301 or BIOL-K 324 or NSCI-K 416 with a grade of C- or better and senior standing. This capstone course is targeted to students interested in becoming an instructor. The student will identify a willing Neuroscience instructor to serve as a mentor and work over a semester in mutually identified areas of interest that will be of service to the Neuroscience learning community.

Physics

Undergraduate

PHYS-I 010 Pre-Physics (3 cr.) P: MATH-I 159 or MATH-I 153 and MATH-I 154, or equivalent. Fall, Spring. For students not ready to take the algebra- and trigonometry-based courses in physics (PHYS-I 218 and PHYS-P 201). Basic concepts of physics. Methods of analyzing physics problems. Setting up equations for physics problems. Interpreting information in physics problems. Analyzing and presenting the results of laboratory measurements. Extensive drill in these topics.

PHYS-I 100 Physics in the Modern World (5 cr.) P: Introductory high school mathematics. Spring, day. Ideas, language, methods, and impact of physics today.

PHYS-I 121 How to Solve a Problem without Solving the problem (2 cr.) P: Consent of instructor. Fall. This course teaches students how to formulate a research question and start doing research with their current knowledge. Enrollment with permission of the instructor.

PHYS-I 122 How To Know When You Are Right (2 cr.) P: PHYS 12100 or consent of instructor. Spring. This course continues developing students' capabilities to perform research. Prerequisite PHYS-I 121. Enrollment with the permission of the instructor.

PHYS-I 140 Short Courses in Physics (1 cr.) Five-week courses on a variety of topics related to the physical world. Examples of topics include: Waves and Particles Are the Same Thing, Relativity, Quarks and Other Inhabitants of the Zoo, Why Things Work and Why They Don't, Lasers and Holography, and Physics of Star Trek.

PHYS-I 152 Mechanics (4 cr.) P: or C: MATH-I 166. Equiv. IU PHYS-P 221. Fall, day; Spring, day, night; Summer, day. 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; and simple harmonic and wave motion.

PHYS-I 153 Honors Mechanics Seminar (1 cr.) P: Department consent. C: PHYS-I 152. The primary goal of the course is to enrich the student's experience in PHYS-I 152 by presenting a topic not traditionally covered in first-year physics, such as special relativity, quantum mechanics, or particle physics. The course will meet weekly for 50 minutes, during which time there will be a lecture and/or a class discussion. The course will carry honor's credit.

PHYS-I 200 Our Physical Environment (3 cr.) Fall, night; Spring, night. A nonmathematical introduction to physical concepts and methods by means of examples from daily life and current technological applications.

PHYS-I 218 General Physics (4 cr.) P: MATH-I 154 or MATH-I 159 or MATH-I 165 or MATH-S 165 or MATH-I 221 OR MATH-I 231 or MATH-I 241 (each course with a C- or higher taken within last three years) OR ALEKS placement score equal or greater to 72.00 completed within the past 12 months. Fall, night; Spring, night; Summer, day. Mechanics, conservation laws, gravitation; simple harmonic motion and waves; kinetic theory, heat, and thermodynamics.

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

PHYS-I 251 Heat, Electricity, and Optics (5 cr.) P: Either PHYS-P 201 or PHYS-I 152 and MATH-I 165, MATH-I 166 and MATH-I 171. P: or C: MATH-I 261 or MATH-I 266. Equiv. IU PHYS-P 222. Fall, day, night; Spring, day; Summer, day. Heat, kinetic theory, elementary thermodynamics, and heat transfer. Electrostatics, electrical currents and devices. Magnetism, electromagnetic radiation, optics.

PHYS-I 285 Introduction to Biophysics (3 cr.) P: MATH-I 166 or MATH-I 222 or MATH-I 232. This course is an introduction to biophysics. The goal is to present important biological phenomena from a physics perspective. Briefly, we will begin with a review of biology from single molecules to cells with an emphasis on time scales and length scales. We will subsequently explore both static and dynamical phenomena in biology.

PHYS-I 290 Special Assignments (0-3 cr.) P: Permission of instructor required. Readings, discussions, written reports, or laboratory work selected for enrichment in special areas of physics.

PHYS-I 299 Introduction to Computational Physics (2 cr.) P: PHYS-I 152. Fall. Application of computational techniques to physical concepts. Topics include mechanics, oscillations, chaos, random processes, etc.

PHYS-I 300 Introduction to Elementary Mathematical Physics (3 cr.) P: MATH-I 261 and PHYS-I 299 and (PHYS-P 202 or PHYS-I 251) minimum grade of C-. Spring. Brief but practical introduction to various mathematical methods used in intermediate-level physics courses. Vector analysis, orthogonal coordinate systems, matrices, Fourier methods, complex numbers, special functions, and computational methods. Emphasis will be on examples and the application of these methods to physics problems.

PHYS-I 310 Intermediate Mechanics (4 cr.) P: PHYS-I 299 and (PHYS-P 202 or PHYS-I 251) and (PHYS-I 300 or MATH-I 266 or MATH-I 366). 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; and elements of hydromechanics and elasticity.

PHYS-I 330 Intermediate Electricity and Magnetism (3 cr.) P: (PHYS-P 202 or PHYS-I 251) and (PHYS-I 300 or MATH-I 266). Spring. Electrostatics; electric currents;

magnetostatics; electromagnetic induction; Maxwell's equations; electromagnetic waves.

PHYS-I 342 Modern Physics (3 cr.) P: (PHYS-P 202 or PHYS-I 251) and PHYS-I 299 and MATH-I 261. Equiv. IU PHYS-P 301. Spring. A survey of basic concepts and phenomena in atomic, nuclear, and solid state physics.

PHYS-I 353 Advanced Physics Laboratory I: Modern Physics and Electronics (2 cr.) P: PHYS-I 251. Spring. Experiments associated with advances in the early part of the 20th century to accompany PHYS-I 342 and an introduction to electronic circuits and test equipment for scientists.

PHYS-I 400 Physical Optics (3 cr.) P: PHYS-I 330. Fall. Electromagnetic waves; wave theory of reflection, refraction, diffraction, and interference. Spatial and temporal coherence. Fourier optics, coherent imaging, and holography. Polarization phenomena; Jones vectors and matrices.

PHYS-I 401 Physical Optics Laboratory (2 cr.) P: PHYS-I 330. C: PHYS-I 400 (majors). Experiments to accompany PHYS-I 400 in reflection, refraction, and interference using lasers. Interferometry. Diffraction patterns with emphasis on Fourier analysis and Fourier transformations. Polarization, Brewster's angle. Coherence length of lasers.

PHYS-I 418 Thermal and Statistical Physics (3 cr.) P: PHYS-I 342, and PHYS-I 310 or PHYS-I 330. Replaces PHYS-I 416. Spring. Temperature, equations of state, first and second laws of thermodynamics, entropy and applications, kinetic theory, transport processes, statistical mechanics.

PHYS-I 442 Quantum Mechanics (3 cr.) P: PHYS-I 342, and PHYS-I 310 or PHYS-I 330. Fall. Inadequacies of classical physics; wave packets and Schrodinger equation, one-dimensional problems; operator formulation of quantum mechanics; linear harmonic oscillator; angular momentum; hydrogen atom; and Pauli principle and application to helium atom.

PHYS-I 470 Reading in Special Topics (1-3 cr.)

PHYS-I 480 Solar Energy Usage (3 cr.) P: MATH-I 166 or equivalent, and two courses in general physics. Theoretical and practical aspects, including collector design, modeling of solar systems, economic evaluation of solar alternatives, and photovoltaics.

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

PHYS-P 201 General Physics I (5 cr.) P: MATH-I 154 or MATH-I 159 or MATH-I 165 or MATH-S 165 or MATH-I 221 OR MATH-I 231 or MATH-I 241 (each course with a C- or higher taken within last three years) OR ALEKS placement score equal or greater to 72.00 completed within the past 12 months. Fall, day; Spring, night; Summer, day. 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.

PHYS-P 202 General Physics II (5 cr.) P: PHYS-P 201. Fall, night; Spring, day; Summer, day. Electricity and magnetism; geometrical and physical optics; introduction to concepts of relativity, quantum theory, and atomic and nuclear physics. Three lectures, one discussion section, and one two-hour laboratory period each week.

PHYS-I 166 The Physics of Rock n' Roll (3 cr.) P: Concurrent enrollment in MATH I-153 or equivalent. Algebra and some trigonometry will be used throughout the semester, though any trigonometry needed will be covered in class. Students may enroll without MATH-I 153 with special permission from the instructor; in such cases it is recommended (but not required) that the student achieve an ALEKS score of 62 or above. This course covers the physics of electric guitars, guitar effects, amplifiers, synthesizers, vocals, speakers, microphones, and room and stage acoustics. Students will participate in a creative project, such as designing / building guitar pickups or guitar effects, and have the opportunity to work with musicians and luthiers. Lecture and lab.

