

# NATURAL SCIENCES AND MATHEMATICS DIVISION

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## Contact Information

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## Introduction to the Natural Sciences and Mathematics Division

The Division of Natural Sciences and Mathematics offers courses in Bioinformatics, Biology, Chemistry, Computer Science, Earth Science, Engineering, Forensic Science, Geology, Geographic Information Science, Mathematics, Physics, and Natural Sciences to provide students with the opportunity to develop their maximum potential in their professional and personal life. Courses within these disciplines emphasize the philosophy and processes of science and mathematics, the contribution of science and mathematics to contemporary culture, and environmental issues.

The philosophy of the Division is to involve students in the process of science through active student research as a means of developing skills needed for critical thought about issues in science. Students are encouraged to become active learners and to develop their own ability to think critically about the role of science and math in society. Our degrees that are designed to prepare students for science and mathematics careers or further study in the form of professional programs (MD, DO, DVM, etc) and MS/PhD programs. Individual courses are fully transferable to other accredited institutions for students who plan to continue studies in physical therapy, occupational therapy, forestry, engineering, agriculture, medical technology, pharmacy, dental hygiene, medical, dental, veterinary science and physician assistance. Students should contact the division office for a faculty advisor in order to plan the courses for their major. Faculty advisors work closely with students in planning course work and preparing for the entrance exams and interviews that are prerequisites for acceptance into a professional school.

The Division's objectives are to provide a well-balanced and high quality science and mathematics education and four-year (BS and BA) degrees in Science, Mathematics, and Secondary Science and Mathematics Education. Students develop specific skills and competencies, become aware of the social role of scientists and mathematicians in the world community, develop personal and intellectual attributes for thoughtful decision making, and develop a general education foundation which promotes competency for life.

The Division also has many special facilities to assist in undergraduate education and provide opportunities for individual research projects. Among these are a bioinformatics computer laboratory, a genomics laboratory, a large teaching collection of plants and animals, a well stocked analytical laboratory that includes equipment such as gas chromatography and atomic absorption, and a large geological collection. Student research is funded via the Idaho INBRE grant and the Idaho EPSCOR grant. Student success in course work is supported by engaged and available faculty as well as a math and science tutoring center that is free for all LCSC students to use.

## Majors Offered

- Bioinformatics BA/BS
- Biology BA/BS (with secondary education option)
- Chemistry BA/BS (with secondary education option)
- Computer Science BA/BS
- Earth Science BA/BS (with secondary education option)
- Engineering AS
- Exercise Science BA/BS
- Liberal Arts Natural Science AS
- Natural Science Secondary Education
- Mathematics (with secondary education option)

## Program Outcomes

### Bioinformatics BA/BS

The goals of the Bioinformatics program are to provide students with learning experiences in both the classroom and laboratory so that they are **well-prepared** to:

- Think critically and apply knowledge in novel contexts;
- Understand the computational analysis of biological systems;
- Understand cell and genome structures, function, and reproduction;

- Understand algorithms and data structures;
- Perform basic laboratory procedures in a safe manner.

### **Biology BA/BS (with secondary education option)**

The goals of the Biology program are to provide students with learning experiences in both the classroom and laboratory so that they are **well-prepared** to:

- Understand cell structure, function, and reproduction;
- Understand the principles of natural selection and evolution;
- Understand organismal form and function;
- Think critically and apply knowledge in novel contexts;
- Perform basic laboratory procedures in a safe manner.

### **Chemistry BA/BS (with secondary education option)**

The goals of the Chemistry program are to provide students with learning experiences in both the classroom and laboratory so that they are **well-prepared** to:

- Understand the relationship between matter and energy, composition and structure, and and their relation to physical and chemical behavior
- Apply chemical principles to biological, geological and environmental phenomena
- Demonstrate quantitative and conceptual reasoning
- Think critically and apply knowledge in novel contexts
- Safely and effectively apply laboratory skills
- Design, conduct and report scientific research within the discipline

### **Computer Science BA/BS**

The goals of the Computer Science program are to provide students with learning experiences in both the classroom and laboratory so that they are **well-prepared** to:

- Think critically and apply knowledge in novel contexts;
- Design and implement object-oriented and imperative programs;
- Understand algorithms and data structures;
- Understand relational databases, operating system kernels, and network software development;
- Perform basic laboratory analysis.

### **Earth Science BA/BS (with secondary education option)**

The goals of the Earth Science program are to provide students with learning experiences in the classroom, laboratory, and field so that they are **well-prepared** to:

- Understand the major features and processes in Earth's systems and the interrelationships between them;
- Understand the interactions between Earth systems and human society;
- Apply geoscience knowledge and critical thinking skills to identify and address a variety of earth science problems;
- Understand field research techniques and be able to critically interpret geologic phenomena in the field;
- Apply scientific methods with clearly articulated hypotheses and understand the fundamentals of collecting and applying data to test hypotheses;
- Communicate in a scientifically effective manner, in both oral and written form.

### **Engineering AS**

Upon successful completion of the program, the students are **well-prepared** to:

- Apply broad knowledge of engineering, science, and mathematics to formulate and solve problems
- Demonstrate effective verbal, written, and spatial skills
- Work effectively in multidisciplinary teams
- Matriculate into a baccalaureate degree

### **Exercise Science BA/BS**

Students completing the major in Exercise Science will be **well-prepared** to:

- Use and interpret formal and informal assessment strategies to advance individual performance and determine program effectiveness.
- Apply skills and knowledge within a professional allied health setting, integrating ethical standards and best practices in the field.
- Create programs and learning environments that encourage positive social interaction, active engagement, and self-motivation.

- Interact in a professional, effective manner with colleagues, families, and community agencies to support growth and well-being of programs and participants.
- Design and conduct a research project, analyze and interpret data and present findings both orally and in writing.

### **Mathematics (with secondary education option) BA/BS**

Upon completion of a Math degree, students are **well-prepared** to:

- Demonstrate the ability to create, formulate, understand, and communicate mathematical conjectures, arguments and proofs
- Demonstrate the ability to apply precise and logical reasoning to construct multi-step strategies to solve mathematical problems and effectively communicate those solutions
- Demonstrate the ability to clearly communicate mathematical ideas verbally and in writing
- Demonstrate the ability to use numerical and symbolic mathematical software to aid in problem-solving and investigation as well as understand the limitations of such software.

### **Secondary Education**

Upon completion of a Secondary Education degree, students are **well-prepared** to:

- Understand how learners grow and develop, recognizing that patterns of learning and development vary individually within and across the cognitive, linguistic, social, emotional, and physical areas, and designs and implements developmentally appropriate and challenging learning experiences.
- Use understanding of individual differences and diverse cultures and communities to ensure inclusive learning environments that enable each learner to meet high standards.
- Work with others to create environments that support individual and collaborative learning, and that encourage positive social interaction, active engagement in learning, and self motivation.
- Understand the central concepts, tools of inquiry, and structures of the discipline(s) he or she teaches and creates learning experiences that make the discipline accessible and meaningful for learners to assure mastery of the content.
- Understand how to connect concepts and use differing perspectives to engage learners in critical thinking, creativity, and collaborative problem solving related to authentic local and global issues.
- Understand and use multiple methods of assessment to engage learners in their own growth, to monitor learner progress, and to guide the teacher's and learner's decision making.
- Plan instruction that supports every student in meeting rigorous learning goals by drawing upon knowledge of content areas, curriculum, cross-disciplinary skills, and pedagogy, as well as knowledge of learners and the community context.
- Understand and use a variety of instructional strategies to encourage learners to develop deep understanding of content areas and their connections, and to build skills to apply knowledge in meaningful ways.
- Engage in ongoing professional learning and use evidence to continually evaluate his/her practice, particularly the effects of his/her choices and actions on others (learners, families, other professionals, and the community), and adapts practice to meet the needs of each learner.
- Seek appropriate leadership roles and opportunities to take responsibility for student learning, to collaborate with learners, families, colleagues, other school professionals, and community members to ensure learner growth, and to advance the profession.

### **General Studies BA/BS**

Upon completion of a General Studies degree, students will meet the learning outcomes associated with the program with which their curriculum is most closely aligned.

## **Assessment**

Assessment of Division programs includes standardized testing just prior to graduation, course level assessments, monitoring of student outcomes after graduation, and a qualitative exit interview. The ETS major field tests are given to students in most degree programs at the conclusion of their program of study. Exit interviews are required of all Natural Sciences & Mathematics majors at the conclusion of their program of study. Each program uses the data collected to review program outcomes for program improvement on a yearly basis.

Admission Requirements: None at this time.

## **Advising**

All students declaring majors in the Division of Natural Sciences and Mathematics will be assigned an advisor. Students should meet with their faculty advisor each semester in advance of registration and any time that they have questions concerning their program or are in need of academic advice.

## Minors, Certificates, Transfer Programs

### One- and Two-Year Transfer Programs

For students interested in any of the following fields, the Division of Natural Sciences and Mathematics offers one to three years of coursework that will prepare them for transfer to an institution offering programs in these fields. The student **MUST** meet with an advisor in the appropriate content area. The advisor will assist in planning a transfer program designed for the institution to which the student plans to transfer.

Formalized transfer programs

- Dental Hygiene
- Engineering
- Physical Therapy Assistant

Pre-Engineering Program

The Pre-Engineering program prepares students to complete a degree in any field of engineering study after transfer to an engineering school. Engineers use the principles of science and mathematics to design and build products that enhance our quality of life in all areas including health, home, work place, recreation and entertainment. All introductory Engineering course numbers follow Idaho statewide standards. Students have the option of participating in formal 2/2 dual-degree agreements with the University of Idaho Engineering programs. Transfer to Engineering programs at any other school is also possible through individual consultation.

## Additional Division Programs

### Tutoring

The Division of Natural Sciences and Mathematics has tutoring support available for all level of courses in Mathematics, as well as introductory Biology and Chemistry courses. The Math and Science Tutoring Center is open Monday through Friday with both daytime and evening hours. <http://www.lcsc.edu/math-and-science-tutoring-center/>

## Clubs, Honor Societies, other Activities

Activities Clubs- The Division has multiple clubs that are designed for students to enjoy popular pastimes. These include: A gaming club, a chess club, and a soccer club.

We also have multiple academic clubs:

Geology club- This club regularly attends regional conferences, participates in numerous field trips, including extended trips to more distant sites over the summer breaks. It sponsors a yearly jet boat trip up the Snake River that is quite famous locally.

IN-STEM club- The goal of this club is to promote inclusivity in STEM fields at LC State, particularly for those underrepresented in STEM, through support, mentoring, and community. Membership is open to all students. Activities include MOLE and PI day festivities, Social nights and Science Outreach to the community.

Math club- Meets to promote mathematics on campus and in the community. It celebrates Pi Day on March 14 by providing free pies along with mathematical activities and games.

LC chapter of the Wildlife Society- Students in this organization attend both local and national academic meetings, invite speakers for on-campus seminars, and are responsible (in collaboration with Idaho Fish and Game) for maintenance of the wood duck boxes in the valley.

## Preparation for Future Graduate Studies

Students who major in Bioinformatics, Biology, Chemistry, Computer Science, Earth Science and Mathematics are regularly accepted into graduate programs across the country. These majors prepare students to successfully complete the Graduate Record Examination and encourage interested students to do an undergraduate research experience (REU) before graduation in the discipline they are considering for graduate study.

### **BIOF-100 INTRODUCTION TO BIOINFORMATICS 3.00 Credits**

An introduction to bioinformatics as a scientific discipline. No prior knowledge needed. Emphasis is on the application of computational tools and techniques to solving Molecular Biology problems. Topics include: essential concepts in Molecular Biology, DNA sequencing methods, sequence alignment methods, sequence databases and web servers, regulatory sequence motif finding, sequence variation and phylogenetics. Pre-requisite: Placement into core MATH or above.

