Department of Natural, Information, and Mathematical Sciences

Robert R. Roales, Chairperson
Professors: Dolph (Botany), Gompa (Mathematics), Haffley (Chemistry)

Associate Professors: Chauret (Biology), Hansen (Mathematics), Kasem (Chemistry), Roales (Anatomy and Physiology), Ross (Information Systems), Steldt (Physics), Symonds (Mathematics), Tinsley (Information Systems), Widland (Mathematics)

Assistant Professor: Finkler (Biology)

Lecturers: Gillette (Chemistry), Henry (Mathematics), Kunkle (Mathematics), Sehr (Mathematics)

Laboratory Supervisors: Bolke (Biology), Deyo (Chemistry)

Bachelor of Arts in Biological and Physical Sciences

The Bachelor of Arts degree in biological and physical sciences centers around a traditional core of courses in the humanities and social and behavioral sciences, as well as the natural sciences. Through academic counseling and proper course selection, students may choose a curriculum that is uniquely suited to their specific needs in the biological and physical sciences. Students may follow a very specific curriculum or they may elect to pursue a more general science education. Graduates of the program are prepared to continue their education at the graduate level of certain disciplines or to enter a health-related profession such as medicine, dentistry, or optometry.

See the section entitled "The Arts and Sciences Curriculum" for specific degree requirements.

Bachelor of Arts in Biology

The Bachelor of Arts degree in biology centers around a traditional core that includes cell biology, genetics, morphology, physiology, plant science, and microbiology. Additional courses in general chemistry, organic chemistry, physics, and mathematics round out the basic program. In addition to their scientific training, students in biology are expected to be able to communicate effectively and to possess an understanding of Western culture and society. As students in the Division of Arts and Sciences, biology students are exposed to a core of courses in the humanities and social and behavioral sciences, as well as the natural sciences. Graduates of the program are well suited to continue their education at the graduate level, or to enter a health-related profession such as medicine or dentistry. The degree program is structured along three tracks to enable students to pursue postbaccalaureate studies. These tracks are biology, pre-medicine, and pre-dentistry.

Degree Requirements

1. Students must complete a minimum of 120 credit hours with a cumulative grade point average of 2.0 or higher.

2. Communication—Students must be able to communicate effectively both orally and in writing. This requirement will be satisfied by completing ENG W131-W132 Elementary Composition I-II and SPCH S121 Public Speaking with grades of C or higher, and W350 Advanced Expository Writing or an approved intensive writing course with a grade of C– or higher.

3. Western Civilization—HIST H113-H114 History of Western European Civilization I-II is required.

4. Foreign Language—Six credit hours at the 200 level (or higher) in a foreign language are necessary. The first year (100-level courses) in the language will apply toward the degree at Kokomo. Students who have studied a foreign language prior to entering Indiana University are required to take the CEEB Achievement Test in that language. Students who place into the second year of a language on such a test will be eligible to receive S credit for the first year upon completion of a second-year course in that language with a grade of C or higher. Students who place into the second semester of a language will be eligible to receive S credit for the first semester upon completion of the second-semester course with a grade of C or higher. First- and second-year language courses may not be taken on the Pass/Fail option in a student's first foreign language. Foreign students may not receive credit for their native language.

5. General Education— At least 40 credit hours must be selected from the three departments of humanities, social and behavioral sciences, and natural, information, and mathematical sciences. These 40 credit hours do not include the requirements mentioned in items 2-4 above (communication, Western civilization, foreign language). Also required are a freshman literature course and one course to be selected from the arts (fine arts, music, theater) or philosophy. Of the 40 credit hours in general education, a total of 12 hours must be included from the humanities, 12 hours from the social and behavioral sciences, and 16 hours from the biological and physical sciences, including two courses involving a laboratory.

6. Arts and Sciences—A student must complete at least 30 credit hours in 300-400-level courses within the arts and sciences, though not necessarily in one department.

7. Specific Biology Degree Requirements—Students must complete BIOL L105 Introduction to Biology, CHEM C105 Principles of Chemistry, CHEM C106 Principles of Chemistry II, CHEM C125 Experimental Chemistry I, CHEM C126 Experimental Chemistry II, CHEM C341 Organic Chemistry I, CHEM C342 Organic Chemistry II, CHEM C343 Organic Chemistry I Laboratory, CHEM C344 Organic Chemistry II Laboratory, PHYS P201 General Physics I, and PHYS P202 General Physics II; and either MATH M119 Brief Survey of Calculus I or MATH M215 Calculus I (mathematics courses require a grade or C- or higher). In addition, students must satisfy the computer literacy requirement of the arts and sciences degree requirements.

8. Biology Courses—A minimum of 33 credit hours in biology at or above the 200 level must be taken with a grade of C– or better in each course. The following biology courses are required: B203 Survey of the Plant Kingdom, Z315 Developmental Anatomy, L364 Principles of Genetics, M310 Microbiology, M315 Microbiology Laboratory, L473 Ecology, P416 Comparative Animal Physiology, and L403 Biology Seminar. Students must also select a minimum of 6 credits

from the following courses: L321 Immunology (3 cr.), K339 Immunology Laboratory (2 cr.); L477 Computers in Biology (3 cr.); L490 Individual Study (1-12 cr.); C483 Biological Chemistry (3 cr.); B364 Summer Flowering Plants (5 cr.); and L367 Cell Physiology (3 cr.).