Advanced Undergraduate and Graduate

PHYS-I 501 Physical Science (3 cr.) 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.

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

PHYS-I 517 Statistical Physics (3 cr.) P: PHYS-I 342, PHYS-I 510, and PHYS-I 515 or equivalent. Laws of thermodynamics; Boltzmann and quantum statistical distributions, with applications to properties of gases, specific heats of solids, paramagnetism, black-body radiation, and Bose-Einstein condensation; Boltzmann transport equation and transport properties of gases; and Brownian motion and fluctuation phenomena.

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

PHYS-I 522 Coherent Optics and Quantum Electronics (3 cr.) P: PHYS-I 330, PHYS-I 442, and PHYS-I 550. Recent experimental and theoretical developments in optics, emphasizing concepts of coherence. Fourier optics and the quantum theory of radiation. Applications to lasers and masers, nonlinear optics, holography, and quantum electronics.

PHYS-I 523 Nanosystems Principles (3 cr.) P: Graduate students in Science or undergraduate students in senior standing in Science or instructor consent. This is the introductory course in the nanosystems area. It introduces students to the principles and applications of nanosystems. The course begins with an introduction to the nanometer scale phenomena. It then introduces students to the basic elements resulting in nanosystems: nanoscale materials, processes, and devices. It also

provides students with a basic understanding of the tools and approaches that are used for the measurement and characterization of nanosystems, and their modeling and simulation. Moreover, the course covers the applications of nanosystems in a wide range of industries, including information technology, energy, medicine, and consumer goods. The course concludes with a discussion of the societal and economical significance of these applications, including benefits and potential risks.

PHYS-I 526 Integrated Nanosystems Processes and Devices (3 cr.) P: PHYS-I 523. This course covers processes and devices associated with integrated nanosystems. Integrated nanosystems refer to the systems that consist of integrated micro-, meso-, and/or macro-scale parts, and their core components, realized by nano-scale materials, processes, and devices. The course, while covering processes which result in integrated nanosystems, will focus on the theory and operation of select electronic, electromechanical, and biomedical devices which are used for information technology, sensing, medical, and other applications. The lectures will be complemented by hands-on laboratory experience.

PHYS-I 530 Electricity and Magnetism (3 cr.) P: PHYS-I 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; and electromagnetic radiation.

PHYS-I 533 Principles of Magnetic Resonance (3 cr.) P: PHYS-I 550 or equivalent. Magnetic resonance in bulk matter; classical and quantum descriptions, relaxation, CW and pulse experiments, interactions and Hamiltonians. Magnetic interactions between electrons and nuclei; nuclear quadrupole interaction, crystal field interactions, and effect of molecular motion. High-resolution NMR spectra; EPR of free-radical solutions; and powder patterns.

PHYS-I 545 Solid-State Physics (3 cr.) P: An undergraduate course in modern physics. Crystal structure; lattice vibrations; free electron theory of solids; band theory of solids; semiconductors; superconductivity; magnetism; and magnetic resonance.

PHYS-I 550 Introduction to Quantum Mechanics (3 cr.) P: PHYS-I 342 and at least one other junior-level course in each of mathematics and physics or equivalent. 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; multielectron atoms; periodic table; molecules; periodic potentials; and Bloch wave functions.

PHYS-I 556 Introductory Nuclear Physics (3 cr.) P: PHYS-I 550 or equivalent. 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; and nuclear reactors.

PHYS-I 570 Selected Topics in Physics (3 cr.) Specialized topics in physics selected from time to time.

PHYS-I 590 Reading and Research (1-3 cr.)

Graduate

PHYS-I 585 Introduction to Molecular Biophysics (3 cr.) Application concepts and methods from physics to the understanding of biological systems with a focus on proteins, lipids and nucleic acids. Introduction of experimental and theoretical techniques, including X-ray crystallography, nuclear magnetic resonance and molecular dynamics simulations in the investigation of structures, forces, dynamics and energetics of these biological molecules.

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

PHYS-I 601 Methods of Theoretical Physics II (3 cr.) P: PHYS-I 600 or equivalent. A continuation of PHYS-I 600.

PHYS-I 610 Advanced Theoretical Mechanics (3 cr.) P: PHYS-I 510 or equivalent. Lagrangian and Hamiltonian mechanics; variational principles; canonical transformations; Hamilton-Jacobi theory; theory of small oscillations; and Lagrangian formulation for continuous systems and field.

PHYS-I 617 Statistical Mechanics (3 cr.) P: PHYS-I 660 or equivalent. Classical and quantum statistical mechanics.

PHYS-I 630 Advanced Theory of Electricity and Magnetism (3 cr.) P: PHYS-I 530 and PHYS-I 600, or equivalent. The experimental origins of Maxwell's equations. Electrostatics and magnetostatics; solution of boundary value problems. Quasistatic currents. Electromagnetic energy and momentum and the Maxwell stress tensor. Foundations of optics. Radiation from antennae, multipole expansion; waveguides.

PHYS-I 631 Advanced Theory of Electricity and Magnetism (3 cr.) P: PHYS-I 630 or equivalent. Covariant formulation of electrodynamics; Lienard-Wiechert potentials; radiation from accelerated particles; Cerenkov radiation; dynamics of relativistic particles; radiation damping; and introduction to magnetohydrodynamics.

PHYS-I 633 Advanced Topics in Magnetic Resonance (3 cr.) P: PHYS-I 533 or consent of instructor. Rotation operators, coupling of angular momenta, Wigner-Eckhart theorem, and density matrix; theory of magnetic resonance, relaxation in liquids, chemical exchange, double resonance, cross-polarization, and magic angle spinning; two-dimensional NMR, correlation spectroscopy, and exchange and NOE spectroscopies; application to biological macromolecules; time domain EPR; and lineshape under slow motion.

PHYS-I 660 Quantum Mechanics I (3 cr.) P: PHYS-I 530, PHYS-I 550, PHYS-I 600, and PHYS-I 610, or equivalent. Origins of the quantum theory, the uncertainty and complementarity principles. The Schrodinger equation and

its solutions for simple physical systems. Mathematical formulation of the quantum theory. Applications: simple harmonic oscillator, theory of angular momentum, and hydrogen atom. Time-independent and time-dependent perturbation theory. The Pauli exclusion principle. Spin of the electron. Elementary theory of scattering.

PHYS-I 661 Quantum Mechanics II (3 cr.) P: PHYS-I 601, PHYS-I 630, and PHYS-I 660, or equivalent. Symmetry and conservation laws. The Klein-Gordon and Dirac equations. Interaction of radiation with matter. Applications of quantum mechanics to atomic structure. Scattering theory.

PHYS-I 670 Selected Topics in Physics (1-3 cr.) P: Consent of instructor. Specialized topics in physics, varied from time to time.

PHYS-I 685 Physics Seminar (0-1 cr.) Offered on Pass/Fail basis only. Weekly physics seminar presented by faculty and invited speakers from outside the department. May be repeated for credit.

PHYS-I 698 Research M.S. Thesis (variable cr.) Research M.S. Thesis.

PHYS-I 699 Research (variable cr.) Ph.D. thesis.

PHYS-G 901 Advanced Research (6 cr.)

Psychology

Undergraduate Level

PSY-B 101 Exploring the Brain (3 cr.) Everything we think, say, feel, and do is because of electrical and chemical activity in the brain. The goal of this course is to help the student understand not only normal brain function but also the diseased drug affected, damaged or cognitively compromised brain. Emphasis will also be placed on how to maintain healthy brain function and maximize performance. PSY-B 101 is a non-majors introductory course geared towards first-year and sophomore students, although others may take it. Cross-listed with NSCI-B 101. Anyone who plans to major or minor in neuroscience will need to take NSCI-B 201/PSY-B 201.

PSY-B 110 Introduction to Psychology (3 cr.) Equiv. to IU PSY-P 155 and PU PSY 12000. This foundational course introduces students to psychology as a systematic and scientific way to think about the biological and social aspects of behavior and mental processes. Topics include research methods, behavioral neuroscience, sensation/perception, learning, memory, cognition/language, motivation/emotion, personality, social, stress and health, psychological disorders and treatment, and lifespan development.

PSY-B 203 Ethics and Diversity in Psychology (3 cr.) P: PSY-B 110 or equivalent. This course introduces students to values and professional issues in psychology, with an emphasis on ethics and diversity. Students will learn to recognize the importance of ethical behavior in all aspects of the science and practice of psychology and that sociocultural factors and personal biases may shape research and practice.