**BIOF-301 COMPUTATIONAL GENOMICS 3.00 Credits**

Introduction to the current computational methods for whole genome sequence analysis. Emphasis is on large-scale sequence data analysis in a high-performance UNIX/Linux computing environment. Topics include, genome structure and organization, whole genome assembly and annotation, comparative genomics, transcriptome assembly and gene expression analysis, genome arithmetic, DNA polymorphism detection, and small RNA Biology and analysis. Pre-requisite: MATH-170 and CS-250, with a grade of C or better.

**BIOF-350 IMAGE ANALYSIS 4.00 Credits**

Covers image processing techniques with application to biological images. This includes scanning technology, image segmentation, application of machine learning to image analysis, and development of automatic image analysis software. Programming experience is expected. Students will both use and develop image analysis software. Pre-requisite: MATH-170 and CS-250, with a grade of C or better.

**BIOF-399 Research Assistantship 12.00 Credits**

Research Assistantship in Bioinformatics.

**BIOF-495 PRACTICUM IN BIOINFORMATICS 1.00-12.00 Credits****BIOL-100 CONCEPTS OF BIOLOGY 4.00 Credits**

This online course will serve as an introductory course for non-science majors. This course will cover the main biological principles and how these relate to daily life. Topics include cell biology, reproduction and genetics, evolution and ecology. Pre-requisite: MATH-023 or MATH-025 or higher, excluding MTHPT-103P, MATH-153P and MATH-157P, or have satisfactory math placement scores into MATH-108 or higher.

**BIOL-120 PLANTS AND PEOPLE 4.00 Credits**

Fundamentals of plant growth and development are addressed through the study of useful plants. Current and historical uses of plants by cultures around the world with an emphasis on plant form and function, plant diversity and origin of crops. Requisites: Completion of MATH-023 or MATH-025 or higher, excluding MTHPT-103P, MATH-153P and MATH-157P, or have satisfactory math placement scores into MATH-108 or higher.

**BIOL-123 BIOLOGY IN FILM 3.00 Credits**

This introductory science course for non-majors will explore the scientific method and biological concepts as they are depicted in popular films. Topics will include genetic diseases, biotechnology, infectious diseases, and bioethics. Requisites: Completion of, or current enrollment in, ENGL-102 or ENGL-109.

**BIOL-175 HUMAN BIOLOGY 4.00 Credits**

Form and function of life using the human organism as the specific example. Topics will include: life, evolution, the human organism in the environment, human ecology, human systems including organization, support and movement, processing and transport, integration and coordination, and reproduction and development. Three hours of lecture and one 3-hour laboratory per week. Pre-requisite: MATH-015, MTHPT-010 or MTHPT-012 with a grade of 'C' or better.

**BIOL-181 ECOLOGY, EVOLUTION, DIVERSITY OF LIFE 4.00 Credits**

An introductory course for science majors examining organismal biology in an evolutionary context, including biodiversity and ecology, structure and function, reproduction, physiology, and morphology of viruses, bacteria, protists, fungi, plants, and animals. Three hours of lecture and one 3-hour laboratory period per week. Lab fee. Pre-requisite: A grade of 'C' or better in MATH-108 or MATH-137 or satisfactory math placement.

**BIOL-182 CONCEPTS IN CELLULAR MECHANISMS 4.00 Credits**

An introductory course for science majors with emphases on chemical, physical, and biological characteristics of the living organism and its metabolism. Students will acquire a general understanding of the chemistry of life, basic cell structure and function, metabolism, and genetics. Three hours of lecture and one 3-hour laboratory per week. Pre-requisites: CHEM-111 or CHEM-105 with a grade of C or better.

**BIOL-190 DIRECTED STUDY IN BIOLOGY 1.00-12.00 Credits****BIOL-192 SPECIAL TOPICS IN BIOLOGY 1.00-12.00 Credits****BIOL-195 PRACTICUM IN BIOLOGY 1.00-12.00 Credits****BIOL-213 PLANT AND ANIMAL FORM AND FUNCTION 4.00 Credits**

This course examines the comparative anatomy and physiology of animals and plants in an evolutionary context. Pre-requisite: A grade of 'C' or better in BIOL-182 and CHEM-111. Lab fee.

**BIOL-216 FIELD EXPERIENCE IN BIOLOGY 4.00 Credits**

This class will teach students field techniques used in population and community ecology. The course includes a mandatory 5-7 day fieldtrip in which students visit different study sites and ecosystems in the inland northwest. Students will learn about the natural history of the study sites, the plant and animal communities present, and how to collect meaningful data from these sites. After the fieldtrip, students will learn how to analyze their data and write a scientific research paper during the classroom portion of the course. Pre-requisite: BIOL-181 with a grade of C or better.

**BIOL-227 HUMAN ANATOMY AND PHYSIOLOGY I 4.00 Credits**

The first semester of a two semester sequence in Human Anatomy and Physiology. The course focuses on principles of cytology, biochemistry and histology and the following body systems: integumentary, skeletal, muscular, and nervous. Three hours of lecture and one three-hour laboratory per week. Pre-requisite: Completion of MATH-023 or MATH-025 or higher, excluding MATH-153P and MATH-157P, or have satisfactory math placement scores into MATH-108 or higher.

**BIOL-228 HUMAN ANATOMY AND PHYSIOLOGY II 4.00 Credits**

The second semester of a two semester sequence in Human Anatomy & Physiology. The course focuses on principles of cytology, biochemistry and histology and the following body systems: endocrine, cardiovascular, immunity, respiratory, digestion, urinary, and reproductive. Three hours of lecture and one three-hour laboratory per week. Pre-requisite: BIOL-227 with a grade of 'C' or better. Co-requisites: CHEM-105 or CHEM-111.

**BIOL-250 MICROBIOLOGY FOR HEALTH SCIENCES 4.00 Credits**

A study of microorganisms causing infectious diseases and contamination of foods. Focus will be on general structure and function of microorganisms, growth, and control through sterilization and antimicrobials. Lab will emphasize growth, identification and aseptic technique. Course does not satisfy requirement for Biology major. Four hours of lecture and one 3-hour laboratory period per week. Pre-requisites: Completion of MATH-023 or MATH-025 or higher, excluding MTHPT-103P, MATH-153P and MATH-157P, or have satisfactory math placement scores into MATH-108 or higher and CHEM-105 or equivalent.

**BIOL-280 PRE-MEDICAL SEMINAR 1.00 Credit**

A seminar-based course designed to introduce students to the various graduate medical programs, including: physician (MD and DO), dentistry, veterinary, podiatry, optometry, pharmacy, physical and occupational therapy, and physician assistant. Students will discuss current healthcare issues, explore health programs and institutions, and be provided formal assistance as they prepare for programs in medicine. Students will develop strategies for admission, writing personal statements, participating in mock interviews, determining plans for letters of recommendation, and discussing individual credentials for these programs. One hour lecture per week with additional time to be determined by individual needs. Pre-requisites: A grade of 'C' or better in ENGL-101 and MATH-025, or satisfactory placement. Graded P/F only.

**BIOL-285 TEACHING ASSISTANT IN HUMAN ANATOMY AND PHYSIOLOGY 1.00-2.00 Credits**

This course is intended for students to gain experience teaching the concepts presented in a Human Anatomy and Physiology laboratory. Students will become familiar with techniques used to explain the following systems: skeletal, muscular, histology of tissues and organs, cardiac, respiratory, digestive, urinary, reproductive, and endocrine. A student may repeat this course but cannot acquire more than 2 total credits that apply towards their Biology degree or general electives. Pre-requisite: BIOL-227.

**BIOL-290 DIRECTED STUDY IN BIOLOGY 1.00-4.00 Credits****BIOL-291 WORKSHOP IN BIOLOGY 1.00-4.00 Credits****BIOL-292 SPECIAL TOPICS IN BIOLOGY 1.00-4.00 Credits****BIOL-295 PRACTICUM IN BIOLOGY 1.00-2.00 Credits****BIOL-299 RESEARCH ASSISTANTSHIP 1.00-12.00 Credits****BIOL-312 PATHOPHYSIOLOGY 3.00 Credits**

The physiological basis of disease. Three hours of lecture per week. Pre-requisites: A grade of 'C' or better in the following: 8 credits of Anatomy and Physiology, 4 credits of Microbiology, 3 credits of Chemistry 105 or equivalent, core math or instructor's approval. Recommended Co-requisite: BIOL-314.

**BIOL-314 PATHOPHYSIOLOGY RECITATION 1.00 Credit**

Designed to grow student learning and increase proficiency at critical thinking and problem solving. Concurrent enrollment in BIOL-312 is required. Graded P/F only.

**BIOL-320 EPIDEMIOLOGY: THE STUDY OF DISEASES IN POPULATIONS 3.00 Credits**

Basics of epidemiology. Students will learn about infectious diseases and chronic diseases in societies, interpretation of medical literature, and basic statistical methods used in public health. Pre-requisite: A grade of 'C' or better in MATH-108, ENGL-102 and Junior standing.

**BIOL-330 ANIMAL BEHAVIOR 3.00 Credits**

This course provides general introduction to the field of animal behavior. Topics include evolution and natural selection, hormonal and neural mechanisms of behavior, navigation and migration, communication, reproduction, and sociobiology. Pre-requisite: A grade of 'C' or better in BIOL-213.

**BIOL-331 ECOLOGY 3.00 Credits**

This class will cover ecological principles as they relate to both plant and animal systems. Topics include the physiological adaptations of organisms to their environment, population ecology and the evolution of different life history strategies, and ecological principles related to species interactions and community dynamics. Three hours of lecture per week. Pre-requisites: BIOL-181 and BIOL-182 with a grade of C or better.

**BIOL-341 GENETICS 4.00 Credits**

An introduction to genetic mechanisms in animals, plants and microorganisms. Areas covered include transmission genetics and molecular genetics. Three hours of lecture and one 3-hour lab per week. This course is writing integrated. Pre-requisites: BIOL-182 and CHEM-112 with a grade of C or better.

**BIOL-355 GENERAL MICROBIOLOGY 4.00 Credits**

The structure, physiology, genetics, and metabolism of microorganisms with emphasis on their diversity and ecology. Microorganisms and their relationship to industry, environment, and disease. Lab will emphasize growth, identification, and laboratory design. Three hours of lecture and one 3-hour laboratory per week. Pre-requisite: BIOL-182 with a grade of 'C' or better.

**BIOL-360 DEVELOPMENT BIOLOGY 4.00 Credits**

A study of vertebrate development. Lectures focus on principles of development and laboratories focus on experimental as well as morphological studies. Two hours of lecture and two 3-hour laboratories per week. Pre-requisite: A grade of 'C' or better in BIOL-202. Lab fee.

**BIOL-362 CELLULAR AND MOLECULAR BIOLOGY 4.00 Credits**

A comprehensive study of cell structure and function with emphasis on cell organelles and the cellular membrane. Included in this course is a detailed examination of cellular metabolism, the cell cycle, regulation of cell growth and division, cell signaling, and gene expression. Recitation includes a thorough survey of cellular and molecular techniques along with a weekly literature review exploring the use of these techniques. Three hours of lecture and one 3-hour recitation per week. Prerequisite: BIOL-182 with a grade of 'C' or better.

**BIOL-372 COMPUTATIONAL BIOSTATISTICS 4.00 Credits**

An integrative biology course that incorporates aspects of biology, statistics, and bioinformatics. The course is designed to familiarize students with experimental design and applied biological statistics using the R statistical environment and other freely available analysis packages. Students will apply parametric and non-parametric analytical methods to various forms of biological data, including phenotypic and sequence data. Three hours of lecture and one three-hour laboratory per week. Pre-requisite: BIOL-182 with a grade of 'C' or better.