Biology Honors Degree

A biology honors degree is available to qualified students. See the section entitled "Honors Program" in this bulletin. Students pursuing the biology honors degree must complete two credits of honors colloquia and a minimum of 6 credits from the following: H339 Immunology Laboratory (2 cr.), P418 Comparative Animal Physiology Laboratory (2 cr.), H474 Ecology Laboratory (2 cr.), and H490 Individual Study (1-12 cr.). No more than 15 credit hours in courses outside of the arts and sciences subject areas, e.g., business or education, may be applied toward the degree.

Thirty of the last 60 hours must be completed at Indiana University Kokomo.

Biology Minor

To earn a minor in biology students must take the following courses:

Required:

- B203 Survey of the Plant Kingdom (5 cr.)
- L105 Introduction to Biology (5 cr.)

plus 6 to 10 hours from the following:

- L364 Principles of Genetics (3 cr.)
- L367 Cell Physiology (3 cr.)
- L473 Ecology (3 cr.)
- M310/315 Microbiology/Lab (5 cr.)
- P416 Comparative Animal Physiology (3 cr.)
- Z315 Developmental Anatomy (5 cr.)

Students must take all the necessary prerequisites before enrolling in courses required for the minor.

Bachelor of Arts in Chemistry

The Bachelor of Arts (B.A.) Degree in Chemistry centers on a traditional core that includes organic, analytical, inorganic and physical chemistry; biochemistry, and mathematics. But good scientists also need to be exposed to other fields of knowledge—to the arts, the social sciences, and humanities. As students in the Division of Arts and Sciences, the curriculum also includes course requirements in subject areas such as history, English, sociology, psychology, foreign languages, mathematics, and information sciences. To graduate, a minimum of 120 credit hours are needed, 39 of these are in required chemistry courses and 81 in required general education courses. Students planning to enter graduate or professional school after earning a bachelor's degree should inquire about IU Kokomo's pre-professional tracks in biology, pre-medicine, and pre-dentistry. If you're interested in becoming a science educator, IU Kokomo offers a program that enables students to earn a chemistry degree and become certified to teach chemistry at the secondary school level. The certification program requires an additional 32 credit hours of methods and professional education curriculum, which are taken through the Division of Education.

Degree Requirements

1. Students must complete a minimum of 120 credit hours with a cumulative grade point average of 2.0 or higher.

2. English—Students must be able to communicate effectively. This requirement will be satisfied by completing English W131 and W132, Elementary Composition I and II, with grades of C or higher and English W350 Advanced Expository Writing or an approved intensive writing course with a grade of C- or higher.

3. Foreign Language—Six hours at the 200 level (or higher) in a foreign language will apply toward the degree at Kokomo. Students who have studied a foreign language prior to entering Indiana University are required to take the CEEB Achievement Test in that language. Students who place into the second semester of a language will be eligible to receive S credit for the first semester upon completion of the second semester course with a grade of C or higher. First- and second-year language courses may not be taken on a pass/fail option in a student's first foreign language. Foreign students may not receive credit for their native language.

4. General Education—At least 43 credit hours must be selected from the four departments of Humanities, Social and Behavioral Sciences, Biological and Physical Sciences and Mathematical and Information Sciences. These 43 credit hours do not include the requirements mentioned in items 2 and 3 above (English, Foreign Language) or in item 6 (Major). Twelve credit hours must be selected from the humanities department, including a freshman literature course, Public Speaking, S121 (with a grade of C- or higher), and one of the following: Fine Arts, Music, Theater or Philosophy. Eighteen credit hours must be selected from the social and behavioral sciences, including 6 credit hours of Western European Civilization I and II, H113 and H114; and twelve credit hours selected from at least two different areas within the department of Social and Behavioral Sciences. Thirteen credit hours must be selected from the biological, physical, mathematical and information sciences. Five credit hours must be selected from the biological sciences, including a course involving a laboratory; and 8 credit hours must be selected from the physical or mathematical and information sciences, including one course involving a laboratory.

5. Arts and Sciences—A student must complete at least 30 credit hours in 300/400-level courses within the arts and sciences, though not necessarily in one department.

6. Major—Students must complete C105, Principles of Chemistry I; C106 Principles of Chemistry II; C125, Experimental Chemistry I; C126, Experimental Chemistry II; C210, Introduction to Quantitative Analytical Chemistry, C211, Introduction to Quantitative Analytical Chemistry Laboratory, C341 and C342, Organic Chemistry Lectures I and II; C343 and C344, Organic Chemistry Laboratory I and II; C361, Physical Chemistry I and 3 additional credit hours of chemistry courses at the 300/400 level.

7. The following courses outside of chemistry must also be completed: L105, Introduction to Biology; P201 and P202, General Physics I and II; M215 and M216, Calculus I and II (with a grade of C- or higher); C106, Introduction to Computers and Their Use; Statistics PSY K300, and an upper

level science elective. These courses may be used to satisfy the general educational requirements described in item 4.

8. Recommended additional courses—Students wishing to pursue a graduate degree in chemistry should include, in addition to the courses listed previously, C362, Physical Chemistry II; C310, Analytical Chemistry; C311, Analytical Chemistry Laboratory; C430, Inorganic Chemistry; C483, Biological Chemistry, and C409, Chemical Research.