PSY-B 252 Topics in Psychology (1-3 cr.) Topics in psychology and interdisciplinary applications. May be repeated provided different topics are studied, for a maximum of 4 credit hours.

PSY-B 292 Readings and Research in Psychology (1-3 cr.) P: Consent of instructor. Independent readings and research on psychology problems. For freshmen and sophomores only.

PSY-B 303 Career Planning for Psychology Majors (1 cr.) P: PSY-B 110 or equivalent. Equiv. to IU PSY-P 199. Students will explore careers, practice job search skills, and learn about graduate and professional school application processes. Students will utilize resources across campus and in psychology, map an academic and co-curricular plan, and develop an understanding of how knowledge gained from the discipline of psychology can be integrated into their careers.

PSY-B 305 Statistics (3 cr.) P: PSY-B 110 or equivalent and 3 credits of mathematics that carry School of Science credit. Equivalent to IU PSY-K 300, PSY-K 310, and PU PSY 20100. Introduction to basic statistical concepts; descriptive statistics and inferential statistics. Introduction to data analytic software.

PSY-B 306 Statistics Laboratory (1 cr.) P: PSY-B 110 or equivalent and 3 credits of mathematics that carry School of Science credit. C: PSY-B 305. The goal of this laboratory course is to orient students to analyzing data using the statistics they are learning in PSY-B 305. Statistical concepts and competencies to be developed in this course include, descriptive statistics, hypothesis testing, t-tests, correlation and regression.

PSY-B 307 Tests and Measurement (3 cr.) P: PSY-B 110 or equivalent and PSY-B 305. Equivalent to IU PSY-P 336 and PU PSY 20200. Overview of statistical foundations of psychological measurement (e.g., test development, norms, reliability, validity). Survey of commonly used assessment instruments (e.g., intelligence/aptitude, personality, academic achievement tests) and applications of psychological testing in different settings (e.g., clinical, industrial/ organizational, school, forensic/legal settings). Recommended for students considering graduate training in clinical, industrial/organizational, school, or related areas of psychology.

PSY-B 310 Lifespan Development (3 cr.) P: PSY-B 110 or equivalent. Equivalent to PU PSY 23000. 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 stressed equally.

PSY-B 311 Research Methods in Psychology (3 cr.) P: PSY-B 110 or equivalent and PSY-B 305. Equiv. to IU PSY-P 211, and PU PSY 20300. Introduction to the science of psychology and to the basic research methods that psychologists use to study thoughts, feelings, and behavior. Topics include measurement, research design (descriptive, correlational, experimental), scientific writing, and ethical issues. By the end of the course, you should be ready to design and analyze your own research.

PSY-B 312 Research Methods Laboratory in Psychology (3 cr.) P: PSY-B 110 or equivalent and PSY-B 305. C: PSY-B 311. This lab is designed to teach the

research process one step at a time. These steps include conceptualizing and structuring scientific questions, learning how to obtain pertinent but credible sources of information, referencing prior research, articulating a research hypothesis, constructing a method to test the hypothesis, and carrying out a research study. Finally, students learn how to communicate their results via APA-formatted written reports and by oral and poster presentations.

PSY-B 320 Behavioral Neuroscience (3 cr.) P: PSY-B 110 or equivalent. Equivalent to IU PSY-P 326 and PU PSY 22000. This course focuses on how behavior emerges from the organ that produces it, the brain. Topics include evolution and anatomy of the brain, neurophysiology, how brain networks function, and what happens to behavior when the brain has problems. A better understanding of structure-function relationships within the central and peripheral nervous system will be achieved through examples from human neuropsychology and animal behavior. Students pursuing a major or minor in Neuroscience are required to take PSY-B 201 plus PSY-B 301 in lieu of PSY-B 320. Credit given for only one of PSY-B 301 or NSCI-B 301 or PSY-B 320.

PSY-B 322 Introduction to Clinical Psychology (3 cr.) P: PSY-B 110 or equivalent. A survey of various aspects of the practice of clinical psychology from a scientist-practitioner perspective. Aspects of the historical framework of clinical psychology will be discussed. In addition, various aspects of the present state of clinical psychology will be covered in addition to directions for the future.

PSY-B 334 Perception (3 cr.) P: PSY-B 110 or equivalent. Equivalent to IU PSY-P 329 and PU PSY 31000. Consideration of the concepts and research in perception. Relation of sense organ systems to human behavior. Some attention to social and cultural factors.

PSY-B 340 Cognition (3 cr.) P: PSY-B 110 or equivalent. Equivalent to IU PSY-P 335 and PU PSY 20000. A survey of information processing theories from historical antecedents through current theories. Research methodology and theory will be emphasized throughout the discussion of issues such as perception, attention, memory, reasoning, and problem solving.

PSY-B 344 Learning (3 cr.) P: PSY-B 110 or equivalent. Equivalent to IU PSY-P 325 and PU PSY 31400. History, theory, and research involving human and animal learning and cognitive processes.

PSY-B 346 Theories of Personality (3 cr.) P: PSY-B 110 or equivalent. Equivalent to IU PSY-P 319 and PU PSY 42000. Methods and results of the scientific study of personality, including the development, structure, and functioning of the normal personality.

PSY-B 356 Motivation (3 cr.) P: PSY-B 110 or equivalent. Equivalent to IU PSY-P 327 and PU PSY 33300. Study of motivational processes in human and animal behavior, how needs and incentives influence behavior, and how motives change and develop.

PSY-B 358 Introduction to Industrial/Organizational Psychology (3 cr.) P: PSY-B 110 or equivalent. Equivalent to IU PSY-P 323 and PU PSY 37200. This course surveys various aspects of behavior in work situations using the scientist-practitioner perspective. Traditional areas covered from personnel psychology include selection, training, and performance appraisal; areas surveyed from organizational psychology include leadership, motivation, and job satisfaction.

PSY-B 360 Child and Adolescent Psychology (3 cr.) P: PSY-B 110 or equivalent. Equivalent to IU PSY-P 316 and PU PSY 23500. Development of behavior in infancy, childhood, and adolescence, including sensory and motor development and processes such as learning, motivation, and socialization.

PSY-B 365 Health Psychology (3 cr.) P: PSY-B 110 or equivalent. This course will familiarize students with the study of physical health within the field of psychology. Topics include the relationship between stress and health, health promotion, health behaviors, chronic illness, and the patient-physician relationship. Research methods in health psychology as well as major theories underlying the field will be examined and evaluated. Psychological variables related to physical health will be examined within the framework of these theories. Practical application of constructs will be emphasized through activities and writing assignments.

PSY-B 370 Social Psychology (3 cr.) P: PSY-B 110 or equivalent. Equivalent to IU PSY-P 320 and PU PSY 24000. Study of the individual in social situations including socialization, social perception, social motivation, attitudes, social roles, and small group behavior.

PSY-B 375 Psychology and Law (3 cr.) P: PSY-B 110 or equivalent. This course provides an overview of the U.S. legal system from a behavioral science perspective. Topics include careers in psychology and law; theories of crime; police investigations and interrogations; eyewitness accuracy; jury decision-making; sentencing; assessing legal competence; insanity and dangerousness; and the psychology of victims.

PSY-B 376 The Psychology of Women (3 cr.) P: PSY-B 110 or equivalent. Equivalent to IU PSY-P 460 and PU PSY 23900. A survey of topics in psychology as related to the biological, social, and psychological development of women in modern society.

PSY-B 380 Abnormal Psychology (3 cr.) P: PSY-B 110 or equivalent. Equivalent to IU PSY-P 324 and PU PSY 35000. Various forms of mental disorders with emphasis on cause, development, treatment, prevention, and interpretation.

PSY-B 385 Positive Psychology (3 cr.) P: PSY-B 110 or equivalent. Equivalent to IU EDUC-G 355. This course is an introduction to Positive Psychology. The two main goals are for students to (1) learn about the content and science that informs Positive Psychology, and (2) apply in their own lives empirically validated strategies that help people develop a happier and more meaningful life. This course will include a positive view of human functioning and a review of research and practices in Positive Psychology. Emphasis will be placed on science and its applications with regard to topics such as human strengths and values, neuroscience as it relates to happiness/mindfulness, gratitude, cultural (eastern/western) aspects of happiness/values, process vs. outcome, optimism,

the new field of self-compassion, positive affect, coping, friendship and love, spirituality, and resilience.

PSY-B 386 Introduction to Counseling (3 cr.) P: PSY-B 110 or equivalent, PSY-B 310, and PSY-B 380. This course will help students acquire a repertoire of basic counseling interview skills and strategies and expose students to specific helping techniques. This will be an activity-based course and students will enhance the general-education goals of listening and problem solving.