**BIOL-390 DIRECTED STUDY IN BIOLOGY 1.00-4.00 Credits****BIOL-392 SPECIAL TOPICS IN BIOLOGY 1.00-4.00 Credits****BIOL-394 INTERNSHIP IN BIOLOGY 1.00-12.00 Credits****BIOL-395 PRACTICUM IN BIOLOGY 1.00-12.00 Credits****BIOL-399 RESEARCH ASSISTANTSHIP 1.00-12.00 Credits****BIOL-401 MAMMALOLOGY 4.00 Credits**

The study of mammals, their evolution, natural history, identification of regional mammals, and field techniques for scientific study. The course includes anatomy, phylogenetics, systematics, ecology, practical field and laboratory techniques. Three hours of lecture and one 3-hour laboratory period per week. There will be at least one weekend field trip. Pre-requisite: BIOL-181 and BIOL-182, with a grade of C or better.

**BIOL-402 ORNITHOLOGY 4.00 Credits**

The study of birds, their evolution, natural history, identification of regional birds by sight and sound, and field techniques for scientific study. The course includes anatomy, phylogenetics, systematics, ecology, practical field and laboratory techniques. Three hours of lecture and one 3-hour laboratory period per week. There will be at least one weekend field trip. Pre-requisite: BIOL-181 and BIOL-182 with a grade of C or better.

**BIOL-403 ICHTHYOLOGY 4.00 Credits**

The study of fish, their evolution, natural history, identification of regional fish, and field techniques for scientific study. The course includes anatomy, phylogenetics, systematics, ecology, practical field and laboratory techniques, and management practices. At least three field trips will be held of which two will be all day trips. 3 hours of lecture with one 3-hour lab per week. Pre-requisite: A grade of 'C' or better in BIOL-213. Lab fee.

**BIOL-404 ENTOMOLOGY 4.00 Credits**

The study of insects, their evolution, natural history, identification of dominant insects and field techniques for scientific study. Includes anatomy, physiology, phylogenetics, systematics, ecology, practical field and laboratory techniques. Three hours of lecture and one 3-hour laboratory period per week. Pre-requisite: BIOL-181 and BIOL-182 with a grade of C or better.

**BIOL-412 HISTOPATHOLOGY 3.00 Credits**

Histopathology is a 3-credit course designed to provide students with basic skills needed to make and interpret histopathology slides. Students will learn the principles and chemistry that are fundamental to fixing, processing, and staining both normal and diseased tissue samples. Students will gain an understanding of both cellular and tissue changes that are characteristic of various disease processes such as cancer. Pre-requisite: CHEM-371 and CHEM-373 with a grade of "B" or better or permission of the instructor.

**BIOL-420 HUMAN DISSECTION 2.00 Credits**

Students dissect and identify gross anatomy of human cadavers under the supervision of the instructor. Pre-requisite: a grade of 'C' or better in BIOL-228.

**BIOL-425 ENDOCRINE PHYSIOLOGY 3.00 Credits**

Endocrine Physiology is an in-depth study of the endocrine system. Students will learn the molecular basis of hormone action, regulation of hormone action, and the physiologic effects of multiple hormones. In addition, the course will include topics such as environmental endocrine disruptors and the role of hormones in disease processes. This course is designed to provide students in biological sciences and health-related fields a thorough examination of endocrine systems. Pre-requisite: BIOL-228, BIOL-213, and CHEM-371, with a grade of C or better, or permission of the instructor.

**BIOL-443 IMMUNOLOGY 3.00 Credits**

Survey of Immunology and Immunological principles. Concepts include development of the immune system, innate versus acquired immunity, immunoglobulin structure and genetics, antigen-antibody reactions, the major histocompatibility complex and antigen presentation, T cell receptors (genetics, structure, selection), T- and B-cell activation and effector functions, cytokines, adhesion molecules, phagocytic cell function, immune responses to infectious organisms and tumors, autoimmune diseases, and immunodeficiency. Three hours of lecture per week. Pre-requisites: A grade of 'C' or better in BIOL-228 and BIOL-250 or BIOL-355.

**BIOL-450 FIELD BOTANY 4.00 Credits**

This class will use the fields of plant systematics and ecology to examine our regional flora. Within the field of plant systematics, we will survey the plant kingdom, from non-vascular plants to angiosperms, with an emphasis on evolutionary relationships and identification of regional plants. Ecological issues related to our regional plant communities will be examined through readings and discussions of the primary literature. There will be one or two required all day field trips. Pre-requisite: BIOL-181 and BIOL-182 with a grade of C or better.

**BIOL-455 MEDICAL MICROBIOLOGY 3.00 Credits**

Course applies basic principles of Microbiology to aspects of infectious disease. Topics include etiology, epidemiology, pathogenesis, and symptomology of bacterial, fungal, and viral diseases of humans as well as treatment and prevention. A survey of bacterial, viral, and fungal pathogens serves as the foundation for the course. Pre-requisite: BIOL-355 with a grade of C or better.

**BIOL-460 EVOLUTION 4.00 Credits**

Every area of biological investigation, from the study of biodiversity and consequences of environmental change to the origin and diversification of protein coding genes and variation in developmental processes, is informed by the principles of evolutionary biology. The field of evolutionary biology is one of the most dynamic areas in biology with application to understanding disease dynamics, human biology, agriculture, and the conservation of biological diversity. The study of evolution encompasses both the description and analysis of historical patterns in the biological diversity of life as well as the conceptual and mathematical frameworks that describes the processes causing evolutionary change through time. In this course, we develop the basic mathematical frameworks for population and quantitative genetics and examine evolution at the molecular and phenotypic levels. Throughout the course we draw extensively from the primary literature to illustrate the amazing diversity of life around us and the evolutionary processes that have shaped this diversity over hundreds of millions of years. There will be approximately 3 hours of lecture and 1 hour of literature review per week. Prerequisite: BIOL-341 with a "C" or better.

**BIOL-480 PRE-MEDICAL SEMINAR 2.00 Credits**

A seminar-based course designed to continue the work done in BIOL 280. This course will emphasize a preparation for applications to medical programs and resulting interviews. Students will continue to explore current events in health care and/or medical science. Discussion of individual credentials for medical programs, planning for letters of recommendation, and self-directed professional job shadowing will be included. One hour lecture per week with additional time to be determined by individual needs. Course does not meet senior elective requirement. Pre-requisite: Successful completion of BIOL-280. Graded P/F only.

**BIOL-485 TEACHING ASSISTANT IN HUMANN ANATOMY AND PHYSIOLOGY 1.00-2.00 Credits**

This course is intended for students to gain experience teaching the concepts presented in a Human Anatomy and Physiology laboratory. Students will become familiar with techniques used to explain the following systems: skeletal, muscular, histology of tissues and organs, cardiac, respiratory, digestive, urinary, reproductive, and endocrine. A student may repeat this course but cannot acquire more than 2 total credits that apply towards their Biology degree or general electives. Pre-req: BIOL-285.

**BIOL-490 DIRECTED STUDY IN BIOLOGY 1.00-4.00 Credits****BIOL-491 WORKSHOP IN BIOLOGY 1.00-4.00 Credits****BIOL-492 SPECIAL TOPICS IN BIOLOGY 1.00-4.00 Credits****BIOL-494 INTERNSHIP IN BIOLOGY 1.00-12.00 Credits****BIOL-495 PRACTICUM IN BIOLOGY 1.00-2.00 Credits****BIOL-499 SENIOR PROJECT AND SEMINAR IN BIOLOGY 1.00-3.00 Credits**

Students will conduct and communicate the results of a research project in the Natural Sciences Division. Topics may include the historical, philosophical, cultural and environmental aspects, and the processes of natural science. Requirements of students include satisfactory oral presentation and defense of their research and submission of a written report approved by their advisor to the Natural Sciences Division. Pre-requisite: NS-398.

**CHEM-100 CONCEPTS OF CHEMISTRY 4.00 Credits**

From the food we eat to the medicines we take to the transportation we use, we experience chemistry every day. In this course, you will study the chemistry of everyday life with the goal of making informed consumer decisions. Pre-requisite: Completion of MATH-023 or MATH-025 or higher, excluding MTHPT-103P, MATH-153P and MATH-157P, or have satisfactory math placement scores into MATH-108 or higher.

**CHEM-105 GENERAL, ORGANIC AND BIOCHEMISTRY 4.00 Credits**

An introduction to chemistry with an emphasis on biochemistry for the health professions. Three lectures and one laboratory per week. Pre-requisite: Completion of MATH-023 or MATH-025 or higher, excluding MTHPT-103P, MATH-153P and MATH-157P, or have satisfactory math placement scores into MATH-108 or higher.

**CHEM-111 PRINCIPLES OF CHEMISTRY I 4.00 Credits**

A systematic and intensive treatment of chemical principles and their applications. Four hours of lecture/recitation, and one 3-hour laboratory per week. Pre-requisite: A grade of 'C' or better in MATH-108 or MATH-137 with a grade of C or better, or satisfactory math placement. Lab fee.

**CHEM-112 PRINCIPLES OF CHEMISTRY II 4.00 Credits**

Elementary theoretical chemistry and its application to analytical practice. Includes emphasis on intermolecular forces, equilibrium, electrochemistry and nuclear chemistry. Four hours of lecture/recitation and one 3-hour laboratory per week. Pre-requisite: CHEM-111 with a grade of C or better. Lab fee.



**CHEM-190 DIRECTED STUDY IN CHEMISTRY 1.00-12.00 Credits****CHEM-192 SPECIAL TOPICS IN CHEMISTRY 1.00-12.00 Credits****CHEM-195 PRACTICUM IN CHEMISTRY 1.00-2.00 Credits****CHEM-199 RESEARCH ASSISTANTSHIP IN CHEMISTRY 1.00-12.00 Credits****CHEM-290 DIRECTED STUDY IN CHEMISTRY 1.00-4.00 Credits****CHEM-291 WORKSHOP IN CHEMISTRY 1.00-4.00 Credits****CHEM-292 SPECIAL TOPICS IN CHEMISTRY 1.00-4.00 Credits****CHEM-294 INTERNSHIP IN CHEMISTRY 12.00 Credits****CHEM-295 PRACTICUM IN CHEMISTRY 1.00-2.00 Credits****CHEM-299 RESEARCH ASSISTANTSHIP 1.00-12.00 Credits****CHEM-300 PHYSICAL CHEMISTRY I WITH LABORATORY 4.00 Credits**

Investigates Properties of Matter and Gases, Laws of Thermodynamics, Energy Changes, Chemical and Phase Equilibrium, Solutions, and Chemical Kinetics. Laboratory component demonstrates and tests these concepts (3 hour lab). Pre-requisite: MATH-175 and CHEM-112 with a grade of C or better.

**CHEM-306 PHYSICAL CHEMISTRY II 3.00 Credits**

Topics include Quantum theory, Atoms, Diatomic Molecules, Polyatomic Molecules and Spectroscopy. Pre-requisite: CHEM-300 with a grade of C or better.

**CHEM-325 QUANTITATIVE ANALYSIS 3.00 Credits**

Theory of classical gravimetric and volumetric chemical analyses with an introduction to instrumental techniques. Basic data handling and statistics, chemical equilibrium, electrochemistry. Three hours of lecture per week. Pre-requisite of CHEM-112 with a grade of C or better. Co-requisite of CHEM-325L.

**CHEM-325L QUANTITATIVE ANALYSIS LABORATORY 2.00 Credits**

Laboratory course companion to CHEM 325 that develops quantitative laboratory skills including accurate/precise weighing and pipetting, acid digestion, dilution, filtration and titration. The operation and basic theory of instruments including molecular and atomic absorption, high performance liquid chromatography, ion chromatography, and gas chromatography-mass spectrometry will be explored. Statistical reasoning will be emphasized. 4 hours per week of lab. PREREQ: CHEM 112; COREQ: CHEM 325; LAB FEE.