9. No more than 15 credit hours in courses outside of the arts and science subject areas, e.g., business or education, may be applied towards the degree. Thirty of the last 60 credit hours must be completed at Indiana University Kokomo.

Bachelor of Science in Computer Information Systems

The Bachelor of Science in Computer Information Systems is a four-year degree that involves the study of computers and their application. The computer core courses ensure that graduates will have a broad understanding of Computer Information Systems. To complement this knowledge of computers, an approved minor in another area is required. This will enable program graduates to become important contributors within the organizations they serve.

Requirements:

1. 120 credit hours with a cumulative grade point average of at least 2.0.

2. Written Communication—ENG W131- W132 Elementary Composition I-II and ENG W231 Professional Writing Skills, with a grade of at least C in each.

3. Oral Communication—SPCH S121 Public Speaking, with a minimum grade of C.

4. History—HIST H113-H114 History of Western European Civilization I-II.

5. Humanities—6 credit hours.

6. Natural Science—One laboratory science course, 4 or 5 credit hours.

7. Mathematics—MATH M118 Finite Mathematics and MATH M125 Pre-calculus Mathematics, with a minimum grade of C, STAT 301 Elementary Statistical Methods I or ECON E270 Statistical Theory in Economics and Business or PSY K300 Statistical Techniques.

8. Students must complete 30 of the last 60 credit hours at Indiana University Kokomo.

Minor—Each student must also complete the requirements for any approved Indiana University Kokomo minor.

Required Courses:

The following courses must be completed with a grade of at least C–:

- CSCI C106 Introduction to Computers and Their Use
- CSCI C297 Visual Basic and Access
- CSCI C309 Objected-oriented Programming
- DPIS D250 Multimedia
- DPIS D335 Computer Hardware, System Software, and Architecture
- DPIS D345 Database Systems Management and Design
- CSCI C445 Information Systems Design
- BUS S302 Management Information Systems
- DPIS D490 Current Directions in Information Systems

Two additional 200-level or higher approved Computer Information Systems courses

Postbaccalaureate Certificate in Computer Information Systems

Requirements:

1. Students must possess an earned baccalaureate degree.

2. Students must complete a minimum of 30 credit hours with a GPA of at least 2.0 and a minimum grade of C- in each course.

3. Students must take the following: CSCI C106 Introduction to Computers and Their Use; DPIS D250 Multimedia; CSCI C297 Visual Basic and Access; CSCI C309 Objected-oriented Programming; DPIS D335 Computer Hardware, System Software, and Architecture; DPIS D345 Database Systems Management and Design; CSCI C445 Information Systems Design; BUS S302 Management Information Systems; DPIS D490 Current Directions in Information Systems and one additional 200-level or higher approved Computer Information Systems courses.

Minor in Computer Information Systems

The minor in Computer Information Systems involves the study of computer systems, including computer-specific terminology, and a fundamental ability to use and develop computer programs.

Required Courses (15 cr.) Minimum grade in all courses is a C–:

- CSCI C106 Introduction to Computers and Their Use
- DPIS D250 Multimedia

A programming course: C297 *or* C309 (Check bulletin for proper prerequisites)

Two additional 300 – 400 level Computer Information Systems courses (Check bulletin for proper prerequisites)

Bachelor of Arts in Mathematics

The Bachelor of Arts degree in mathematics is designed to prepare individuals to understand the nature of truth and the concept of proof in the discipline of mathematics, to understand the application of mathematical techniques to other fields, and to formulate and solve problems mathematically. Students may select courses to enter graduate school in mathematics or enter business or industry.

Requirements:

1. Students must satisfy the arts and sciences degree requirements outlined in the section entitled "Degree Requirements" under "Division of Arts and Sciences."

2. Major Concentration—Students must complete a minimum of 31 credit hours in mathematics with a grade point average of at least 2.0. The following courses are required:

- MATH M215-216 Calculus I-II (10 cr.)
- MATH M311 Calculus III (3 cr.)
- MATH M303 Linear Algebra for Undergraduates (3 cr.)

In addition, students must complete one course from Group A and two sequences from Group B, or three courses from Group A and one sequence from Group B.

Group A:
- MATH M313 Elementary Differential Equations with Applications (3 cr.)
- MATH T336 Topics in Euclidean Geometry (3 cr.)
- MATH M360 Elements of Probability (3 cr.)
- MATH M366 Elements of Statistical Inference (3 cr.)
- MATH M415 Elementary Complex Variables with Applications (3 cr.)

Group B:
- MATH M403-M404 Introduction to Modern Algebra I-II (6 cr.)
- MATH M413-M414 Introduction to Analysis I-II (6 cr.)
- MATH M447-M448 Mathematical Models and Applications I-II (6 cr.)
- MATH M471-M472 Numerical Analysis I-II (6 cr.)

3. General Examination—Students must pass a written examination covering the entire undergraduate mathematics program. The examination will be given near the end of the semester in which the student is expected to graduate. The mathematics faculty may permit a student who does not perform satisfactorily on the written examination to take an oral examination that same semester. Students who still do not perform satisfactorily may take the general examination the next time it is offered. Those who do not pass the general examination on the second attempt must petition the mathematics faculty to take the general examination a third time, and are expected to document additional preparation in mathematics.