PSY-B 394 Drugs and Behavior (3 cr.) P: PSY-B 110 or equivalent. Equivalent to PU PSY 42800. An introduction to psychopharmacology, the study of drugs that affect behavior, cognitive functioning, and emotions, with an emphasis on drugs of abuse. The course will explore how drugs alter brain function and the consequent effects, as well as the long-term consequences of drug exposure. Cross-listed with NSCI-B 394.

PSY-B 396 Alcoholism and Drug Abuse (3 cr.) P: PSY-B 110 or equivalent. Introduction to the use and abuse of alcohol and other psychoactive drugs. Topics include theories of alcohol and other drug use, neurobiology, and the factors that influence use, abuse, and addiction. Addiction assessment, recovery, treatment, relapse, and prevention are also covered.

PSY-B 421 Internship in Psychology (1-3 cr.) P: Consent of instructor, PSY-B 110, PSY-B 303, PSY-B 305 and three additional credit hours of psychology. A professional internship that allows students to apply psychological knowledge and skills to a specific work setting, develop work related skills, explore career options and gain experience in a field of interest.

PSY-B 422 Professional Practice (1-3 cr.) P: Faculty or staff must approve and oversee activity. Registration is by permission only. For students who have applied for and are approved to be a Peer Advisor in the Psychology Advising Office or have been approved to be a Teaching Assistant for a psychology course.

PSY-B 433 Capstone Laboratory in Psychology (3 cr.) P: PSY-B 305, PSY-B 311 / PSY-B 312, at least two 300-level PSY foundation courses and senior standing. This advanced research course builds on the skills and knowledge students have acquired during their undergraduate education that will enable them to conduct a team research project in a specialized area of psychology in order to further develop and consolidate their understanding of psychology as a science.

PSY-B 452 Seminar in Psychology (1-3 cr.) P: PSY-B 110 or equivalent. Topics in psychology and interdisciplinary applications. May be repeated, provided different topics are studied, for a maximum of 6 credit hours.

PSY-B 454 Capstone Seminar in Psychology (3 cr.) P: PSY-B 305, PSY-B 311 / PSY-B 312, at least two 300-level PSY foundation courses and senior standing. Topics in psychology and interdisciplinary applications, which have been approved to fulfill the capstone course requirement.

PSY-B 492 Readings and Research in Psychology (1-3 cr.) P: Consent of instructor. Equivalent to IU PSY-P 495 and PU PSY 39000 and PSY 39100. Gain hands-on research experience in a research lab or with an independent research project mentored by an instructor in the psychology department. For highly motivated students who are planning to attend graduate school or work in a field that requires a solid foundation in research. Projects need to be pre-arranged with faculty and registration is by permission only.

PSY-B 499 Capstone Honors Research (3 cr.) P: PSY-B 305, PSY-B 311 / PSY-B 312, at least two 300-level PSY foundation courses, senior standing and consent of instructor. Application is required. Equivalent to IU PSY-P 499. Independent readings and research resulting in a research paper.

Graduate Level

PSY-G 901 Advanced Research (6 cr.)

PSY-I 501 Multicultural Counseling (3 cr.) P: Graduate standing. This course explores the role of increasing diversity in the U.S. population and how it will affect the delivery of mental health services. The focus of the course is on different ethnic and minority groups, their customs and values, and the impact that these cultural factors have on the utilization of psychological services.

PSY-I 518 Memory and Cognition (3 cr.) A graduate-level survey of theories and research concerned with the acquisition, retention, and retrieval of information. Topics include amnesia, eyewitness memory, forgetting, developmental trends in memory, related issues in attention, language processing, and problem solving.

PSY-I 535 Developmental Neuroscience (3 cr.) P: Graduate standing in Psychology or permission of instructor. Course will examine the nature of how biological and developmental alterations lead to aberrant behaviors that define psychopathology. Course covers theories of development and neuroscience, including methods of study. Discussion of the ethics involved in the field of Developmental Neuroscience.

PSY-I 541 History of Psychology (3 cr.) P: Nine (9) credit hours of psychology. A review of the philosophical, theoretical, and methodological issues that entered into the development of modern psychology. Emphasis on historical themes that continue to be active in the science and profession of psychology.

PSY-I 544 Psychobiology of Learning and Motivation (3 cr.) P: PSY-B 320 or equivalent. The course examines past and present biologically based theories of learned and motivated behavior. Neural processes of feeding, drinking, aggression, fear, anxiety, and sexual behavior will be emphasized. Selected coverage of behavioral research principles used to investigate these processes also will be discussed.

PSY-I 545 Psychopharmacology (3 cr.) P: PSY-I 615 or consent of instructor. A survey of the effects of drugs on behavior, cognitive functioning, and emotions. Emphasis will be placed on the practical advantages of understanding how psychotropic drugs work, and on how the brain functions in health and disease. Students will be exposed to the most current theories and research in the field.

PSY-I 549 Introduction to Vocational Rehabilitation (3 cr.) P: Nine (9) credit hours of psychology. Philosophy, procedures, and practices underlying the vocational rehabilitation movement, including the historical, social,

cultural, and economic factors and legislation that have contributed to its rapid development.

PSY-I 555 Medical and Psychosocial Aspects of Chronic Illness (3 cr.) P: Nine (9) credit hours of psychology including PSY-I 549. Provides medical information for rehabilitation counselors and introduces students to medical terminology. Includes knowledge of the etiology, prognosis, methods of treatment, and effects of disabling conditions, and implications for the rehabilitation counselor. Counselor relationships with other health-related personnel are emphasized.

PSY-I 565 Seminar in Cognitive, Affective, and Social Aspects of Behavior (3 cr.) P: Prerequisite: Graduate standing in Psychology or permission of instructor. Students examine key ideas in cognitive, affective and social aspects of behavior. This course provides a solid foundation in psychology including substantive breadth of cognitive, affective and social psychology for graduate students in psychology and allied disciplines.

PSY-I 571 Staffing (3 cr.) Spring. This seminar course will introduce students to HR practices associated with bringing new members into organizations. Topics covered include recruitment, procedures for assessing the individual differences of applicants, models used to make selection decisions, and legal considerations associated with personnel selection (e.g., discrimination and affirmative action). The course will focus on theory and empirical research related primarily to the fields of industrial/organizational psychology and management.

PSY-I 570 Drugs of Abuse (3 cr.) P: Graduate: None Undergraduate: Permission of instructor pending review of prior undergraduate course work. This course will cover the basic principles of the study of drugs of abuse, as well as focusing on particular drugs and drug classes. For each drug or drug class, we will discuss issues ranging from basic pharmacology to the social impact of the abuse of the particular substance. We will utilize a text book as well as current literature in the field, and critical examination of all course material will be encouraged.

PSY-I 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.

PSY-I 573 Occupational Health Psychology (3 cr.) P: Regular graduate standing in Psychology or permission of instructor. Fall, every other year. Occupational health psychology (OHP) is one of the most heavily researched areas within the work domain, although it is not well publicized in the traditional IO psychology domain. For instance, traditional topics in IO, such as job design (job characteristic model), person- environment fit, shift work, job stress, coping and adjustment, type A/B, safety climate, workplace violence, and so on, are covered in the OHP. This course provides an in depth treatment of this literature with the foci on occupational stress, violence, and safety.

PSY-I 575 Psychology and Law Seminar (3 cr.) P: Permission of instructor. Fall, every other year. This seminar examines the relevance of social psychological and industrial/organizational (I/O) theory and research to various forensic contexts, including criminal and tortious behavior, police and other investigatory processes, evaluation of scientific and behavioral evidence, employment law issues, and the role of psychological consultants and expert witnesses.

PSY-I 576 Human Resource Development (3 cr.) Spring. This is a graduate level course intended for individuals who are seeking advanced training in the science and practice of employee development. Employee Development is construed broadly in this course to include performance management and employee training. Students will be exposed to the critical extant literature, to best practices in the development of these human resources systems in organizations, and will gain applied experience through course projects.

PSY-I 578 Occupational Analysis (3 cr.) P: PSY-I 570. Survey of systematic study of human work, including techniques for analyzing jobs and occupations for personnel and related purposes. Survey of occupational research and related topics. Practice in job analysis.

PSY-I 579 Foundations of Diversity Science (3 cr.) P: Regular graduate standing in Psychology or permission of instructor. Fall, every other year. Diversity science investigates the creation, consequences, and maintenance of group differences. This graduate-level seminar takes a sociocultural approach to diversity science questions at the micro-level of analysis, focusing on the psychological processes that give rise to intergroup behavior and individual strategies for addressing and coping with group-based biases and stigma.

PSY-I 580 Survey of Clinical Approaches with Children and Adolescents (3 cr.) P: Nine (9) credit 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.