**CHEM-353 LABORATORY PREPARATION TECHNIQUES 2.00 Credits**

Techniques of solution preparation, chemical storage and management, prevention of contamination, and quality assurance. One hour of lecture and one 3-hour laboratory per week. Pre-requisite: CHEM-325 with a grade of C or better.

**CHEM-371 ORGANIC CHEMISTRY I 3.00 Credits**

Principles and theories of organic chemistry and the properties, preparations, and reactions of organic compounds. Three hours of lecture per week. This is a writing integrated course. Pre-requisite: CHEM-112 with a grade of C or better.

**CHEM-372 ORGANIC CHEMISTRY II 3.00 Credits**

Continuation of Chemistry 371. Three hours of lecture per week. Pre-requisite: CHEM-371 with a grade of C or better.

**CHEM-373 ORGANIC CHEMISTRY I LAB 1.00 Credit**

Laboratory to accompany Chemistry 371. One 3-hour lab per week. Co-requisite: CHEM-371.

**CHEM-376 ORGANIC CHEMISTRY II LAB 2.00 Credits**

Laboratory to accompany CHEM-372. 3-hours of lab per week and information literacy. Pre-requisite: CHEM-371 and CHEM-373, with a grade of C or better. Co-requisite: CHEM-372. Lab fee.

**CHEM-390 DIRECTED STUDY IN CHEMISTRY 1.00-4.00 Credits****CHEM-392 SPECIAL TOPICS IN CHEMISTRY 1.00-4.00 Credits****CHEM-394 INTERNSHIP IN CHEMISTRY 1.00-12.00 Credits****CHEM-395 PRACTICUM IN CHEMISTRY 1.00-2.00 Credits****CHEM-399 RESEARCH ASSISTANTSHIP 1.00-12.00 Credits****CHEM-420 PRINCIPLES OF GEOCHEMISTRY 3.00 Credits**

This 400-level course is designed to draw together the themes and topics from other courses in the Earth Science major into an integrated picture of Earth and its interrelated systems, as well as applying chemistry to these systems. The focal discussion will be on the interactions between the atmosphere, hydrosphere, biosphere and lithosphere and current topics of interest related to them. Of particular interest are scientific problems involving Earth's systems such as coral bleaching, climate change, and water pollution. Pre-requisite: CHEM-112 with a grade of C or better. Crosslisted with GEOL-420.

**CHEM-454 INSTRUMENTAL ANALYSIS 5.00 Credits**

Course covers the basic principles and use of instruments. Ultraviolet, visible, infrared, Raman, and atomic absorption spectroscopy. Electrochemistry. Pre-requisite: CHEM-325 with a grade of C or better.

**CHEM-463 INORGANIC CHEMISTRY 4.00 Credits**

Course covers the basic principles of descriptive chemistry, coordination chemistry, models of bonding in transition metal complexes, molecular symmetry, molecular orbital theory, spectroscopy, and organometallic chemistry. The laboratory component introduces the student to standard aspects of synthetic inorganic chemistry, bioinorganic chemistry, organometallic chemistry and catalytic chemistry. Pre-requisite: CHEM-371 with a grade of C or better.

**CHEM-481 BIOCHEMISTRY I 4.00 Credits**

A study of protein structures and functions and the basics of sugar and lipid protein analysis. Three hours of lecture and one 3-hour laboratory per week. Pre-requisite: CHEM-371 with a grade of C or better.

**CHEM-482 BIOCHEMISTRY II 3.00 Credits**

Functional continuation of CHEM-481. Lipid, amino acid and nucleotide metabolism. Emphasis is on regulation of metabolism, metabolic dysfunctions, biochemical mechanisms of hormone action, biochemical genetics, protein synthesis, and metabolic consequences of genetic defects. Three hours of lecture/discussion per week. Pre-requisite: CHEM-481 with a grade of C or better.

**CHEM-490 DIRECTED STUDY IN CHEMISTRY 1.00-4.00 Credits****CHEM-491 WORKSHOP IN CHEMISTRY 1.00-4.00 Credits****CHEM-492 SPECIAL TOPICS IN CHEMISTRY 1.00-4.00 Credits****CHEM-494 INTERNSHIP IN CHEMISTRY 1.00-12.00 Credits****CHEM-495 PRACTICUM IN CHEMISTRY 1.00-2.00 Credits****CHEM-499 RESEARCH PROJECT AND SEMINAR IN CHEMISTRY 1.00-3.00 Credits**

Students will conduct and communicate the results of a research project in the Natural Sciences Division. Topics may include the historical, philosophical, cultural and environmental aspects, and the processes of natural science. Requirements of students include satisfactory oral presentation and defense of their research and submission of a written report approved by their advisor to the Natural Sciences Division. Pre-requisite: NS-398.

**CS-101 COMPUTER SCIENCE SEMINAR 1.00 Credit**

Introduces the computing and information technology profession and the LCSC's curriculum emphasis options. Topics include: fields of study, curriculum and professional options, legal and ethical issues for computing professionals, academic responsibilities and ethical conduct. Emphasis on the computing science fields of study and their uses in today's digital society.

**CS-108 INTRODUCTION TO COMPUTER SCIENCE 4.00 Credits**

This course is an introduction to the basic concepts of Computer Science. You will learn how to program a computer using the Java language, the basic capabilities of a computer system, how to form and validate a hypothesis in computer science, and how computer science relates to other scientific endeavors and society at large. Programming concepts include objects, functions, conditionals, and recursion. This course is suitable both for the non-major and as an entry point into the Computer Science major. Cross-listed with CITPT-108.

**CS-111 FOUNDATIONS OF PROGRAMMING 4.00 Credits**

Introduction to problem solving and the basic building blocks of algorithm design using a modern programming language. Topics include: procedural programming constructs and basic program modularization. Pre-requisite: CS-108 and MATH-108 or MATH-170, all with a grade of C or better.

**CS-190 DIRECTED STUDY IN COMPUTER SCIENCE 1.00-12.00 Credits****CS-192 SPECIAL TOPICS IN COMPUTER SCIENCE 1.00-4.00 Credits****CS-211 COMPUTER SCIENCE II 4.00 Credits**

Covers object-oriented (OO) design and implementation techniques. Topics include: the Unified Modeling Language (UML), data types and classes, collaboration, association, aggregation, inheritance, polymorphism, parametric programming, and software libraries. Emphasis on design and implementation of object-oriented software systems through the adequate design and implementation of domain specific data types that collaborate to implement the requested functionality. Pre-requisites: CS-111 with a grade of C or better.

**CS-226 SQL: STRUCTURED QUERY LANGUAGE 3.00 Credits**

Introduces the basic concepts of relational database systems and the role of the Structured Query Language (SQL) in database development. It also covers SQL and its applications to the creation and maintenance of data in a Database Management System (DBMS). Emphasis is placed on using SQL for database querying. Pre-requisite: Completion of MATH-023 or MATH-025 or higher, excluding MTHPT-103P, MATH-153P and MATH-157P, or have satisfactory math placement scores into MATH-108 or higher.

**CS-250 COMPUTER ORGANIZATION AND ARCHITECTURE 4.00 Credits**

Introduces the architecture and organization of modern computer systems. Topics include: digital logic, number systems, Von Neumann architecture, processing and instruction sets, memory and memory addressing, parallel systems, and parallel architectures. Emphasis on the connections between the computer's hardware and its software. Pre-requisite: A grade of 'C' or better in MATH-108.

**CS-253 INTRO TO SYSTEMS PROGRAMMING 4.00 Credits**

Detailed overview of software development on unix-like operating systems with an emphasis on systems programming using C, C++, or an equivalent systems programming language. This includes an introduction to command-line usage and scripting using a common shell. Students will learn about mechanisms available on POSIX-compliant platforms such as signals, pipes, and file descriptors. Pre-requisite: CS-211 with a grade of C or better.

**CS-290 DIRECTED STUDY IN COMPUTER SCIENCE 1.00-6.00 Credits****CS-291 WORKSHOP IN COMPUTER SCIENCE 1.00-6.00 Credits****CS-292 SPECIAL TOPICS IN COMPUTER SCIENCE 1.00-3.00 Credits****CS-294 INTERNSHIP IN COMPUTER SCIENCE 1.00-12.00 Credits****CS-295 PRACTICUM IN COMPUTER SCIENCE 1.00-6.00 Credits****CS-311 ALGORITHMS AND DATA STRUCTURES 4.00 Credits**

Covers the fundamentals of data structures, abstract data types and associated algorithms. Topics include: abstract data types, recursion, trees, graphs, hashing, and searching and sorting. Pre-requisite: CS-211 with a grade of C or better.

**CS-360 SOFTWARE ENGINEERING 3.00 Credits**

Introduces the engineering principles for the design and development of high quality computing systems. Topics include: the software life cycle model, requirements definition, design, verification and validation, software and system modeling and documentation, and project management techniques. Pre-requisite: A grade of 'C' or better in CS-311.

**CS-390 DIRECTED STUDY IN COMPUTER SCIENCE 1.00-6.00 Credits****CS-391 WORKSHOP IN COMPUTER SCIENCE 1.00-6.00 Credits****CS-392 SPECIAL TOPICS IN COMPUTER SCIENCE 1.00-4.00 Credits****CS-394 INTERNSHIP IN COMPUTER SCIENCE 1.00-12.00 Credits****CS-395 PRACTICUM IN COMPUTER SCIENCE 1.00-6.00 Credits****CS-399 RESEARCH ASSISTANTSHIP 1.00-12.00 Credits****CS-401 FUTURE PROFESSIONALS SEMINAR 1.00 Credit**

Students develop either a job application packet or a graduate school application packet. This includes the development and presentation of a portfolio and resume or curriculum vita. Pre-requisite: A grade of 'C' or better in MATH-147 (or equivalent placement score) and CS-312 which can be taken as a co-requisite.

**CS-405 OBJECT-ORIENTED DESIGN FOR SECONDARY EDUCATION 4.00 Credits**

Covers object-oriented (OO) design and implementation techniques. Topics include: the Unified Modeling Language (UML), data types and classes, collaboration, association, aggregation, inheritance, polymorphism, parametric programming, and software libraries. Emphasis on design and implementation of object-oriented software systems through the adequate design and implementation of domain specific data types that collaborate to implement the requested functionality. Additional information focuses on adapting content to high school courses. Registration will be restricted to students admitted to the Secondary Education Program and/or students who are Secondary Education Certified. Pre-requisite: CS-411 with a grade of C or better.

**CS-408 INTRODUCTION TO COMPUTER SCIENCE FOR SECONDARY EDUCATION 4.00 Credits**

This course is an introduction to the basic concepts of Computer Science. You will learn how to program a computer using an object-oriented language, the basic capabilities of a computer system, how to form and validate a hypothesis in computer science, and how computer science relates to other scientific endeavors and society at large. Programming concepts include objects, functions, conditionals, and recursion. Additional information focuses on adapting content to high school courses. Registration will be restricted to students admitted to the Secondary Education Program and/or students who are Secondary Education Certified.

**CS-410 AUTOMATA:THEORY OF COMPUTATION 4.00 Credits**

Provides an introduction to the theoretical foundations of computing. Topics include: automata and languages (finite automata, regular languages, and context-free languages), computability theory (the Church-Turing thesis and decidability), and complexity theory (time and space complexity). Emphasis on the use of rigorous mathematical approaches to problem definition and description of solutions. Pre-requisite: A grade of 'C' or better in MATH-147 (or equivalent placement score) AND CS-312 which can be taken as a co-requisite.