4. Students must complete 30 of the last 60 credit hours, at least 9 credit hours of mathematics from Groups A or B, and the general examination at Indiana University Kokomo.

Minor in Mathematics

Students must complete a minimum of 19 cr. hours in mathematics with a grade point average of 2.0 or higher. At least 6 cr. hours of mathematics must be comleted at IU Kokomo.

Students must complete the following courses:

- MATH M215 Calculus I (5 cr.)
- MATH M216 Calculus II (5 cr.)
- MATH M311 Calculus III (3 cr.)
- MATH M303 Linear Algebra for Undergraduates (3 cr.)

Students must also select one from the following list of courses:

- MATH M313 Elementary Differential Equations with Applications (3 cr.)
- MATH T336 Topics in Euclidean Geometry (3 cr.)
- MATH M360 Elements of Probability (3 cr.)
- MATH M403 Introduction to Modern Algebra (3 cr.)
- MATH M413 Introduction to Analysis I (3 cr.)
- MATH M415 Elementary Complex Variables with Applications (3 cr.)
- MATH M447 Mathematical Models and Applications I (3 cr.)
- MATH M471 Numerical Analysis I (3 cr.)

Natural, Information, and Mathematical Science Courses

Note: The university reserves the right to cancel courses for insufficient enrollment.

P = prerequisite
C = corequisite
R = recommended
* = lab fee

Biological Sciences

Anatomy (ANAT)

A215 Basic Human Anatomy (5 cr.)
Fall, Spring. Structure of cells, tissues, organs, and systems and their relationship to function.*

Biology (BIOL)

K339 Immunology Laboratory (2 cr.)
P or C: L321. Demonstration of immunological principles by experimentation. Exercises include cells and factors of the innate and the adaptive immune system. *

L100 Humans and the Biological World (5 cr.)
Fall, Spring. Principles of biological organization, from molecules through cells and organisms, with special reference given to humans. Credit given for only one 100-level biology course. For nonmajors.*

L105 Introduction to Biology (5 cr.)
Fall, Spring. P: high school or college chemistry. Integrated picture of manner in which organisms at diverse levels of organization meet most problems in maintaining and propagating life. Credit given for only one 100-level biology course.*

L270 Humans and Microorganisms (3 cr.)
Beneficial and harmful activities of algae, bacteria, fungi, protozoa, viruses. Element cycles, production of fermented foods and dairy products, food poisonings, industrial fermentations, and antibiotics. Water and sewage microbiology. Microbial diseases and immunization problems.

L321 Principles of Immunology (3 cr.)
Spring 2004. Alternate years. P: L105, CHEM C101, or CHEM C105. An introductory survey of the basic principles of immunology and their practical applications.

L364 Principles of Genetics (3 cr.)
Spring 2003. Alternate years. P: L367 or M310. Analysis of genetic mechanisms and processes, recombination, genetic interaction, gene regulation, and evolution.

L367 Cell Physiology (3 cr.)
Fall 2002. Alternate years. P: an introductory biology and general chemistry course. R: organic chemistry. Introduction to biochemical structure and metabolic activities of plant, animal, and microbial cells; physiology of membranes; locomotion and response; growth, division, and differentiation of cells.

L370 Plants, Animals, and Civilization (3 cr.)
Fall, Spring. R: junior or senior standing. The principal domesticated plants and animals from prehistoric times to the present, with consideration of their origin, spread, and relationship

to development of civilization and to present problems of hunger. Not open to students who have had B368. Note: L370 will not count toward a Bloomington or Kokomo biological science degree.

L403 Biology Seminar (3 cr.)
Fall 2002. Alternate years. P: junior or senior standing. A seminar course concerned with current topics and issues in the biological sciences.

L473 Ecology (3 cr.)
Fall 2003. Alternate years. P: 8 hours of biology. R: L364. Major concepts of ecology for science majors; relation of individual organisms to their environment, population ecology, and structure and function of ecosystems.

L474 Laboratory in Ecology (2 cr.)
Arr. P or C: L473. Introduction to research problems and techniques in the ecology of individuals, populations, and ecosystems.*

L477 Computers in Biology (3 cr.)
Spring 2004. Alternate years. Applications of mini, micro, and mainframe computers to biological work. Lectures and computer operation. Not concerned with computer programming.

L490 Individual Study (cr. arr., 12 cr. max.)
Arr. P: overall GPA of 2.5 or above; must have written consent of faculty member supervising research. Must complete a written assignment as evidence of each semester's work. Must present oral report to complete more than 6 credit hours.

Botany (PLSC)

B203 Survey of the Plant Kingdom (5 cr.)
Spring. Survey of various groups of plants, including their structure, behavior, life histories, classification, and economic importance.*

B364 Summer Flowering Plants (5 cr.)
Summer P: one introductory biology course. A course for students desiring a broad, practical knowledge of common wild and cultivated plants.*

Microbiology (MICR)

J200 Microbiology and Immunology (3 cr.)
Fall, Spring. P: A215, CHEM C101-102, and P215 or equivalent. For students of the baccalaureate curricula in the School of Nursing and in the Division of Allied Health Sciences; others by consent of instructor. Concurrent or previous registration in J201 Microbiology Laboratory is recommended. Consideration of pathogenic bacteria, viruses, fungi, and parasites in human disease; immunology and host-defense mechanisms.