PSY-I 581 Gender Issues in the Workplace (3 cr.) P: Regular graduate standing in Psychology or instructor permission. Spring. This is a graduate seminar that examines women's (and by comparison, men's) experiences in the workplace, with a focus on intersectionality. Topics will span the psychological and related social science literature on gender issues in career interests, occupational decisions, work experiences, advancement, discrimination, and organizational interventions to address these issues.

PSY-I 582 Organizational Diversity and Intergroup Relations (3 cr.) P: Regular graduate standing in Psychology or permission from instructor. Spring, every other year. Examines the importance of diversity in groups, discrimination and biases in organizations, minority and majority group reactions to different diversity initiatives, the unintended consequences of diversity initiatives, and the importance of empirically validating diversity interventions and trainings.

PSY-I 583 Judgment and Decision Making in Organizations (3 cr.) P: Regular graduate standing in Psychology or instructor permission. Fall, as needed. This

graduate seminar examines how decisions are made by individuals and groups in various organizational and institutional settings. Topics covered include how individuals process information, make judgments, and reach decisions; how groups reach decisions through interactive social processes; and how choices, decisions and plans are formulated by individuals and groups in selected real-world contexts (e.g., legal, medical, politics, sports, business, etc.). The course will rely heavily on theory and research in psychology, but also draw on the scholarly literature in related social science fields (e.g., sociology).

PSY-I 590 Individual Research Problems (1-3 cr.) P: Twelve (12) credit hours of psychology and consent of instructor. Opportunity for students to study particular problems in any field of psychology or to learn research techniques under the guidance of a faculty member.

PSY-I 591 Psychopathology (3 cr.) P: Enrollment in psychology graduate program or consent of instructor. An intensive survey of the methods, theories, and research concerning the nature, causes, and development of psychopathology. An evaluation of current systems of assessment and classification of abnormal behavior is emphasized.

PSY-I 595 Seminar in Teaching Psychology (0-3 cr.) P: Consent of the Department of Psychology. A problem-solving approach to teaching psychology at IU Indianapolis. Planning the course; anticipating problems; and dealing with ongoing teaching problems. Current faculty members will present their innovative techniques. Participants will evaluate each other's classroom performance.

PSY-I 596 Advanced Seminar in the Psychology of Teaching (3 cr.) P: PSY-I 595 Seminar in Teaching Psychology. This experiential seminar focuses on applying best practices in teaching. In this class, you will think deeply about your goals as an instructor, prepare and lead a class session, critique your own and other's instructional practices, expand your knowledge of evidence-based teaching practices, and develop a reflective approach to teaching.

PSY-I 600 Statistical Inference (3 cr.) P: Student must be a degree-seeking student in psychology graduate program or have consent of instructor and PSY-B 305 or equivalent. Emphasis on principles underlying both parametric and nonparametric inference.

PSY-I 601 Correlation and Experimental Design (3 cr.) P: PSY-I 600. Continuation of PSI-I 600, with emphasis on the design and analysis of experiments.

PSY-I 605 Applied Multivariate Analysis (3 cr.) P: PSY-I 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.

PSY-I 608 Measurement Theory and the Interpretation of Data (3 cr.) P: PSY-I 600 and PSY-B 307, 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.

PSY-I 609 Multilevel Modeling (3 cr.) P: PSY-I 601 or equivalent. Course includes (1) generalized linear mixed (multilevel) models often used in social sciences; (2) best practices in the models' applications and interpretations. Models are extensions of classic linear regression models (multilevel modes, hierarchical and mixed models, etc.). Conceptual introduction of models and methods and illustrations using real and simulated data.

PSY-I 613 Psychiatric Rehabilitation (3 cr.) P: Consent of instructor. A seminar examining recent developments in the rehabilitation of persons with severe psychiatric disabilities. Covers assertive case management, vocational approaches, clubhouse models, residential alternatives, psychoeducation, and the consumer movement. Field observations complement classroom instruction. Issues in program planning and cost effectiveness will be discussed.

PSY-I 614 Behavioral Medicine in Rehabilitation (3 cr.) P: Consent of instructor. The theory and practice of behavioral medicine will be explored. Emphasis is on the application of behavioral principles to individuals suffering from various chronic diseases or disabilities including spinal cord injury, chronic pain, cancer, diabetes, strokes, cardiovascular diseases, and epilepsy.

PSY-I 615 Introduction to Psychobiology (3 cr.) P: Consent of instructor. A survey of the integrated neurosciences emphasizing 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.

PSY-I 618 Interventions in Health Psychology (3 cr.) P: Consent of instructor. The goal of the course is to familiarize students with clinical interventions and research relevant to health problems and lifestyle. This will enable students to critically evaluate the work that has been accomplished and to design and implement intervention protocols.

PSY-I 622 Animal Learning (3 cr.) A survey of the methods, problems, and research in Pavlovian, instrumental, and operant conditioning. Current issues and attempts at theoretical integration are highlighted. Emphasis is also given to the empirical and conceptual foundations of the present views on the mechanisms governing learned behavior.

PSY-I 640 Survey of Social Psychology I (3 cr.) P: PSY-B 370 or equivalent. An extensive survey of methods, research, and theory in social psychology.

PSY-I 643 Research Methods and Experimentation (3 cr.) P: PSY-I 600. Covers methods appropriate for methods in psychology research. Topics will include

experimental design, measurement, and ethics associated with research. Course will include the development of a research proposal.

PSY-I 647 Attitudes and Social Cognition (3 cr.) P: Regular graduate standing in Psychology or permission of instructor. This graduate-level seminar provides an overview of contemporary social psychological theory and research, emphasizing the social-cognitive, affective, and motivational processes underlying attitudes, social inference, stereotyping, prejudice, and self-regulation. Class discussion will focus on the application of this research to promote prosocial and prevent antisocial behaviors affecting individuals, organizations, and society.

PSY-I 650 Developmental Psychology (3 cr.) Major concepts, principles, and facts concerning the biological and environmental influences on behavioral and psychological development. Particular emphasis on essential principles of ontogenetic development (lifespan) emerging from current research in genetics and psychology.

PSY-I 664 Psychological Assessment in Rehabilitation I (3 cr.) P: Consent of instructor. Presentation of general principles of psychological assessment, professional practice, interviewing, intelligence/cognitive assessment, and psychological report writing. Supervised practice in the development of direct service skills in interviewing, behavioral observation, and psychometric assessment of cognitive abilities. Emphasis on functional implications of test results for rehabilitation populations.

PSY-I 665 Intervention I: Counseling Approaches (3 cr.) P: Consent of instructor. Introduces doctoral students to intervention procedures used in rehabilitation psychology. The course has both didactic and clinical skills components, involving traditional counseling interventions, behavior therapy, and biofeedback. Applications to disabled populations will be emphasized.

PSY-I 666 Intervention II: Cognitive Behavioral Interventions (3 cr.) P: Consent of instructor. This course covers the history, theory, research, and clinical application of cognitive-behavioral therapy (CBT). General CBT principles and clinical skills, as well as CBT programs for specific disorders/problems are reviewed. Diversity-related discussions are infused throughout, and general and specific approaches to culturally adapting CBT are presented.

PSY-I 669 Psychological Assessment in Rehabilitation II (3 cr.) P: PSY-I 664 and consent of instructor. Presentation of psychometric foundations and the basic prediction model in personality/interest assessment. Coverage of the history of personality, assessment, personality development, and supervised clinical practice in personality/interest assessment in rehabilitation. Emphasis on prediction of everyday functioning.

PSY-I 670 Ethical, Legal, and Cultural Issues in Psychology (3 cr.) P: Admission to graduate training in psychology or consent of instructor. Exploration of models of ethical decision making. Examination of ethical principles and legal mandates that apply to professional psychology including psychologists' roles in health care service delivery, consultation (clinical and organizational), research, and teaching. Examination of cultural issues, including issues related to ethnicity, age, gender, religion, and sexual orientation.

PSY-I 675 Human Neuropsychology (3 cr.) P: Admission to graduate training in psychology or consent of instructor. Review of essential neuroanatomy, survey of experimental and correlational research methods in the study of brain-behavior relationships, and overview of the history of neuropsychology. Critical examination of neural models for human behavior: hemispheric specialization and integration, sensation/perception, motor skills, language, spatial processing, attention, memory, executive operations, and gender differences.

PSY-I 676 Principles of Clinical Neuropsychology (2 cr.) P: Admission to graduate training in clinical psychology or consent of instructor. Application of theoretical models of brain-behavior relationships to evaluation of patients with suspected nervous system disorders. Review of neuropsychological profiles associated with various neurological and psychiatric disorders. Examination of ethical/cultural issues in neuropsychological evaluation. This course does not provide training in test administration (see PSY-I 677).