**CS-411 FOUNDATIONS OF PROGRAMMING FOR SECONDARY EDUCATION 4.00 Credits**

An introduction to computer programming using a modern programming language. The course focuses on problem solving techniques and the basic concepts of procedural programming, by using the Python programming language. Additional information focuses on adapting content to high school courses. Registration will be restricted to students admitted to the Secondary Education Program and/or students who are Secondary Education Certified. Pre-requisite: CS-408 with a grade of C or better.

**CS-413 ALGORITHMS & DATA STRUCTURES FOR SECONDARY EDUCATION 4.00 Credits**

Covers the fundamentals of data structures, abstract data types and associated algorithms. Topics include: abstract data types, recursion, trees, graphs, hashing, and searching and sorting. Additional information focuses on adapting content to high school courses. Registration will be restricted to students admitted to the Secondary Education Program and/or students who are Secondary Education Certified. Pre-requisite: CS-405 with a grade of C or better.

**CS-420 ANALYSIS OF ALGORITHMS 4.00 Credits**

Covers fundamental formal techniques and algorithmic strategies that support advanced algorithm design. Topics include: asymptotic complexity bounds, time analysis of iterative and recursive algorithms, advanced data structures such as balanced and red-black trees and hashing, and advanced algorithmic strategies such as dynamic programming. Emphasis on the underlying mathematical theory, practical considerations of efficiency, and algorithm design trade-offs. Pre-requisites: A grade of 'C' or better in MATH-147 or equivalent placement score AND CS-312 which can be taken as a co-requisite.

**CS-430 OPERATING SYSTEMS 3.00 Credits**

Covers operating system's fundamental concepts and structure. Topics include: operating systems architecture, processes and threads, mutual exclusion and synchronization, deadlock and starvation, memory management and virtual memory, and processor scheduling. Emphasis on operating system design issues, techniques, and trade-offs; includes a hands-on introduction to multithreaded and multicore programming issues and approaches. Pre-requisites: A grade of 'C' or better in CS-253.

**CS-435 COMPUTER NETWORKS 3.00 Credits**

Covers current computer network architectures, protocols, and applications. Topics include: digital networks and the Internet, network architecture, network layers, services and communication protocols, the application layer, the transport layer, the network layer, the data link layer, wireless and mobile networks, and ethical issues with digital networks. Emphasis on Internet and current communication protocols, and the engineering trade-offs of network design and implementation. Includes hands-on sockets programming coursework. Pre-requisites: A grade of 'C' or better in CS-311.

**CS-440 INTELLIGENT SYSTEMS:AI AND INFORMATION 4.00 Credits**

Introduces students to the fundamental concepts and techniques of artificial intelligence (AI) and information management. Pre-requisite: A grade of 'C' or better in MATH-147 (or equivalent placement score) and CS-312 which can be taken as a co-requisite.

**CS-445 DATABASES AND KNOWLEDGE MANAGEMENT 3.00 Credits**

Covers the fundamental concepts required for the design and implementation of database applications and their underlying Database management Systems (DBMS). Topics include: principles and architectures, the relational data model, normalization, conceptual data modeling, design and implementation of database-based applications, and DBMS design issues and approaches. Pre-requisites: A grade of 'C' or better in CS-226 and CS-311.

**CS-450 USABILITY:HUMAN-CENTERED DES/EVALUATION 4.00 Credits**

An introduction to key methods in user-interface design and emphasis on usability design and evaluation. Topics include the user interface analysis, usability enhancement methods, and usability testing. Pre-requisite: A grade of 'C' or better in MATH-147 (or equivalent placement score) AND CS-312 which can be taken as a co-requisite.

**CS-475 COMPUTER SYSTEMS SECURITY 3.00 Credits**

Covers the fundamental concepts and practical applications of computing systems security with a holistic view and applied approach. Topics include: security concepts and services, physical, operational, and organizational security, the role of people in systems security, introduction to cryptography and public key infrastructure, computing systems hardening, secure code, and secure applications development. Emphasis on developing, deploying, and maintaining a secure computing infrastructure with a hands-on approach. Pre-requisite: CS-311.

**CS-480 CAPSTONE DESIGN PROJECT 4.00 Credits**

The application of engineering principles needed for the development and maintenance of high quality medium to large software systems, delivered on time and within budget. Emphasis on the development of a semester long project and final presentation. Pre-requisite: CS-445.

**CS-490 DIRECTED STUDY IN COMPUTER SCIENCE 1.00-6.00 Credits****CS-491 WORKSHOP IN COMPUTER SCIENCE 1.00-6.00 Credits****CS-492 SPECIAL TOPICS IN COMPUTER SCIENCE 1.00-4.00 Credits****CS-494 INTERNSHIP IN COMPUTER SCIENCE 1.00-12.00 Credits****CS-495 PRACTICUM IN COMPUTER SCIENCE 1.00-6.00 Credits****CS-499 RESEARCH PROJECT AND SEMINAR IN COMPUTER SCIENCE 1.00-12.00 Credits**

Students will perform a research project in Computer Science. Includes a satisfactory final oral presentation of findings and results as well as an advisor approved final written report. Proposal and interim oral and written reports may also be required.

**ENGR-105 ENGINEERING GRAPHICS 2.00 Credits**

Engineering Graphics emphasizes computer aided graphical analysis and transmission of information. Study of computer designing and drafting systems is presented using various CAD software applications with specialization in the AUTOCAD program. Included will be freehand and computer generated engineering graphics, 2D, and 3D graphics in orthographic and pictorial projections in sections and various views, graphical analysis of data, and measurements dimensioning. Course Fee.

**ENGR-110 SOLIDWORKS - COMPUTER AIDED DRAFTING 3.00 Credits**

An introduction to the concepts commands of parametric solid modeling. Students create sketches and add relationships to the sketch segments, extrude the sketches to create models, add features such as fillets, cut, extrude, chamfers, holes, draft, shell, lofts and sweeps, assemblies and BOM, the use of equations, part configurations and design tables, derived and molded parts.

**ENGR-115 SURVEYING 3.00 Credits**

Theory of measurements, basic equations for survey computations, types of distribution of errors, topographical and land surveying introduction to geographic information systems and global positioning systems, coordinate geometry and coordinate transformations, site engineering projects using land development software, application of surveying methods to construction; site engineering, and civil engineering projects surveying instruments. Pre-requisite: MATH-144.

**ENGR-120 ENGINEERING FUND ANALYSIS & DESIGN 4.00 Credits**

This course provides both an introduction to the engineering profession through design projects, research, and guest speakers along with development of college success skills for an engineering academic program including time management and study skills, critical thinking, problem solving skills, communication skills, ethics, and an introduction to basic computer programs.

**ENGR-210 ENGINEERING STATICS 3.00 Credits**

Engineering application of the principles of mechanics, force systems, equilibrium, structures, distributed forces, moments of inertia, and friction with an emphasis on problem solving. Pre-requisite: Grade of 'C' or better in MATH-170.

**ENGR-220 ENGINEERING DYNAMICS 3.00 Credits**

Engineering application of principles of particle and rigid body kinematics, force-mass-acceleration relations, work and energy, impulse and momentum, and moments of inertia and mass with an emphasis on problem solving. Course fee. Pre-requisite: A grade of 'C' or better in MATH-170 and ENGR-210.

**ENGR-240 ELECTRICAL CIRCUITS 4.00 Credits**

An introduction to basic electric circuit analysis with lab. Concepts covered include steady-state DC circuits, AC steady-state circuits using phasor analysis, AC power calculation, first order transient, ideal op-amps, ideal transformers, and introduction to balanced 3-phase circuits. Pre-requisite: PHYS-211 or MATH-170.

**ENGR-292 SPECIAL TOPICS IN ENGINEERING 3.00 Credits****ENGR-330 MECHANICS OF MATERIALS 3.00 Credits**

An introduction to the principles and methods of mechanics of materials analyzing stress, strain and displacement fields in mechanically and thermally loaded components. Pre-requisite: ENGR-210.

**FSCI-101 INTRODUCTION TO FORENSIC SCIENCE 4.00 Credits**

Introduces students to the field of forensic science. Will focus on different forms of physical evidence, including their collection, analysis and evidentiary value in a criminal investigation. The laboratory portion of the course will supplement the lecture and allow students to examine evidence using modern techniques and instrumentation. Topics discussed include organic and inorganic chemical analyses of physical evidence, principles of serology and DNA analysis, identification of fresh and decomposed human remains, ballistics, fingerprint analysis, facial reconstruction, drug analysis and forensic entomology. Pre-requisite: Completion of MATH-023 or MATH-025 or higher, excluding MTHPT-103P, MATH-153P and MATH-157P, or have satisfactory math placement scores into MATH-108 or higher.

**GEOL-101 PHYSICAL GEOLOGY 4.00 Credits**

Introduction to basic concepts of geology in the context of geologic hazards and geologic resources. Topics covered include: global circulation of water and air, rocks and minerals, plate tectonics, geologic time, deductive reasoning from sparse evidence. Geologic and topographic map reading skills are taught and emphasized, using examples from the local area. Lecture and laboratory. Pre-requisite: Completion of MATH-023 or MATH-025 or higher, excluding MTHPT-103P, MATH-153P and MATH-157P, or have satisfactory math placement scores into MATH-108 or higher.

**GEOL-120 INTRODUCTION TO EARTH SYSTEMS 4.00 Credits**

This course will examine the formation of planet Earth, its structure, atmosphere, hydrosphere and biosphere. We will learn about the climate and how the various systems interact with each other. Human impacts on the atmosphere and climate will also be discussed from a scientific perspective. Three hours of lecture and 3 hours of laboratory time per week.

**GEOL-190 DIRECTED STUDY IN GEOLOGY 1.00-12.00 Credits****GEOL-202 HISTORICAL GEOLOGY 4.00 Credits**

Emphasis on geologic time; no other discipline offers such a long time perspective relevant to modern decision-making. Includes: review of basic Earth materials; plate-tectonic framework for interpreting Earth history; absolute dating techniques and the age of the Earth's formation; depositional environments and interpretation of sedimentary rocks as a tool of paleogeography; lithostratigraphic principles and relative dating by Steno's laws and cross-cutting relationships; basic principles of paleontology, including overview of taxonomy, processes of fossilization, evolutionary principles, biostratigraphic principles; systematic examination of tectonic setting, paleogeography, paleobiology, and paleoclimate for each period of Earth's history. Lecture and laboratory. Pre-requisite: A grade of 'C' or better in GEOL-101.

**GEOL-290 DIRECTED STUDY IN GEOLOGY 1.00-12.00 Credits**

Additional library and/or field research by individuals based on student/faculty interests. This course can provide a mechanism for students to participate in faculty research projects for academic credit. Pre-requisite: Permission of instructor.

**GEOL-291 WORKSHOP IN GEOLOGY 1.00-12.00 Credits**

**GEOL-292 SPECIAL TOPICS IN GEOLOGY 1.00-12.00 Credits**

**GEOL-295 PRACTICUM IN GEOLOGY 1.00-2.00 Credits**

**GEOL-299 RESEARCH ASSISTANTSHIP 1.00-12.00 Credits**

**GEOL-301 GEOLOGIC FIELD METHODS 1.00-6.00 Credits**

Six-week course in the field. Principles of geologic mapping in igneous, sedimentary and metamorphic terranes using examples from Hells Canyon. Pre-requisite: Permission of instructor. Lab fee.

**GEOL-309 HYDROGEOLOGY 4.00 Credits**

Fundamentals of surface and groundwater movement in a geologic context. Includes hydrologic, geologic, and other factors controlling groundwater flow, occurrence, development, chemistry, and contamination. Groundwater flow theory and aquifer test methods are introduced. Interactions between surface and subsurface hydrologic systems are covered. Some field trips are possible. Introduction to aquifer pumping tests, aquifer analysis, watershed analysis, and water budgets. Field methods are emphasized through consideration of local examples. Lecture and laboratory. Pre-requisite: A grade of 'C' or better in GEOL-101.