J201 Microbiology Laboratory (1 cr.)
Fall, Spring. P or C: J200. Bacteriological techniques of microscopy, asepsis, pure culture, and identification. Biology of microorganisms; action of antimicrobial agents. Representative immunological reactions: blood typing, bacterial agglutination, precipitin reaction, immune lysis. Virology: bacteriophage, animal viruses, viral hemagglutination, and cytopathogenic effects. Recognition of pathogenic fungi and animal parasites.*

M310 Microbiology (3 cr.)
Fall 2003. Alternate years. P: two semesters of college chemistry. C: M315. Application of fundamental biological principles to the study of microorganisms. Significance of microorganisms to humans and their environment.

M315 Microbiology Laboratory (2 cr.)
Fall 2003. Alternate years. C: M310. Laboratory exercises and demonstrations to yield proficiency in principles and techniques of cultivation and utilization of microorganisms under aseptic conditions.*

Physiology (PHSL)

P215 Basic Human Physiology (5 cr.)
Fall, Spring. Functional aspects of cells, tissues, organs, and systems in mammalian organisms. Designed for pre-professional students in allied health, nursing, speech and hearing, and HPER.*

P416 Comparative Animal Physiology (3 cr.)
Fall 2003. Alternate years. P: CHEM C106, two college biology courses, and one college mathematics course. Physiological principles of the respiratory, circulatory, excretory, and related systems in a variety of invertebrate and vertebrate animals.

P418 Laboratory in Comparative Animal Physiology (2 cr.)
Arr. P or C: P416. Laboratory experiments using a variety of animals to illustrate physiological principles.*

Zoology (ZOOL)

Z315 Developmental Anatomy (5 cr.)
Fall 2002. Alternate years. P: an introductory biology course. Comparative study of the structure and development of vertebrates, including humans.

Physical Sciences

Astronomy (AST)

A100 The Solar System (3 cr.)
Spring. Celestial sphere and constellations, measurement of time, astronomical instruments, earth as a planet, the moon, eclipses, planets and their satellites, comets, meteors, theories of origin of solar system.

Chemistry (CHEM)

C100 The World of Chemistry (3 cr.)
Fall. For students requiring only one semester of chemistry. Descriptive course, including inorganic, organic, and biological chemistry, with illustrations of scientific reasoning. Credit given for only one of the following: C100, C101, or C105.

C101 Elementary Chemistry I (3 cr.)
Fall. Introduction to chemistry. Usually taken concurrently with C121. The two sequences, C101-C121 and C102-C122, usually satisfy programs that require only two semesters of chemistry. Admission to advanced courses on basis of C101, C121, C102, C122 granted only in exceptional cases. May be taken without credit in preparation for C105. Credit given for only one of the following: C100, C101, or C105.

C102 Elementary Chemistry II (3 cr.)
Spring. P: C101. Continuation of C101. Usually taken concurrently with C122. The chemistry of organic compounds and

their reactions, followed by an extensive introduction to biochemistry. Credit not given for both C102 and C106.

C105 Principles of Chemistry I (3 cr.)
Fall. P: two years of high school algebra or MATH M125, which may be taken concurrently; one year of high school chemistry. C: C125. Basic principles, including stoichiometry, thermochemistry, atomic and molecular structure, gases, solutions, and selected topics in descriptive chemistry. Credit given for only one of the following, C100, C101, or C105-C125.

C106 Principles of Chemistry II (3 cr.)
Spring. P: C105, C125. C: C126. Chemical equilibrium with emphasis on acids, bases, solubility and electrochemistry, elementary thermodynamics, chemical kinetics, and selected topics in descriptive chemistry. Credit not given for both C102, and C106-C126.

C120 Chemistry Laboratory (2 cr.)
Fall, Spring. P or C: C100. For nonmajors. An introduction to techniques and reasoning of experimental chemistry. Experiments and projects illustrate topics studied in C100. Credit given for only one of the following: C120, C121 or C125*

C121 Elementary Chemistry Laboratory I (2 cr.)
Fall. P or C: C101. An introduction to the techniques and reasoning of experimental chemistry. Credit not given for both C121 and C125.*

C122 Elementary Chemistry Laboratory II (2 cr.)
Spring. P: C101, C121. P or C: C102. Continuation of C121. Emphasis on organic and biochemical experimental techniques. Credit not given for both C122 and C126.*

C125 Experimental Chemistry I (2 cr.)
Fall. C: C105. Introduction to laboratory experimentation, with particular emphasis on the collection and use of experimental data, some properties of solutions, stoichiometry, thermochemistry, and synthesis. Credit given for only one of the following: C121, or C125.*

C126 Experimental Chemistry II (2 cr.)
Spring. P: C125. C: C106. A continuation of C125 with emphasis on equilibria; qualitative analysis; acids and bases; oxidation-reduction reactions including electrochemistry, chemical kinetics, and synthesis. Credit given for only one of the following: C126, or C122.*

C210 Introduction to Quantitative Analytical Chemistry (3 cr.)
P: C106, C126. C:C211. Introduction to the theory and practice of non-instrumental quantitative/qualitative analytical chemistry, including sample selection and preparation and methods of data analysis. Emphasis will be placed on the theory of titrimetric and gravmetric techniques.