PSY-I 677 Neuropsychological Assessment Lab (1 cr.) P: PSY-I 664 and PSY-I 669 and admission to graduate training in clinical rehabilitation psychology. C: Students must register for PSY-I 676 concurrently with PSY-I 677. Training and supervised practice in neuropsychological assessment techniques and procedures. Critical review of the psychometric properties of prevailing assessment tools. Review models of interpretation/reporting. Development of proficiencies in administering prominent neuropsychological tests, neuropsychological interviewing, and writing of reports that integrate multidisciplinary data.

PSY-I 680 Seminar in Industrial-Personnel Psychology (3 cr.) P: PSY-I 570, PSY-I 572, and PSY-I 601. Extensively surveys the various areas of industrial-personnel psychology (e.g., selection, placement, training, performance appraisal). Provides a critical and up-to-date review of recent and classical research in these areas.

PSY-I 681 Seminar in Methodologies of Industrial/Organizational Psychology (3 cr.) P: PSY-I 570, PSY-I 601, or consent of instructor. Intensive analysis of application of various applied, research, and statistical methods to the study of human behavior in organizational settings.

PSY-I 682 Advanced Seminar in Industrial/Organizational Psychology (3 cr.) P: PSY-I 570, PSY-I 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.

PSY-I 684 Practicum in Industrial/Organizational Psychology (3 cr.) P: PSY-I 570, PSY-I 572, and consent of instructor. Practical experience in the development and implementation of field research in organizational settings. Gives students the opportunity to spend eight hours per week in local business organizations to gain experience and skills in industrial/organizational psychology.

PSY-I 685 Professional Seminar in Industrial/ Organizational Psychology (1 cr.) P: Regular graduate standing in the Industrial/Organizational Psychology graduate program. This seminar facilitates the professional development of students in Industrial/ Organizational Psychology. Presentations and discussions occur each week; topics will vary. Presentations are conducted by outside speakers, faculty and/or students on applied and research-oriented topics. During facilitated discussions, students will review newly published research and address ethics in the discipline.

PSY-I 689 Practicum in Clinical Rehabilitation Psychology (3 cr.) P: PSY-I 549 and consent of instructor. Supervised practice of rehabilitation psychology in a community agency or organization.

PSY-I 691 Seminar in Clinical Psychology (1 cr.) P: Consent of instructor. Current trends, problems, and developments in clinical psychology. Students pursue a special interest and mutually share information and experience with the group. Individual report and group discussions.

PSY-I 697 Internship in Clinical Psychology (0-9 cr.) P: Consent 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 the agency.

PSY-I 698 Research M.S. Thesis (3 cr.) Research M.S. Thesis.

PSY-I 699 Research Ph.D. Thesis (0-12 cr.) Research Ph.D. Thesis.

PSY-I 588 Advanced Introduction to Industrial and Organizational Psychology (3 cr.) Industrial/ Organizational (I/O) psychology is the study of behaviors, thoughts, and feelings of people as they adjust to their workplace, and the use of that information to maximize the economic and psychological well-being of employees and their organizations. This course concentrates heavily on I/ O science and practice for human resource activities.

PSY-I 558 Advanced Introduction to Industrial and Organizational Psychology (3 cr.) Industrial/ Organizational (I/O) psychology is the study of behaviors, thoughts, and feelings of people as they adjust to their workplace, and the use of that information to maximize the economic and psychological well-being of employees and their organizations. This course concentrates heavily on I/ O science and practice for human resource activities.

Statistics

Undergraduate

STAT-I 190 Topics in Statistics for Undergraduates (1-5 cr.) Supervised reading course or special topics course at the freshman level. Prerequisites and course material vary with the topic.

STAT-I 290 Topics in Statistics for Undergraduates (3 cr.) Supervised reading course or special topics course at the sophomore level. Prerequisites and course material vary with the topic.

STAT-I 301 Elementary Statistical Methods I (3 cr.) P: MATH-I 110 or MATH-I 111, with a grade of C or better, or MATH-M 118 with a grade of C- or better, taken within last 3 terms or an appropriate ALEKS placement score. Not open to students in the Department of Mathematical Sciences. Introduction to statistical methods with applications to diverse fields. Emphasis on understanding and interpreting standard techniques. Data analysis for one and several variables, design of samples and experiments, basic probability, sampling distributions, confidence intervals and significance tests for means and proportions, and correlation and regression. Software is used throughout.

STAT-I 350 Introduction to Statistics (3 cr.) P: MATH# I 165 or MATH#I 221 or MATH#I 231 or MATH#I 241, or higher, with a grade of C# or better. A data-oriented introduction to the fundamental concepts and methods of applied statistics. Topics include: basic real data analysis using R, basic probability theory; random variables; Normal distribution; law of large numbers; Central Limit Theorem; statistical estimation; confidence intervals; hypothesis testing; simple linear regression; analysis of variance (ANOVA).

STAT-I 371 Prep for Actuarial Exam I (2 cr.) This course is intended to help actuarial students prepare for the SOA/ CAS Exam P/1.

STAT-I 390 Topics in Statistics for Undergraduates (3 cr.) Supervised reading course or special topics course at the junior level. Prerequisites and course material vary with the topic.

STAT-I 416 Probability (3 cr.) P: MATH-I 242 or MATH-I 261. An introduction to mathematical probability suitable as preparation for actuarial science, statistical theory, and mathematical modeling. General probability rules, conditional probability, Bayes theorem, discrete and continuous random variables, moments and moment generating functions, continuous distributions and their properties, law of large numbers, and central limit theorem.

STAT-I 417 Statistical Theory (3 cr.) P: STAT-I 416. An introduction to the mathematical theory of statistical inference, emphasizing inference for standard parametric families of distributions. Properties of estimators. Bayes and maximum likelihood estimation. Sufficient statistics. Properties of test of hypotheses. Most powerful and likelihood-ratio tests. Distribution theory for common statistics based on normal distributions.

STAT-I 421 Modern Statistical Modeling Using R and SAS (3 cr.) P: STAT-I 417 or equivalent. An introductory course on statistical computation. The primary goals of this course are (i) to introduce popular statistical software SAS and R and to develop basic data analysis skills, and (ii) to introduce basic statistical computation methods used in applications.

STAT-I 432 Introduction to Stochastic Process and Probability Modeling (3 cr.) P: STAT-I 416 or equivalent. The course builds on elementary probability theory and introduces stochastic processes applied to the study of phenomena in fields such as engineering, computer science, management science, the life, physical and social sciences, and operations research. The approach is heuristic and non-rigorous. It develops students' intuitive feel for the subject and enables them to think probabilistically. Computation is emphasized and requires use of software such as Excel, MINITAB, and R.

STAT-I 433 Introduction to Nonparametric Statistics (3 cr.) P: STAT-I 417 and STAT-I 421 or equivalents. The course acquaints students with rank-based, permutation-based and resampling-based methods of statistical analysis used in widely applicable settings where the data do not follow parametric models. It extends techniques taught in STAT-I 350 / STAT-I 511, where the normal theory is assumed, to situations where the normal theory does not hold. It includes computer projects which use statistical software such as R and SAS.

STAT-I 472 Actuarial Models I (3 cr.) P: STAT-I 417 or equivalent. Mathematical foundations of actuarial science emphasizing probability models for life contingencies as the basis for analyzing life insurance and life annuities and determining premiums. This course, together with its sequel, STAT-I 473, provides most of the background for Exams MLC and MFE of the Society of Actuaries.

STAT-I 473 Actuarial Models II (3 cr.) P: STAT-I 472. Continuation of STAT-I 472. Together, these courses cover contingent payment models, survival models, frequency and severity models, compound distribution models, simulation models, stochastic process models, and ruin models.

STAT-I 479 Loss Models (3 cr.) P: STAT-I 417 and STAT-I 472 and STAT-I 473. This material provides an introduction to modeling and covers important actuarial methods that are useful in modeling. Students will be introduced to survival, severity, frequency and aggregate models, and use statistical methods to estimate parameters of such models given sample data. The student will further learn to identify steps in the modeling process, understand the underlying assumptions implicit in each family of models, recognize which assumptions are applicable in a given business application, and appropriately adjust the models for impact of insurance coverage modifications. The student will be introduced to a variety of tools for the calibration and evaluation of the models. Permission of instructor required.

STAT-I 480 Credibility and Simulation (3 cr.) P: STAT-I 479. A continuation of the material covered in STAT-I 479, including Credibility Theory and Simulation calibration and evaluation of the models.

STAT-I 490 Topics in Statistics for Undergraduates (1-5 cr.) Supervised reading and reports in various fields.

STAT N501 Statistical Methods for Health Sciences (3 cr.) P: MATH-I 153. An introductory statistical methods course, with emphasis on applications in the health sciences. Topics include descriptive statistics, probability distributions, sampling distributions, confidence interval estimation, hypothesis testing, analysis of variance, linear regression, goodness-of-fit tests, and contingency tables.