**GEOL-313 EARTH MATERIALS I 4.00 Credits**

The study of naturally occurring, inorganic crystalline solids with definite chemical structures which give them unique physical properties (minerals). It is an important curricular component for both (1) Geology majors who intend to pursue careers in the Earth Sciences as well as (2) students preparing for teaching careers who expect to teach Earth Science classes at the junior high or secondary level. The study of minerals has ancient roots and was associated with the development of geology, chemistry, and physics. Therefore, this course integrates many of these fields of study. This course introduces mineral chemistry, symmetry and classification; provides basic geologic skills in descriptive mineralogy, including space groups and the use of stereo nets; hand-sample petrography of igneous, metamorphic and sedimentary rocks; and elementary optical methods. Pre-requisite: A grade of 'C' or better in GEOL-101.

**GEOL-314 EARTH MATERIALS II 4.00 Credits**

Introduction of descriptive igneous, sedimentary and metamorphic petrography; plate-tectonic framework for interpreting petrogenesis; phase equilibria and basic geochemistry of magmatic systems; geochemistry of weathering and soil formation; pressure-temperature-time relationships of metamorphic facies; and economic geology, including ore mineralogy and resource extraction. Labs emphasize microscopic identification of minerals and textures, and the formulation of petrogenetic interpretations. Lecture and laboratory. Pre-requisite: A grade of 'C' or better in GEOL-313.

**GEOL-335 EARTH SURFACE PROCESSES 4.00 Credits**

This course examines the evolution of natural landscapes by water, wind, ice and tectonic processes. Topics include: weathering and mass wasting, neotectonics, fluvial geomorphology, glacial geomorphology, and Quaternary geology field techniques. Approximately one third of instructional time is spent in the field. Lecture and laboratory. Pre-requisite: A grade of 'C' or better in GEOL-101.

**GEOL-390 DIRECTED STUDY IN GEOLOGY 1.00-12.00 Credits**

**GEOL-392 SPECIAL TOPICS IN GEOLOGY 1.00-12.00 Credits**

**GEOL-393 SERVICE LEARNING IN GEOLOGY 1.00-12.00 Credits**

SERVICE LEARNING IN GEOLOGY.

**GEOL-394 INTERNSHIP IN GEOLOGY 1.00-12.00 Credits**

**GEOL-395 PRACTICUM IN GEOLOGY 1.00-12.00 Credits**

**GEOL-399 RESEARCH ASSISTANTSHIP 1.00-3.00 Credits**

**GEOL-420 PRINCIPLES OF GEOCHEMISTRY 3.00 Credits**

This 400-level course is designed to draw together the themes and topics from other courses in the Earth Science major into an integrated picture of Earth and its interrelated systems, as well as applying chemistry to these systems. The focal discussion will be on the interactions between the atmosphere, hydrosphere, biosphere and lithosphere and current topics of interest related to them. Of particular interest are scientific problems involving Earth's systems such as coral bleaching, climate change, and water pollution. Pre-requisite: CHEM-112 with a grade of C or better. Crosslisted with CHEM-420.

**GEOL-421 STRUCTURAL GEOLOGY 4.00 Credits**

Emphasizes 3-dimensional thinking; no other scientific discipline requires the same spatial thinking skills that geology does. This class covers classical and modern concepts of structural geology including: the recognition and description of folds, faults, joints, and metamorphic fabrics in rocks; description and interpretation of stress and strain from these structures; preparation and interpretation of geologic maps and cross-sections. Lecture and laboratory. Pre-requisites: a grade of 'C' or better in GEOL-101.

**GEOL-450 EARTH SYSTEMS CAPSTONE 3.00 Credits**

This course is designed to draw together the themes and topics from other courses in the Earth Science major into an integrated picture of Earth and its interrelated systems. The focal discussion will be on the interactions between the major systems and current topics of interest related to them. Of particular interest are scientific problems involving Earth's systems that are, as of yet, unresolved. Pre-requisite: GEOL-120 and NS-380.

**GEOL-490 DIRECTED STUDY IN GEOLOGY 1.00-12.00 Credits****GEOL-491 WORKSHOP IN GEOLOGY 1.00-12.00 Credits****GEOL-492 SPECIAL TOPICS IN GEOLOGY 1.00-12.00 Credits****GEOL-495 PRACTICUM IN GEOLOGY 1.00-12.00 Credits****GEOL-499 RESEARCH PROJECT AND SEMINAR IN GEOLOGY 1.00-3.00 Credits**

Students will conduct and communicate the results of a research project in the Natural Sciences Division. Topics may include the historical, philosophical, cultural and environmental aspects, and the processes of natural science. Requirements of students include satisfactory oral presentation and defense of their research and submission of a written report approved by their advisor to the Natural Sciences Division. Prerequisite: NS-398.

**MATH-015 ARITHMETIC AND PRE-ALGEBRA 3.00 Credits**

Preparation for MATH 023 and MATH 025. Arithmetic with whole numbers, signed numbers, fractions, and decimals. Order of operations, variables, simplifying of algebraic expressions. Concrete representations of arithmetic operations and algebraic concepts are emphasized. Particularly appropriate for students who experience anxiety when learning mathematics. Course fee.

**MATH-023 BASIC ALGEBRA FOR MATH AS A LIBERAL ART 3.00 Credits**

Brief review of integer arithmetic, fraction arithmetic, percent and order of operations. Evaluating formulas. Units and unit analysis. Solving equations in one variable and using equations in one variable to solve application problems. Graphing linear equations, intercepts, slope, writing the equation of a line. Introduction to functions. Average rate of change, introduction to linear and exponential models. Simplifying exponential expressions, scientific notation, introduction to logarithms. Introduction to sets, counting methods, and discrete probability. Pre-requisite: A grade of C or better in Math-015 or satisfactory placement score. Course fee.

**MATH-025 BASIC ALGEBRA 3.00 Credits**

Brief review of prealgebra. Solving equations and inequalities in one variable; applications. Evaluating formulas; unit analysis. Graphing linear equations, intercepts, slope, writing the equation of a line, introduction to functions. Average rate of change and linear models. Graphing linear inequalities. Systems of linear equations; applications. Exponent rules and scientific notation. Addition, subtraction, multiplication, and factoring of polynomials in one variable. Using the zero product property to solve quadratic equations in one variable. Pre-requisite: A grade of 'C' or better in MATH-015 or satisfactory placement score.

**MATH-123 MATH IN MODERN SOCIETY 3.00 Credits**

This course introduces students to the form and function of mathematics as it applies to liberal-arts studies with a heavy emphasis on its applications. Topics covered include ratios, rates and proportions; properties of linear equations; graphing linear equations; constructing and using linear models; exponential and logarithmic equations and models; financial applications; and elementary probability and statistics. Pre-requisite: MATH-023, MATH-025, MTHPT-103 or MTHPT-120 with a grade or 'C' or better, or permission of the instructor.

**MATH-123P MATH IN MODERN SOCIETY--SUPPLEMENT 2.00 Credits**

This course provides just-in-time preparation for the mathematical skills necessary to be successful in MATH-123 with an emphasis on problem-solving and college-readiness skills. Topics will include order of operations, fraction and decimal arithmetic, percent, scientific notation, interval notation, lines, calculator use, and mathematical modeling. Must be taken concurrently with MATH-123.

**MATH-130 FINITE MATHEMATICS 4.00 Credits**

Systems of linear equations and inequalities, elementary matrix algebra, introduction to linear programming, elementary discrete probability and statistics. Emphasis on applications to business, economics and social sciences. Pre-requisite: A grade of 'C' or better in MATH 025 or MTHPT 103 or satisfactory placement score.

**MATH-143 COLLEGE ALGEBRA 3.00 Credits**

Emphasis on the concept of real-valued functions and their applications, including domain, range, algebraic operations, composition, inverses, and graphing. Topics include polynomial functions, division of polynomials, roots of polynomials, theory of equations, complex numbers, fundamental theorem of algebra, rational functions and asymptotes, logarithmic and exponential functions, and transformations. Students will engage in multi-step algebraic manipulation of complicated functional expressions. Pre-requisite: Satisfactory placement score, or placement into MATH-143P to be taken concurrently with MATH-143.

**MATH-143P SUPPLEMENTAL INSTRUCTION FOR COLLEGE ALGEBRA 2.00 Credits**

The course provides embedded instruction of skills necessary for college algebra. Topics may include absolute value, factoring trinomials, function notation, exponents and logarithms, systems of linear equations, simplifying rational and radical expressions, solving rational and radical equations, graphing, and inequalities. Pre-requisite: This course must be taken concurrently with MATH-143. MATH-025 with a grade of C or better, or satisfactory placement score.

**MATH-144 TRIGONOMETRY 2.00 Credits**

This course introduces right-triangle and circular function approaches to trigonometry. Topics include plane trigonometry, trigonometric identities, graphs of trigonometric functions, amplitude, frequency, phase shift, inverse trigonometric functions and their graphs, polar coordinates, and polar representation of complex numbers. Pre-requisite: MATH-143 or satisfactory placement score.

**MATH-147 COLLEGE ALGEBRA AND TRIGONOMETRY 5.00 Credits**

The course emphasizes functions, circular trigonometry and multilevel problem solving as preparation for calculus. Functions are treated as mathematical entities, including domain, range, algebraic operations, composition, inverses, and graphing. Polynomial, logarithmic, exponential, trigonometric, inverse trigonometric, radical and rational functions are explored. Algebraic techniques include division of polynomials, roots of polynomials, theory of equations and inequalities, complex numbers and DeMoivre's Theorem, the Fundamental Theorem of Algebra and solving systems of linear and nonlinear equations. Trigonometric identities are derived, proven, and applied. Polar coordinates, vectors and oblique triangles are introduced and used in a variety of applications. Analytic geometry focuses on circles, parabolas, distance and midpoints. MATH-147 is equivalent to MATH-143 plus MATH-144. Pre-requisite: A grade of 'C' or better in MATH-143P or satisfactory placement score.

**MATH-153 STATISTICAL REASONING 3.00 Credits**

This course introduces students to problem solving and decision making using single and multivariable statistical models. The course focuses on conceptual understanding of randomness, variability, statistical models, and inference through exploration of data. The use of technology for analysis of data is integrated throughout. Topics include descriptive statistics, probability, hypothesis testing, confidence intervals, likelihood ratios, correlation, and regression. Pre-requisite: A grade of 'C' or better in MATH-023, MATH-025, or appropriate math placement score.

**MATH-153P SUPPLEMENTAL INSTRUCTION FOR MATH 153 1.00 Credit**

This course provides just-in-time preparation of the mathematical skills necessary to be successful in MATH-153 with an emphasis on problem-solving and college-readiness skills. Topics may include order of operations, fraction and decimal arithmetic, percent, scientific notation, interval notation, lines, calculator use, and use of statistical software. Pre-requisite: This course must be taken concurrently with MATH-153. MATH-015 with a grade of C or better, or satisfactory placement score.

**MATH-157 MATHEMATICS FOR ELEMENTARY TEACHERS I 4.00 Credits**

This course provides an overview of some of the mathematics taught in grades K-8 with an emphasis on conceptual understanding and communication of mathematical principles. This is the first course in a two-course sequence of mathematics content courses which is not intended to be a methods of teaching course. Topics may include numbers and the base-ten system; fractions and problem-solving; addition, subtraction, multiplication, and division of real numbers; ratio and proportional relationships; and number theory. Pre-requisite: A grade of 'C' or better in MTHPT-137 or satisfactory placement score, or placement into MATH-157P to be taken concurrently with MATH-157.