C211 Introduction to Quantitative and Analytical Chemistry Laboratory (2 cr.)
P: C126. C:C210. Laboratory instruction in the fundamental analytical techniques discussed in CHEM C210.*

C310 Analytical Chemistry (3 cr.)
P: C106. Fundamental analytical processes including solution equilibria, theory and applications of electrochemistry and spectrophotometry, and chemical methods of separation.

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

C390 Environmental Science (3 cr.)
For nonmajors. Exploration of the complex interrelationships among the physical, chemical, biological, cultural, economic, and political forces that shape the global environment.

C341 Organic Chemistry I: Lecture (3 cr.)
Fall. P: C106. C: C343 or consent of chemistry undergraduate advisor. Chemistry of carbon compounds; nomenclature; qualitative theory of valence; structure and reactions. Syntheses and reactions of major classes and monofunctional compounds.

C342 Organic Chemistry II: Lecture (3 cr.)
Spring. P: C343. C: C344 or consent of instructor. Syntheses and reactions of polyfunctional compounds, natural and industrial products, physical and chemical methods of identification.

C343 Organic Chemistry I: Laboratory (2 cr.)
Fall. C: C341. Laboratory instruction in the fundamental techniques of organic chemistry and the use of general synthetic methods.*

C344 Organic Chemistry II: Laboratory (2 cr.)
Spring. P: C343. C: C342. Preparation, isolation, and identification of organic compounds. Emphasis on modern research methods.*

C361 Physical Chemistry I (3 cr.)
P: C106, P202, M216. Chemical thermodynamics and kinetics, introduction to statistical thermodynamics.

C362 Physical Chemistry II (3 cr.)
P: C361. Introduction to quantum mechanics. Structure and spectra of atoms, molecules, and solids.

C409 Chemical Research (1-5 cr.; 10 cr. Max.)
For outstanding students. To be elected only after consultation with the faculty reaserch advisor. Cannot be substituted for any course required in the chemistry major. A research thesis is required.

C430 Inorganic Chemistry (3 cr.)
P: C106. R: C342. Structure and bonding of inorganic compounds, survey of chemistry of nonmetal and metal elements, coordination compounds, organometallic compounds, mechanisms and reactions.

C483 Biological Chemistry Lecture (3 cr.)
Spring 2004. Alternate years. P: 18 credit hours of chemistry, including C341. Introduction to structure, chemical properties, and interrelationships of biological substances.

Geography (Physical) (GEOG)

G107 Physical Systems of the Environment (3 cr.)
Physical environment as the home of humans, emphasizing the distribution and interaction of environmental variables (landforms, vegetation, soils, and climate). Note: Business majors may count GEOG G107 only as a social science.

G315 Environmental Conservation (3 cr.)
R: 3 credit hours of geography or junior standing. Conservation of natural resources including soil, water, wildlife, and forests as interrelated components of the environment, emphasizing an ecological approach. Current problems relating to environmental quality.

Physics (PHYS)
P100 Physics in the Modern World (5 cr.)
Fall. Ideas, language, methods, impact, and cultural aspects of physics today. Includes classical physics up to physical bases of radar, atomic-energy applications, etc. Beginning high school algebra used. Cannot be substituted for physics courses explicitly designated in specified curricula. No credit in this course will be given to students who have passed P201-P202.*

P201 General Physics I (5 cr.)
Fall. P: MATH M125 or high school equivalent. Newtonian mechanics, oscillations and waves, bulk properties of matter and thermodynamics.*

P202 General Physics II (5 cr.)
Spring. P: P201. Electricity and magnetism, geometrical and physical optics, and modern physics.*

P301 Contemporary Physics (3 cr.)
Arr. P: P202 or P222; MATH M215, which may be taken concurrently with consent of instructor. Introduction to modern physics. Atomic and nuclear physics, kinetic theory, relativity, elementary particles.

P310 Environmental Physics (3 cr.)
Arr. P: P201 or consent of instructor. Relationship of physics to current environmental problems. Energy production, comparison of sources and by-products; nature of and possible solutions to problems of noise; particulate matter in atmosphere.

Computer Information Systems

Computer Science (CSCI)

C100 Computing Tools (1 cr.)
Fall, Spring. An introduction to computing applications useful in college work. Microcomputer systems, word processing, spreadsheets, graphics, e-mail and Web browsers are used.

C106 Introduction to Computers and Their Use (3 cr.)
Fall, Spring. P: C100 or knowledge of Windows/Internet Explorer. Introduction to computers and data processing. Includes the historical and current status of data processing and electronic digital computers; a survey of computer applications; foundations of computer programming; survey of programming languages; and the fundamentals of a high-level language such as Visual Basic.

C297 Visual Basic with Access (3 cr.)
Fall, Spring. P: C106. An intensive introduction to computer programming techniques using Visual Basic. Emphasis on proper program design and documentation. Includes interfacing VB with Access database.

C309 Object-oriented Programming (3 cr.)
Fall, Spring. P: C297 or another programming course. An introduction to objected-oriented programming in C++ or Java. Covers the transition from structured programming to OOP techniques to support encapsulation, inheritance, and polymorphism.