STAT-S 351 Honors Introduction to Statistics (3 cr.) P: MATH-I 166. This course introduces the basic concepts and methods of applied statistics in all areas of science and engineering. Three distinctive features of this honors course are: (1) self-learning and discovery of concepts and methods of statistical analysis through guided instructions, literature search, derivation and simulation; (2) classroom participation - both individually and collaboratively - in active learning of difficult concepts; and (3) communicating such learning to general readers. Students will acquire a basic competence in using statistical freeware R, in presenting data visually, in analyzing data appropriately, in interpreting the results in the context of research problems, and in communicating findings in plain but impactful language to readers not trained in Statistics. STAT-S 351 extends all material covered in STAT-I 350 to a deeper level and gives glimpses into some methodologies delegated to advanced courses, thereby motivating and preparing students to take advanced undergraduate statistics courses.

STAT-I 414 Introduction to Design of Experiments (3 cr.) P: STAT-I 417 or STAT-I 512 or MATH-M 366 or MATH-M 466 or equivalent. The course offers comprehensive coverage of the key elements of experimental design used by applied researchers to solve problems in the field. It shows students how to use applied statistics for planning, running, and analyzing experiments. The emphasis is placed on the basic philosophy of design. The course requires the use of the software such as SAS, Minitab, or R.

STAT-S 352 Data Modeling and Inference (3 cr.) P: STAT-I 350 or MATH-M 366 or MATH-M 466 or equivalent. Intermediate-level survey of resampling, likelihood, and Bayesian methods of statistical inference. Distributional models of various data types. Categorical, count, time-to-event, time series, linear models, and hierarchical regression models.

STAT-S 437 Categorical Data Analysis (3 cr.) P: STAT-I 417 or MATH-M 366 or MATH-M 466 or equivalent. The analysis of cross-classified categorical data. Loglinear models; regression models in which the response variable is binary, ordinal, nominal, or discrete. Logit, probit, multinomial logit models; logistic and Poisson regression.

STAT-S 460 Sampling (3 cr.) P: STAT-I 417 or MATH-M 366 or MATH-M 466 or equivalent. Design of surveys and analysis of sample survey data. Simple random sampling, ratio and regression estimation, stratified and cluster sampling, complex surveys, nonresponse bias.

STAT-S 431 Applied Linear Models I (3 cr.) P: P: MATH-M 466 or MATH-M 366, with a minimum grade of C-. Part I of a two-semester sequence on linear models. Presents the analysis of simple and multiple linear regression in the presence of simple and complex regressors. Introduces transformations, regression diagnostics, influence analysis, and regression shrinkage methods.

Advanced Undergraduate and Graduate

STAT-I 511 Statistical Methods I (3 cr.) P: MATH-I 165 or MATH-I 221 or MATH-I 231 or MATH-I 241, or higher. Descriptive statistics; elementary probability; random variables and their distributions; expectation; normal, binomial, Poisson, and hypergeometric distributions; sampling distributions; estimation and testing of hypotheses; one-way analysis of variance; and correlation and regression.

STAT-I 512 Applied Regression Analysis (3 cr.) P: STAT-I 511. Inference in simple and multiple linear regression, estimation of model parameters, testing, and prediction. Residual analysis, diagnostics and remedial measures. Multicollinearity. Model building, stepwise, and other model selection methods. Weighted least squares. Models with qualitative independent variables. Analysis of

variance. Orthogonal contrasts; multiple comparison tests. Ridge Regression; Lasso Regression.

STAT-I 513 Statistical Quality Control (3 cr.) P: STAT-I 511. Control charts and acceptance sampling, standard acceptance plans, continuous sampling plans, sequential analysis, and response surface analysis. Use of existing statistical computing packages.

STAT-I 514 Designs of Experiments (3 cr.) P: STAT-I 512. Fundamentals, completely randomized design, and randomized complete blocks. Latin squares, multiclassification, factorial, nested factorial, balanced incomplete blocks, fractional replications, confounding, general mixed factorial, split-plot, and optimum design. Use of existing statistical computing packages such as R, SAS and Minitab.

STAT-I 515 Statistical Consulting Problems (1-3 cr.) P: Consent of advisor. Consultation on real-world problems involving statistical analysis under the guidance of a faculty member. A detailed written report and an oral presentation are required.

STAT-I 516 Basic Probability and Applications (3 cr.) P: MATH-I 261. Instructor consent required for any undergraduate student. 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; and introduction to Markov chains.

STAT-I 517 Statistical Inference (3 cr.) P: STAT-I 511 or STAT-I 516. A basic course in statistical theory covering standard statistical methods and their applications. Includes unbiased, maximum likelihood, and moment estimation; confidence intervals and regions; testing hypotheses for standard distributions and contingency tables; and introduction to nonparametric tests and linear regression.

STAT-I 519 Introduction to Probability (3 cr.) P: MATH-I 261. Sample spaces and axioms of probability, conditional probability, independence, random variables, distribution functions, moment generating and characteristics functions, special discrete and continuous distributions--univariate and multivariate cases, normal multivariate distributions, distribution of functions of random variables, modes of convergence and limit theorems, including laws of large numbers and central limit theorem.

STAT-I 520 Time Series and Applications (3 cr.) P: STAT-I 519. A first course in stationary time series with applications in engineering, economics, and physical sciences. Stationarity, autocovariance function and spectrum; integral representation of a stationary time series and interpretation; linear filtering; transfer function models; estimation of spectrum; and multivariate time series. Use of existing statistical computing packages.

STAT-I 521 Statistical Computing (3 cr.) C: STAT-I 512 or equivalent. A broad range of topics involving the use of computers in statistical methods. SAS and R programming language. Simulation Studies. Bootstrapping. EM algorithm. Machine Learning algorithms.

STAT-I 522 Sampling and Survey Techniques (3 cr.) P: STAT-I 512 and STAT-I 519. Survey designs and analyses; simple random, stratified, and systematic samples; systems of sampling; methods of estimation; ratio and regression estimates; and costs. Two-stage, multi-stage sampling; Optimization. Other related topics as time permits.

STAT-I 523 Categorical Data Analysis (3 cr.) P: STAT-I 528, or STAT-I 512 and STAT-I 519. Models generating binary and categorical response data, two-way classification tables, measures of association and agreement, goodness-of-fit tests, testing independence. General linear models, logistic regression, probit and extreme value models, and multinomial logit models. Loglinear models and loglinear-logit Connection. Model building, selection, and diagnostics. Computer applications using existing statistical software.

STAT-I 524 Applied Multivariate Analysis (3 cr.) P: STAT-I 528. Extension of univariate tests in normal populations to the multivariate case, equality of covariance matrices, multivariate analysis of variance, discriminant analysis and misclassification errors, canonical correlation, principal components, and factor analysis. Strong emphasis on the use of existing computer programs.

STAT-I 525 Generalized Linear Models (3 cr.) P: STAT-I 528 or equivalent, or consent of instructor. Generalized linear models, likelihood methods for data analysis, and diagnostic methods for assessing model assumptions. Methods covered include multiple regression, analysis of variance for completely randomized designs, binary and categorical response models, and hierarchical loglinear models for contingency tables.

STAT-I 528 Mathematical Statistics (3 cr.) P: STAT-I 519. Sufficiency and completeness, the exponential family of distributions, theory of point estimation, Cramer-Rao inequality, Rao-Blackwell Theorem with applications, maximum likelihood estimation, asymptotic distributions of ML estimators, hypothesis testing, Neyman-Pearson Lemma, UMP tests, generalized likelihood ratio test, asymptotic distribution of the GLR test, and sequential probability ratio test.

STAT-I 529 Applied Decision Theory and Bayesian Analysis (3 cr.) P: STAT-I 528 or equivalent. Foundation of statistical analysis, Bayesian and decision theoretic formulation of problems; construction of utility functions and quantifications of prior information; methods of Bayesian decision and inference, with applications; empirical Bayes; combination of evidence; and game theory and minimax rules, Bayesian design, and sequential analysis. Comparison of statistical paradigms.

STAT-I 532 Elements of Stochastic Processes (3 cr.) P: STAT-I 519. A basic course in stochastic models including discrete and continuous time processes, Markov chains, and Brownian motion. Introduction to topics such as Gaussian processes, queues and renewal processes, and Poisson processes. Application to economic models, epidemic models, and reliability problems.

STAT-I 533 Nonparametric Statistics (3 cr.) P: STAT-I 516 or consent of instructor. Binomial test for dichotomous data, confidence intervals for proportions, order statistics, one-sample signed Wilcoxon rank test, two-sample Wilcoxon test, two-sample rank tests for dispersion, and

Kruskal-Wallis test for one-way layout. Runs test and Kendall test for independence, one- and two-sample Kolmogorov-Smirnov tests, and nonparametric regression.