**MATH-157P SUPPLEMENTAL INSTRUCTION FOR MATH 157 1.00 Credit**

This course provides just-in-time preparation of the mathematical skills necessary to be successful in MATH-157 and MATH-257 with an emphasis on problem-solving and college-readiness skills. Topics may include accuracy vs precision, order of operations, number theory, fraction and decimal arithmetic, percent, properties of real numbers, conversions and unit analysis, geometry and measurement, factoring, mental math, exponents and scientific notation, lines and graphing, probability, and statistics. This course must be taken concurrently with MATH-157. Prerequisite: MATH-023 or MATH-025 with a grade of C or better or satisfactory placement score.

**MATH-170 CALCULUS I 4.00 Credits**

Definitions of limit, derivative, antiderivative, definite integral. Computation of the derivative, including logarithmic, exponential, and trigonometric functions. Applications of the derivative, optimization, mean value theorem. The fundamental theorem of calculus, brief introduction to applications of the integral and to computation of antiderivatives. Intended for students in engineering, mathematics, and the sciences. Pre-requisites: A grade of "C" or better in MATH-147 or MATH-143 and MATH-144 or satisfactory placement score.

**MATH-175 CALCULUS II 4.00 Credits**

Applications of the integral, symbolic and numerical techniques of integration, inverse transcendental functions. Sequences and series, with an emphasis on power series and approximation. Pre-requisite: A grade of 'C' or better in MATH-170.

**MATH-186 DISCRETE MATHEMATICS 3.00 Credits**

Topics such as sets, functions, algorithms, logic, Boolean algebra are included. This course consists of numerous topics which are particularly valuable to students pursuing a computer science minor. Pre-requisite: A grade of 'C' or better in MATH-143 or MATH-147, or satisfactory placement score.

**MATH-190 DIRECTED STUDY IN MATH 1.00-12.00 Credits****MATH-192 SPECIAL TOPICS IN MATHEMATICS 1.00-12.00 Credits****MATH-195 PRACTICUM IN MATHEMATICS 1.00-2.00 Credits**

Tutoring in the mathematics laboratory or functioning as a teacher's aide in a lower division mathematics course. Pre-requisite: Approval of the division chair. May be repeated for a total of 4 credits.

**MATH-240 INTRODUCTION TO LINEAR ALGEBRA 2.00 Credits**

The introduction to linear algebra course covers systems of linear equations, Gaussian elimination, matrices vector spaces, linear independence, basis, dimension, determinants, eigenvalues, and eigenvectors. Pre-requisite: MATH-170.

**MATH-253 STATISTICAL METHODS FOR THE SCIENCES 3.00 Credits**

Introduction to statistical methods for scientists including design of statistical studies, basic sampling methods, descriptive statistics, probability and sampling distributions, inference regression, and analysis of variance. Pre-requisite: A grade of 'C' or better in MATH-143 or MATH-147 or satisfactory placement score.



**MATH-257 MATHEMATICS FOR ELEMENTARY TEACHERS II 4.00 Credits**

This course is a continuation of MATH-157 and continues an overview of some of the mathematics taught in grades K-8 with an emphasis on conceptual understanding and communication of mathematical principles. This is the second course in a two-course sequence of mathematics content courses which is not intended to be a methods of teaching course. Topics may include algebra; geometry; measurement; area of shapes; circumference; the number pi; construction proofs of the Pythagorean theorem; solid shapes and their volumes and surface areas; geometry of motion and change; statistics; and probability. Pre-requisite: MATH-157 with a grade of C or better.

**MATH-267 MATHEMATICS FOR MIDDLE SCHOOL TEACHERS 4.00 Credits**

This course is designed to prepare teachers of middle school mathematics. The course provides an overview of some of the mathematics taught in grades 6-10 with an emphasis on conceptual understanding and communication of mathematical principles through reasoning and problem-solving. Topics will include set theory; coordinate geometry; counting and probability; and statistics. Additional topics may include graph theory; number theory; coding; intuitive calculus; introduction to linear algebra; basic topology; and discrete mathematics. Pre-requisite: MATH-143 or MATH-147 with a grade of C or better, or satisfactory placement score.

**MATH-275 CALCULUS III 4.00 Credits**

Vector algebra and geometry, functions of several variables, partial and directional derivatives, gradient, chain rule, optimization, multiple and iterated integrals. Parametric curves and surfaces in 3-space, vector fields, divergence and curl, line and surface integrals. Green's, Stokes' and divergence theorems. Pre-requisite: A grade of 'C' or better in MATH-175.

**MATH-285 EUCLIDEAN GEOMETRY 3.00 Credits**

This course is designed to prepare teachers of middle and high school geometry. The course emphasizes classic geometric proof and application of geometric theorems. Topics include parallel lines, triangles, quadrilaterals, circles, and polygons. Pre-requisite: A grade of 'C' or better in MATH-147A, MATH-157, or MATH-186, or satisfactory placement score.

**MATH-290 DIRECTED STUDY IN MATHEMATICS 1.00-3.00 Credits**

Pre-requisite: A grade of 'C' or better in MATH 170 or permission of the division.

**MATH-291 WORKSHOP IN MATHEMATICS 1.00-3.00 Credits****MATH-292 SPECIAL TOPICS IN MATHEMATICS 1.00-3.00 Credits****MATH-295 PRACTICUM IN MATHEMATICS 1.00-2.00 Credits**

Tutoring in the mathematics laboratory or functioning as a teacher's aide in a lower division mathematics course. Pre-requisite: Approval of the division chair. May be repeated for a total of 4 credits.

**MATH-299 RESEARCH ASSISTANTSHIP 1.00-12.00 Credits****MATH-300 INTRODUCTION TO MATHEMATICAL REASONING 3.00 Credits**

Introductory topics in mathematics- logic, set theory, properties of the real line- number theory, induction, mappings, rigorous treatment of limits of sequences. Emphasis is on the concept of theorem and proof. Pre-requisite: A Grade of "C" or better in MATH 175.

**MATH-313 NUMBER THEORY 3.00 Credits**

Modular arithmetic, Pythagorean triples, prime numbers, quadratic reciprocity, Diophantine approximation, elliptic curves, and public key encryption systems. Pre-requisite: MATH-175.

**MATH-320 PROBABILITY AND STATISTICS 3.00 Credits**

Sample spaces, random variables, central limit theorems, stochastic processes, estimation and testing of hypotheses. Pre-requisite: A grade of 'C' or better in MATH-175.

**MATH-340 LINEAR ALGEBRA 3.00 Credits**

Systems of linear equations, vector spaces, linear independence, basis, dimension, inner products, transformation, injectivity and surjectivity, orthogonal projections, orthonormal bases. Eigenvalues and eigenvectors. Positive definite matrices. Pre-requisite: A grade of 'C' or better in MATH-175.

**MATH-345 ORDINARY DIFFERENTIAL EQUATIONS 3.00 Credits**

Separation of variables, variations of parameters- methods of characteristic roots, undetermined coefficients- systems of differential equations. Laplace transform, and power series. Pre-requisite: A Grade of "C" or better in MATH-175.

**MATH-364 PRINCIPLES OF OPTIMIZATION 3.00 Credits**

In this course, students will learn the optimization techniques used to model and solve problems from various disciplines such as business, engineering, sciences, sports, etc. This course introduces students to optimization methods for linear, nonlinear, and integer programming. Emphasis will be on techniques that expand student understanding of Calculus and Linear Algebra concepts as well as how to formulate a model; interpret problems mathematically and geometrically; solution techniques in cases where Calculus cannot be used. Additional emphasis will include the theory behind solution techniques; sensitivity analysis; and how to use Octave/Matlab to solve problems. Pre-requisite: MATH-275 with a grade of C or better, or permission of the instructor.

**MATH-386 MODERN GEOMETRY 3.00 Credits**

Postulates of Euclid and Hilbert, transformational geometry, topics from projective and affine geometry. Understanding of the foundations of high school geometry is emphasized. Pre-requisite: MATH-170 with a grade of C or better.

**MATH-390 DIRECTED STUDY IN MATHEMATICS 1.00-3.00 Credits****MATH-391 WORKSHOP IN MATHEMATICS 1.00-3.00 Credits****MATH-392 SPECIAL TOPICS IN MATHEMATICS 1.00-3.00 Credits****MATH-395 PRACTICUM IN MATHEMATICS 1.00-2.00 Credits****MATH-399 RESEARCH ASSISTANTSHIP 1.00-12.00 Credits****MATH-450 COMPLEX ANALYSIS 3.00 Credits**

Complex numbers and functions, complex derivatives and integrals, residue theory, conformal mappings and uniform convergence. Pre-requisite: A grade of 'C' or better in MATH-300.

**MATH-460 ABSTRACT ALGEBRA I 3.00 Credits**

This is the first course in a two-course sequence that provides an introduction to abstract algebra. Topics include groups, subgroups, permutation groups, isomorphisms, homomorphisms, quotient groups, and the fundamental theorem of finite abelian groups. Pre-requisite: MATH-300 with a grade of C or better.

**MATH-461 ABSTRACT ALGEBRA II 3.00 Credits**

This is the second course in a two-course sequence that provides an introduction to abstract algebra. Topics include rings, subrings, ideals, quotient rings, polynomial rings, vector spaces, fields, extension fields, and Galois theory. Pre-requisite: MATH-460 with a grade of C or better.

**MATH-470 GENERAL TOPOLOGY 3.00 Credits**

An introduction to the fundamental concepts of general topology including set theory, metrics, neighborhoods, bases, subspaces, mappings, continuity, separation axioms, compactness and connectedness. Pre-requisite: A grade of 'C' or better in MATH-300.

**MATH-480 REAL ANALYSIS I 3.00 Credits**

This course is the first course in a two-course sequence that provides a theory of the real line, properties of real numbers, and real-valued functions. Topics include convergence of sequences; open and closed sets; density of sets; Cauchy sequences; monotone convergence theorem; pointwise and uniform convergence of functions; continuity; mean value theorem; intermediate value theorem; compactness; and differentiability. Pre-requisite: MATH-300 with a grade of C or better.

**MATH-481 REAL ANALYSIS II 3.00 Credits**

This course is the second course in a two-course sequence on the theory of real-valued functions. Topics include sequences and series of functions, Weierstrass M-test, power series, Taylor series, Riemann integrability, metric spaces, convergence in metric spaces, and differentiability of functions with higher dimensional domains. Pre-requisite: MATH-480 with a grade of C or better.

**MATH-490 DIRECTED STUDY IN MATHEMATICS 1.00-3.00 Credits**

Pre-requisite: A grade of 'C' or better in MATH-170 or permission of the division.

**MATH-491 WORKSHOP IN MATHEMATICS 1.00-3.00 Credits****MATH-492 SPECIAL TOPICS IN MATHEMATICS 1.00-3.00 Credits****MATH-494 INTERNSHIP IN MATHEMATICS 1.00-12.00 Credits**

Internship in Math.

**MATH-495 PRACTICUM IN MATHEMATICS 1.00-2.00 Credits**

Tutoring in the mathematics laboratory or functioning as a teacher's aide in a lower division mathematics course. Pre-requisite: Approval of the division chair. May be repeated for a total of 4 credits.

**MATH-499 RESEARCH PROJECT AND SEMINAR IN MATH 1.00-3.00 Credits**

Students will conduct and communicate the results of a research project in the Natural Sciences Division. Topics may include the historical, philosophical, cultural and environmental aspects, and the processes of natural science. Requirements of students include satisfactory oral presentation and defense of their research and submission of a written report approved by their advisor to the Natural Sciences Division. Prerequisite: NS-398.

**NS-100 INTRODUCTION TO ENVIRONMENTAL SCIENCE 4.00 Credits**

An introductory course for non-science majors. This course will cover the vast interdisciplinary subject of environmental science, which uses ecological principles to address a broad range of topics from conservation of single species to global issues such as global warming and climate change. These issues involve a complex array of information and applications from Ecology, environmental policy, politics, Geology, and Geography. Three hours of lecture and one 3-hour laboratory period per week. Pre-requisite: MATH-015 or satisfactory math placement.