C390 Individual Programming Laboratory (1-3 cr.)
Arr. P: junior/senior standing. Students will design, program, verify, and document a special project assignment selected in consultation with their instructor. This course may be taken several times up to a maximum of 6 credit hours. Prior to enrolling, students must arrange for an instructor to supervise their course activity.

C445 Information Systems Design (3 cr.)
Spring. P: C309. Concepts, theory, and practice in systems design and analysis. Tools of systems analysis used with computer systems to define data flow, control, and process requirements. Includes object-oriented analysis techniques.

Y398 Internship in Professional Practice (S/F Grading) (3-6 cr.)
Arr. P: sophomore standing; approval of major department. Designed to provide opportunities for students to receive credit for selected, career-related, work. Evaluation by employer and faculty sponsor.

Information Systems (DPIS)

D250 Multimedia (3 cr.)
Fall, Spring. P: Intro-level PC skills. Covers the development of CD and graphics-based presentations such as would be made by corporate trainers, system developers, elementary/secondary school teachers, and marketing professionals. Students will use image capture, scanning, and audio capture to create projected presentations in class.

D285 Advanced Productivity Tools (3cr.)
Spring. P: D250. A survey of various (primarily Microsoft) PC-based software programs that facilitate superior workplace effectiveness. These programs will be utilized in greater detail than just the basics. Current examples of widely available tools include PowerPoint, FrontPage, NetMeeting, and Outlook.

D335 Computer Hardware, System Software, and Architecture (3 cr.)
Fall, Spring. P: C297. A functional, systems-level review of computing equipment and the organization of components and devices into architectural configurations. The principles of system software, operating system design, and components as they relate to the coordinated functioning of a computer.

D345 Database Systems Management and Design (3 cr.)
Spring. P: CSCI C297. The theory and practice of database management systems (DBMS); information management; database models hierarchical, network, relational; distributed

processing; database administration, design, evaluation, acquisition, and implementation; use of DBMS by analysts, programmers, and end users. Database used is Oracle.

D490 Current Directions in Data Processing and Information Systems (3 cr.)
Fall. P: C309. A survey of current computer systems, and an examination of state-of-the-art applications that significantly improve workplace productivity. Students will investigate one area in depth.

Mathematics (Math)

M003 Graphics Calculator Lab (0 cr.)
Fall, Spring. A short laboratory course in the operation and use of graphics calculators to prepare students for mathematics courses utilizing such calculators.

M006 Elementary Mathematical Skills (3 cr.)
Traditional and graphics calculator solutions to whole numbers, fractions, decimals, signed numbers, proportion and percent problems, estimation techniques, area, perimeter, circumference, surface area and volume; problem-solving skills with real world application problems. Credit may not be applied to any degree.

M007 Elementary Algebra (3 cr.)
Fall, Spring. Signed numbers, operations with polynomials, solving equations, factoring, introduction to graphing, fractional and radical expressions. Not open to students who have had M014. Credit may not be applied toward any degree.

M117 Intermediate Algebra (3cr.)
Fall and Spring. P: M007 or equivalent. R: C– or above in M007. Factoring, rational expressions, fractional exponents, radicals, quadratic equations, and functions. Does not count toward the arts and sciences divisional distribution requirements.

M118 Finite Mathematics (3 cr.)
Fall, Spring. P: two years of high school algebra or M117. R: a grade of C– or better in M117 or equivalent. Set theory, linear systems, matrices and determinants, probability, linear programming. Applications to problems from business and the social sciences.

M119 Brief Survey of Calculus I (3 cr.)
Fall, Spring. P: two years of high school algebra or M125 or equivalent. R: a grade of C– or better in M125 or equivalent. Introduction to calculus. Primarily for students in the social sciences. Not open to those who have had M211 or M215.

M120 Brief Survey of Calculus II (3 cr.)
Fall, Spring. P: M119. R: a grade of C– or above in M119. A continuation of M119, covering topics in elementary differential equations, calculus of functions of several variables and infinite series. Intended for non-physical science students. Credit not given for both M216 and M120. Knowledge of trigonometry required.

M125 Precalculus Mathematics (3 cr.)
Fall, Spring. P: M117. R: a grade of C– or better in M117 or equivalent. Designed to prepare students for calculus. Algebraic operations, polynomials, functions and their graphs, conic sections, linear systems of equations. Does not count toward the arts and science divisional distribution requirements. Credit not given for both M125 and M015 and M017.

M126 Trigonometric Functions (3 cr.)
Fall, Spring. P: M125. Designed to develop the properties of the trigonometric, exponential, and logarithmic functions and to prepare for courses in calculus (M211 or M215). Credit not given for both M125 and M015 and M017.

M215-M216 Calculus I-II (5-5 cr.)
Fall, Spring. P: two years of high school algebra and trigonometry, or both M125 and M126. Coordinates, functions, straight line, limits, continuity, derivative and definite integral, applications, circles, conics, techniques of integration, infinite series. M215 not open to those who have had M119 or M211. A student cannot receive credit for both M131 and M215, M119 and M215, M211 and M215, or M120 and M216.

M303 Linear Algebra for Undergraduates (3 cr.)
P: M216 or consent of instructor. Introduction to theory of real and complex vector spaces. Coordinate systems, linear dependence, bases. Linear transformations and matrix calculus. Determinants and rank. Credit not given for both M301 and M303.