STAT-I 536 Introduction to Survival Analysis (3 cr.) P: STAT-I 517 or equivalent. Deals with the modern statistical methods for analyzing time-to-event data. Background theory is provided, but the emphasis is on the applications and the interpretations of results. Provides coverage of survivorship functions and censoring patterns; parametric models and likelihood methods, special life-time distributions; nonparametric inference, life tables, estimation of cumulative hazard functions, and the Kaplan-Meier estimator; one- and two-sample nonparametric tests for censored data; and semiparametric proportional hazards regression (Cox Regression), parameters' estimation, stratification, model fitting strategies, and model interpretations. Heavy use of statistical software such as R and SAS.

STAT-I 598 Topics in Statistical Methods (0-6 cr.) P: Consent of instructor. Directed study and reports for students who wish to undertake individual reading and study on approved topics.

STAT-I 619 Probability Theory (3 cr.) P: STAT-I 519. Probability Theory is the foundation of statistical methodologies, which is fundamental in the practice of science. From this course students will get a precise mathematical understanding of probabilities and sigma-algebras, random weak convergence, characteristic functions, the central limit theorem, Lebesgue decomposition, conditioning and martingales.

STAT-I 628 Advanced Statistical Inference (3 cr.) P: STAT-I 519 and STAT-I 528. C: STAT-I 619. Real analysis for inference, statistics and subfields, conditional expectations and probability distributions, UMP tests with applications to normal distributions and confidence sets, invariance, asymptotic theory of estimation and likelihood based inference, U-statistics, Edgeworth expansions, saddle point method.

STAT-I 698 Research M.S. Thesis (6 cr.) P: Consent of advisor. M.S. thesis in Applied Statistics.

Science - General

Undergraduate Level

SCI-I 120 Windows on Science (1 cr.) Fall, Spring. Designed for new and prospective science majors, the course covers an integrative overview of science, examining science and society, the scientific method and community of scientists, undergraduate research, professional ethics, an exploration of science-based careers, and strategies for success as a science major.

SCI-I 190 Topics in Science (1-3 cr.) P: Prerequisites and course material vary with the topic. Fall, Spring, Summer. Topics in science and interdisciplinary fields.

SCI-I 197 Exploring Health Professions (1 cr.) Fall, Spring. Exploring Health Professions is designed to help students gain a wider and deeper understanding of the variety of health professions and how to most effectively prepare for entry into the professions. Guest speakers, readings, and class discussions provide opportunities for students to explore a variety of health fields, network with current health professionals, reflect on their interests and values, and learn ways to stand out in a competitive field.

SCI-I 200 Tutorial in Interdisciplinary Studies (1 cr.) Fall, Spring. Tutorial under the supervision of a faculty mentor to develop a proposal to pursue a plan of study focused on a science-based, interdisciplinary area. The proposal is to be submitted to the review committee for approval. Each student will maintain a journal on the progress on the plan of study.

SCI-I 220 Introduction to Research Methods (1 cr.) This course is an introduction to research. Topics include learning the language of scholarly research; research ethics; laboratory safety; and research approval processes. Students will learn how to design, write, and present research for a variety of audiences and disciplines.

SCI-I 225 Mentor-Based Research Experience (0-3 cr.) This course is designed to introduce a student to fundamental research. It will link to a program through which the student is participating, e.g. Diversity Research Scholars Program (DSRP), Multidisciplinary Undergraduate Research Institute (MURI), or 1st Year Research Immersion Program (1RIP). May be eligible for other programs.

SCI-I 290 Intermediate Topics in Science (1-3 cr.) P: Prerequisites and course material vary with the topic. Fall, Spring, Summer. Intermediate topics in science and interdisciplinary fields.

SCI-I 294 Beginning Science-Based Internship (0-3 cr.) P: Sophomore or junior standing and program advisor approval. Fall, Spring, Summer. A semester of full- or part-time beginning internship experience in an industrial, government, or business setting matching the student's academic and career objectives. A comprehensive written report on the experience is required. Yes.

SCI-I 296 Career Planning & Success Strategies (1 cr.) This course is designed to provide tools for the student who is interested in seeking an internship or career employment after college graduation. This course will explore personal values and strategies for finding the ideal career paths based on abilities, skills, and interests. Students will explore the value of internships, and tactics for identifying and securing internship opportunities. Practical strategies for approaching the art of networking and its impact on the success of career planning and securing opportunities will be examined.

SCI-I 297 Health Professions Shadowing (1 cr.) Fall, Spring, Summer. The Health Professions Shadowing course exposes students to the healthcare field through shadowing and being mentored by a healthcare professional. Students gain hands on experience, basic healthcare knowledge and insights into the careers of medical professionals.

SCI-I 390 Advanced Topics in Science (0-3 cr.) P: Prerequisites and course material vary with the topic. Fall, Spring, Summer. Advanced topics in science and interdisciplinary fields. Prerequisites and course material vary with the topic. Repeatable under different topics.

SCI-I 395 Science and Health Professions Study Abroad (0-3 cr.) Fall, Spring, Summer, as needed to be scheduled with a study abroad trip. This course will provide students with a culturally rich experience. There will be two components to this class: 1. Learning about

the cultural, political, historical, and science or health-related aspects of the host community through pre-trip, on-site, and post-trip mandatory classes. 2. Engaging with professionals, translators, fellow participants, and local residents/patients on the service trip to the host community focusing on science or health issues. Repeatable.

SCI-I 397 Professional School Application Preparation (1 cr.) P: Junior or Senior standing. Fall. This course will help juniors and seniors prepare to apply for graduate-level professional health programs (e.g. medicine, dentistry, PT, PA, etc.). Topics covered will include: school selection; application overview; personal statement development; requesting letters of recommendation; interviewing; financing professional school; professionalism; and parallel planning.

SCI-I 398 Medical School Application Preparation (1 cr.) Spring. The course will prepare students for the medical school application process, including the MCAT and the application process. The application portion of the course will cover the AMCAS/AACOMAS application overview, developing and editing a personal statement, identifying and soliciting letters of recommendation, constructing experience descriptions, and interviewing. The MCAT preparation portion will focus on the four main areas of the MCAT, which include: Critical Analysis and Reasoning, Chemistry and Physics, Biology and Biochemistry, and Psychology and Sociology.

SCI-I 494 Internship in Science-Based Fields (0-6 cr.) P: Junior or senior standing and program advisor approval. Fall, Spring, Summer. A semester of full- or part-time internship experience in an industrial, government, or business setting matching student's academic/career objective.

SCI-I 495 Readings and Research in Science (1-3 cr.) P: Junior or senior standing, consent of instructor(s), and approval of review committee. Every semester, time arranged. Independent, interdisciplinary study and research in science and science-related fields. A major paper must be submitted. May be repeated for a maximum of 6 credit hours.

SCI-I 394 Graduate School Application Preparation (1 cr.) P: Prerequisite: Junior or senior standing. This course will help students prepare to apply for graduate school. Topics covered include school selection, application overview, developing resumes and/or CVs, personal statement development, requesting letters of recommendation, and financing graduate school.

SCI-I 396 Dental School Application Preparation (1 cr.) P: Junior or Senior standing. Fall. The course will prepare students for the dental school application process, including the DAT and the application process. The DAT preparation portion will focus on the four main areas of the DAT, which include: Natural Sciences, Perceptual Ability, Reading Comprehension, and Quantitative Reasoning.

Graduate Level

SCI-I 590 Topics in Science (1-3 cr.) Consent of instructor. Directed study for students who wish to undertake individual reading and study on approved topics.

Candidate

CAND 99100 Candidate (0 cr.) For School of Science Purdue Graduate students only. Course permission to register is not required. Candidacy enrollment in a student's final semester signals to the Graduate School that a degree audit will be processed in that semester. Candidacy 99100 is the usual enrollment which is a zero-credit, no requirement course. Students must also have at least one credit of regular tuition-bearing enrollment to be considered an active student in that semester.

CAND 99200 Degree Only (0 cr.) For School of Science Purdue Graduate students only. CAND 99200 is for a graduate student who has completed all requirements and is registering only to declare candidacy. No courses are taken with this registration. This privileged candidacy enrollment will require completion of all graduation requirements by the published Early Deposit Deadline (first half of the semester) for Purdue University students in the term of graduation.

CAND 99300 Exam Only (0 cr.) For School of Science Purdue Graduate students only. CAND 99300 is for graduate students who have only to take final oral exams, language exams, or a similar requirement to receive the degree. No courses are taken with this registration.