**NS-140 INTEGRATED SCIENCE I 4.00 Credits**

This team-taught, place-based, course is designed to provide an introduction to multiple scientific disciplines, including biology, chemistry, computer science, earth science, mathematics, and physics around the theme of the greater Lewiston-Clarkston valley watershed. Course content is integrated in order to allow the students the opportunity to use multiple scientific disciplines to understand the world in which they live. Weekly laboratories will be used to provide students with hands-on learning experiences that directly related to the topics covered in lecture and may include field experiences. The course will include emphases on college reading, college writing, collaboration, and using math to solve real-world problems. This is a 4-credit class with 3 hours of lecture a week and approximately 3 hours of laboratory each week. Pre-requisite: Placement into MATH-143P or equivalent or permission of the instructor. Must be concurrently enrolled into MATH-143 or permission of instructor.

**NS-150 INTRODUCTION TO NATURAL SCIENCES 3.00 Credits**

An introduction to science as a way of knowing. Examples are chosen from astronomy, genetics, genetic engineering, evolution and other timely topics. Pre-requisite: ENGL-101.

**NS-171 INTEGRATED SCIENCE I 3.00 Credits**

First of a two-semester sequence designed for the LCSC pre-service teachers to teach science in the elementary grades. NS-171 provides a college-level understanding of the scientific knowledge base for the physical sciences taught in grades K-8 in most states. Pre-requisite: A grade of 'C' or better in MATH-108 or MATH-137 or satisfactory math placement.

**NS-172 INTEGRATED SCIENCE II 3.00 Credits**

Second of a two-semester sequence. NS-172 provides a college-level understanding of the scientific knowledge base for the life and earth sciences taught in grades K-8 in most states. Pre-requisite: A grade of 'C' or better in NS-171.

**NS-173 INTEGRATED SCIENCE I RECITATION 1.00 Credit**

Students will have the opportunity to practice solving problems relating to fundamental physical scientific concepts in order to prepare themselves to teach science in the elementary grades with competence. The opportunity to become more familiar with scientific terminology will also be given.

**NS-174 NATURAL SCIENCE FOR ELEMENTARY EDUCATOR 4.00 Credits**

This course is an introduction to biology and earth science for future elementary educators. To this end, we will cover the natural science topics specified by the Idaho State Standards for grade K through 8. These include cells, genetics, human biology, planets, weather, and basic geology, as well as science methodology. Throughout the semester, we will also explore ways of learning that foster deep learning, conceptual understanding, curiosity, and confidence.

**NS-190 DIRECTED STUDY IN NATURAL SCIENCE 1.00-12.00 Credits****NS-192 SPECIAL TOPICS IN NATURAL SCIENCE 1.00-12.00 Credits****NS-270 SCIENCE OUTREACH 1.00 Credit**

A course where students will learn about and participate in science outreach, involving visits to local elementary and secondary schools as well as those conducted on the LCSC campus. Students will assist others (both faculty and students in NS 470) in the presentation of outreach programs and will gain valuable skills in both outreach preparation and interpersonal communication.

**NS-275 FIELD EXPERIENCES IN SCIENCE 2.00 Credits**

A field-based experience integrating a variety of disciplines including, but not limited to, field biology, earth science, environmental chemistry, astronomy, and cultural history. No pre-requisites required.

**NS-290 DIRECTED STUDY IN NATURAL SCIENCE 1.00-12.00 Credits****NS-291 WORKSHOP IN NATURAL SCIENCE 1.00-12.00 Credits****NS-292 SPECIAL TOPICS IN NATURAL SCIENCE 1.00-12.00 Credits****NS-295 PRACTICUM IN NATURAL SCIENCE 1.00-12.00 Credits****NS-299 RESEARCH ASSISTANTSHIP 1.00-12.00 Credits****NS-380 SENIOR SEMINAR 1.00 Credit**

Reading and research involving primary literature in the student's field of study. Topic-driven research will result in written and oral presentations.

**NS-390 DIRECTED STUDY IN NATURAL SCIENCE 1.00-12.00 Credits****NS-395 PRACTICUM IN NATURAL SCIENCE 1.00-12.00 Credits****NS-398 SENIOR PROJECT PROPOSAL 2.00 Credits**

Preparation of the proposal for Senior Research projects to be completed in NS 499. Students will become familiar with the procedure by which proposals are prepared and submitted to funding agencies like the National Science Foundation (NSF). The format of the proposal is based on NSF proposal requests. The course will ensure that the research projects are well conceived, carefully planned, and have a reasonable chance of succeeding. All senior-research proposals are reviewed by a board of Natural Science faculty members. Proposals may be accepted, accepted with revisions, or returned for major revisions with a request for resubmission during the next semester's review. Pre-requisite: Junior standing.

**NS-399 RESEARCH ASSISTANTSHIP 1.00-3.00 Credits****NS-465 TUTORING IN NATURAL SCIENCE 3.00 Credits**

In this course, students will learn various tutoring skills accepted by the National Tutoring Association (NTA) as they work toward earning Basic Level Tutor Certification through the NTA. Students will learn to tutor and improve their tutoring through practice and working directly with tutees. Students will develop essential job skills, such as communication, teamwork, critical thinking, problem-solving, creativity, organization, and accountability.

**NS-470 SCIENCE OUTREACH 1.00 Credit**

A course where students will learn about and participate in science outreach, involving visits to local elementary and secondary schools as well as those conducted on the LCSC campus. Students will also be responsible for designing and implementing the program in the classroom setting, and will participate in peer assessment of other students' presentations, gaining valuable skills in outreach preparation and both interpersonal and large group communication. Pre-requisites: A grade of 'C' or higher in BIOL-181 or CHEM-112 & NS-270.

**NS-475 FIELD EXPERIENCE 2.00 Credits**

A field-based experience integrating a variety of disciplines including, but not limited to, field biology, earth science, environmental chemistry, astronomy, and cultural history. Requires written and/or oral presentations as a part of the field experience. No pre-requisites required.

**NS-490 DIRECTED STUDY IN NATURAL SCIENCE 1.00-12.00 Credits****NS-491 WORKSHOP IN NATURAL SCIENCE 1.00-12.00 Credits****NS-492 SPECIAL TOPICS IN NATURAL SCIENCE 1.00-12.00 Credits****NS-494 INTERNSHIP IN NATURAL SCIENCE 1.00-12.00 Credits****NS-495 PRACTICUM IN NATURAL SCIENCE 1.00-12.00 Credits****NS-499 RESEARCH PROJECT AND SEMINAR IN NATURAL SCIENCE 1.00-3.00 Credits**

Students will conduct and communicate the results of a research project in the Natural Sciences Division. Topics may include the historical, philosophical, cultural and environmental aspects, and the processes of natural science. Requirements of students include satisfactory oral presentation and defense of their research and submission of a written report approved by their advisor to the Natural Sciences Division. Pre-requisite: NS-398.

**PHYS-108 GENERAL PHYSICS WITH RADIATION 4.00 Credits**

Classical mechanics, electricity and magnetism, circuits, atomic structure, radiation health physics, and X-ray production. This course introduces topics in physics essential to the field of radiation science and technology. There are three hours of lecture and one 2-hour laboratory per week. Emphasis will be placed on problem-solving. Pre-requisites: MATH-137, MATH-143 and MATH-144, or MATH-147.

**PHYS-111 GENERAL PHYSICS I 4.00 Credits**

Mechanics, heat and thermodynamics. General Physics I is a study of the fundamental principles of classical physics. An emphasis is placed upon analytic problem solving using algebra and elementary trigonometry, and laboratory skills. There are three hours of lecture and one 3-hour laboratory per week. Pre-requisite: A grade of 'C' or better in MATH-144 or MATH-147 or satisfactory math placement.

**PHYS-112 GENERAL PHYSICS II 4.00 Credits**

Electricity and magnetism, optics, modern physics. General Physics II is the sequel to General Physics I. Course covers the fundamental principles of electricity, magnetism, and light. There are three hours of lecture and one 3-hour laboratory per week. Pre-requisite: A grade of 'C' or better in PHYS-111.

**PHYS-171 PHYS SCIENCES FOR ELEMENTARY EDUCATORS 4.00 Credits**

This course is an introduction to chemistry and physics for future elementary educators. To this end, we will cover the physical science topics specified by Idaho State Standards for grades K through 8. These include measurement, forces, energy, electricity and mixtures and solutions, and science methodology. Throughout the semester, we will also explore ways of teaching that foster deep learning, conceptual understanding, curiosity and confidence-building. Pre-requisite: MATH-025 with a grade of 'C' or better or satisfactory math placement.

**PHYS-190 DIRECTED STUDY IN PHYSICS 1.00-12.00 Credits****PHYS-192 SPECIAL TOPICS IN PHYSICS 1.00-12.00 Credits****PHYS-205 DESCRIPTIVE ASTRONOMY 4.00 Credits**

A survey of descriptive astronomy. Topics: historical development of theories of the universe, physical organization of the solar system/universe; the formation and evolution of stars, galaxies, recently discovered astronomical objects such as quasistellar objects and black holes; evolution of the universe. Three hours of lecture and one 3-hour laboratory per week. Pre-requisite: A grade of 'C' or better in MATH-108, or MATH-137, or satisfactory math placement.

**PHYS-211 ENGINEERING PHYSICS I 5.00 Credits**

Mechanics, heat and thermodynamics. Engineering Physics I is the standard, calculus based university physics course. Fundamental principles of physics are examined using analytic problem-solving and laboratory exploration. There are four hours of lecture and one 3-hour laboratory per week. Co-requisite: MATH-170 must be taken concurrently.

**PHYS-212 ENGINEERING PHYSICS II 5.00 Credits**

Electricity and magnetism, optics, modern physics. Engineering Physics II is the sequel to Engineering Physics I. Principles of electrodynamics theory, elements of optics, and modern physics are examined using analytic problem solving and laboratory exploration. There are four hours of lecture and one, three-hour laboratory per week. Pre-requisite PHYS-211 with a grade of C or better.

**PHYS-290 DIRECTED STUDY IN PHYSICS 1.00-4.00 Credits**

**PHYS-291 WORKSHOP IN PHYSICS 1.00-4.00 Credits**

**PHYS-292 SPECIAL TOPICS IN PHYSICS 1.00-12.00 Credits**

**PHYS-293 SERVICE LEARNING 1.00-12.00 Credits**

**PHYS-295 PRACTICUM IN PHYSICS 1.00-12.00 Credits**

**PHYS-299 RESEARCH ASSISTANTSHIP 1.00-12.00 Credits**

**PHYS-305 AN INTRODUCTION TO MODERN PHYSICS 3.00 Credits**

An introduction to the non-classical physics of the 20th century. Selected topics include the historical development that lead to modern physics, the transitional Bohr model, descriptive elements of quantum mechanics, special relativity, nuclear physics, and elementary particles. Three hours of lecture per week. Pre-requisite: A grade of 'C' or better in PHYS-111 or PHYS-211.

**PHYS-390 DIRECTED STUDY IN PHYSICS 1.00-4.00 Credits**

**PHYS-395 PRACTICUM IN PHYSICS 1.00-12.00 Credits**

**PHYS-399 RESEARCH ASSISTANTSHIP 1.00-12.00 Credits**

**PHYS-490 DIRECTED STUDY IN PHYSICS 1.00-4.00 Credits**

**PHYS-491 WORKSHOP IN PHYSICS 1.00-4.00 Credits**

**PHYS-492 SPECIAL TOPICS IN PHYSICS 1.00-12.00 Credits**

**PHYS-495 PRACTICUM IN PHYSICS 1.00-12.00 Credits**