M311 Calculus III (3 cr.)
P: M216 or consent of instructor. Elementary geometry of 2, 3, and n-space; functions of several variables; partial differentiation; minimum and maximum problems; and multiple integration.

M313 Elementary Differential Equations with Applications (3 cr.)
P: M216 or consent of instructor. Ordinary differential equations of first order and linear equations of higher order with applications, series solutions, operational methods, Laplace transforms, and numerical techniques. A student may not receive credit for both M313 and M343.

M360 Elements of Probability (3 cr.)
P: M216. C: M311. Introduction to mathematical theory of probability. Probability models, combinatorial problems, conditional probability and independence, random variables, discrete and continuous distributions, repeated Bernoulli trials, gambler's ruin problems, moments, moment generating functions, law of large numbers, central limit theorem, and applications.

M366 Elements of Statistical Inference (3 cr.)
P: M360. Sampling distributions (Chi square, t and F distributions), order statistical decisions, and inference. Hypothesis-testing concepts, Neyman-Pearson Lemma, likelihood ratio tests, power of tests. Point estimation, method of moments, maximum likelihood, Cramer-Rao bound, properties of estimators. Interval estimation, applications. Regression, correlation, analysis of variance, nonparametric methods.

M403-M404 Introduction to Modern Algebra I-II (3-3 cr.)
P: M301 or M303. Study of groups, rings, fields (usuallyincluding Galois theory), with applications to linear transformations.

M413-M414 Introduction to Analysis I-II (3-3 cr.)
P: M301 or M303, and M311, or consent of instructor. Modern theory of real number system, limits, functions, sequences and series, Riemann-Stieltjes integral, and special topics.

M415 Elementary Complex Variables with Applications (3 cr.)
P: M311. Algebra and geometry of complex numbers, elementary functions of a complex variable, power series, integrations, calculus of residues, conformal mapping. Application to physics.

M447-M448 Mathematical Models and Applications I-II (3 cr.)
P: M301 or M303, M311, and M360, which may be taken concurrently, or with consent of instructor. Formation and study of mathematical models used in the biological, social, and management sciences. Mathematical topics include games, graphs, Markov and Poisson processes, mathematical programming, queues, and equations of growth. Suitable for secondary school teachers.

M471-M472 Numerical Analysis I-II (3-3 cr.)
P: M301 or M303, M313 or M343, and M311, or consent of instructor. R: C301 or FORTRAN programming. Interpolation and approximation of functions, numerical integration and differentiation, solution of nonlinear equations, acceleration and extrapolation, solution of systems of linear equations, eigenvalue problems, initial and boundary value problems for ordinary differential equations, and computer programs applying these numerical methods.

T109 Mathematics for Elementary Education I (3 cr.)
Fall, Spring. P: M117. Introduction to problem-solving, including use of patterns and Venn diagrams; study of various numeration systems; whole numbers, fraction, and decimal algorithms with manipulatives; ratio; percent; logic. Open only to elementary education majors. Does not count towards divisional distribution requirement.

T110 Mathematics for Elementary Education II (3 cr.)
Fall, Spring. P: M117. Emphasis on geometry with use of manipulatives; study of plane figures and solids. Discussion of area, volume, symmetry, perimeter, tesselation, constructions with mira and compass, congruence, similarity, probability, statistics. Open only to elementary education majors. Does not count toward divisional distribution requirement.

T336 Topics in Euclidean Geometry (3 cr.)
P: M301 or M303 and M391 or their equivalents. Axiom systems for the plane, the parallel postulate and non-Euclidean geometry, classical theorems. Geometric transformation theory, vectors and analytic geometry, convexity, theory of area and volume.

Mathematics (Purdue courses)

MA 153 Algebra and Trigonometry I (3 cr.)
Fall, Spring. R: A grade of C– or better in MATH M117 or equivalent. Algebra for students with inadequate preparation for calculus. This is the first half of a two-semester version of MA 151. Not open to students with credit for MA 151.

MA 154 Algebra and Trigonometry II (3 cr.)
Fall, Spring. P: MA 153 or equivalent. Trigonometry for students with inadequate preparation for calculus. This is the second half of a two-semester version of MA 151. Not open to students with credit for MA 151.

MA 221 Calculus for Technology I (3 cr.)
Fall. P: MA 153 or equivalent. R: a grade of CB or better in MA 153 or MA 154 or equivalent. Not open to students with credit in MATH M119. First course in techniques of calculus for students enrolled in certain technical curricula.

MA 222 Calculus for Technology II (3 cr.)
Spring. P: MA 221. R: a grade of C– or better in MA 221 or equivalent. Not open to students with credit in MA 224 or MATH 120. Continuation of MA 221. Knowledge of trigonometry required.

Statistics (STAT)

STAT 301 Elementary Statistical Methods I
(3 cr.) P: MATH M125 or M118 or MA 153. Fall, Spring. A basic introductory statistics course with applications shown to various fields and emphasis placed on assumptions, applicability, and interpretations of various statistical techniques. Subject matter includes frequency distribution, descriptive statistics, elementary probability, normal distribution, applications, sampling distribution, estimation, hypothesis testing, and linear regression.