

NATURAL SCIENCES AND MATHEMATICS DIVISION

Contact Information

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The Division of Natural Sciences and Mathematics offers courses in Biology, Chemistry, Chemistry: Secondary Education, Computer Science, Earth Science, Engineering, Forensic Science, Geology, Geographic Information Science, Mathematics, Physics and Natural Science 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. The Division offers baccalaureate majors in Biology, Biology: Secondary Education, Earth Science, Earth Science: Secondary Education, Chemistry, Chemistry: Secondary Education, Computer Science, Mathematics, Mathematics: Secondary Education, and Natural Science: Secondary Education. The Division also offers an associate degree in Liberal Arts: Natural Science. 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, premedical, pre-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. Students seeking entrance into medicine, dentistry, physical therapy, occupational therapy, medical technology, and veterinary medicine usually complete a baccalaureate degree in Biology or Chemistry prior to admittance to a professional program. 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 Computer Science Laboratory, a Science and Math Tutoring Lab, the LCSC 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.

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.

Transfer programs

- Agriculture
- Dental Hygiene
- Engineering
- Forestry
- Medical Technology

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 2/3 dual-degree agreements with BSU and ISU Engineering programs. Transfer to Engineering programs at any other school is also possible through individual consultation.

Assessment

Major field examinations are given to students in most degree programs at the conclusion of their study. The purpose of these exams is to assess content knowledge in their area of study to continue improving the program. Exit interviews are required of all Natural Sciences majors at the conclusion of their program of study. Data gathered from the major field examinations and the exit exams are used to guide improvement and development of programs within the Division of Natural Sciences and Mathematics. Additionally, the success of graduates who enter professional and graduate schools is monitored.

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.

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.

Clubs

The Geology 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.

The Computer Science club is a community club that extends membership to both LC students and members of the local community. The club promotes Computer Science in all of its forms with regional K-12 schools. Members of the CS club are encouraged to consider membership in the Association for Computing Machinery (ACM). The club works on projects locally with an emphasis on creating a community for those interested in computer science.

The Math Club meets regularly 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.

Preparation for Future Graduate Studies

Students who major in 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 COMPUTERIZED 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.

BIOL-102 SCIENCE FOR LIFE 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: NS 150 and Math 025 with a grade of 'C' or better or satisfactory math placement. Lab Fee.

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: MATH 023 or 025 with a grade of 'C' or better, or satisfactory math placement.

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: A grade of 'C' or better in Math 015, MTHPT 010 or MTHPT 012. Lab fee.

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: A grade of 'C' or better in BIOL 181 and in CHEM 111 or CHEM 105. Lab fee.

BIOL-190 DIRECTED STUDY IN BIOLOGY 1.00-12.00 Credits**BIOL-192 SPECIAL TOPICS IN BIOLOGY 1.00-12.00 Credits****BIOL-202 ZOOLOGY 4.00 Credits**

A phylogenetic study of the animal kingdom. Beginning with unicellular animals and ending with vertebrates. The course includes the anatomy, physiology, systematics, ecology and evolution of animals. Three hours of lecture and one 3-hour laboratory period per week. Pre-requisites: A grade of 'C' or better in BIOL 180 and BIOL 181. Lab fee.

BIOL-203 BOTANY 4.00 Credits

Structure, function and diversity of plants with an emphasis on evolution by natural selection. Three hours of lecture and one 3-hour laboratory period per week. Pre-requisites: A grade of 'C' or better in BIOL 180 and BIOL 181. Lab fee.

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 Biology 182 and Chem 111. Lab fee.

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: A grade of 'C' or better in MATH 025 or satisfactory math placement and CHEM 105 or equivalent.

BIOL-252 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, nervous, and endocrine. Four hours of lecture and one two-hour laboratory per week. Pre-requisite: MATH 025. Lab Fee.

BIOL-253 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: cardiovascular, immunity, respiratory, digestion, urinary, and reproductive. Four hours of lecture and one 2-hour laboratory per week. Pre-requisite: A grade of 'C' or better in BIOL 252. Co-requisite: CHEM 105. Lab fee.

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-req: BIOL 252.

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-301 EVOLUTION 3.00 Credits

This course serves as an introduction to evolutionary theory for students in biology, biological education and related fields. Areas that will be covered include: the origins and history of evolutionary ideas, mechanisms that produce genetic diversity, natural selection, methods of phylogenetic analysis, the evolution of the primates. Three hours of lecture per week. Pre-requisites: A grade of 'C' or better in BIOL 180 and BIOL 181.

BIOL-307 HUMAN GENETICS FOR HEALTH SCIENCES 2.00 Credits

Explores the biological basis of human inheritance, including mechanisms of cell division, DNA replication & repair, and causes & types of common mutations with a focus on the relationship of these processes to human health. Two one hour lectures per week. Pre-requisite: A grade of 'C' or better in BIOL 253 and CHEM 105.

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 4.00 Credits

Ecological principles of plants and animals; structure and function of the ecosystem; ecological monitoring and management. Three hours of lecture and one 3-hour lab per week. Lab fee. Pre-requisites: A grade of 'C' or better in BIOL 202 and BIOL 203. Co-requisite: Core mathematics course. Lab fee.

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. Lab fee. Pre-requisites: A grade of 'C' or better in BIOL 213 and CHEM 112 and completion of ENGL 102, MATH 170 and MATH 253.

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. Lab fee. Pre-requisites: A grade of 'C' or better in BIOL 213 and CHEM 112.

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 the cellular metabolism, the cell cycle, regulation of cell growth and division, cell signaling, and gene expression. Three hours of lecture and one 3-hour laboratory session per week. Pre-requisites: A grade of 'C' or better in BIOL 213 and CHEM 112.

BIOL-380 BIOLOGY SENIOR SEMINAR 1.00 Credit

Reading, applying and understanding classical biological literature is an important task for any biology major. The reading and understanding of classical literature allows the students to understand the beginnings of many of the foundational biological concepts they are taught in their time as undergrads. Having this class be Biology Specific allows biology students to focus on topics that are more relevant to their degree. Prerequisite: BIOL 213.

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 1.00-2.00 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: A grade of 'C' or better in BIOL 213. Lab fee.

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: A grade of 'C' or better in BIOL 213. Lab fee.

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: A grade of 'C' or better in BIOL 213. Lab fee.

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: Chemistry 371 and 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 253.

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 253 and BIOL 250 or BIOL 355.

BIOL-450 FIELD BOTANY 4.00 Credits

A systematic survey of the plant kingdom, from non-vascular to vascular plants, with an emphasis on identification of the regional flora. Two hours of lecture and one 4 hour laboratory period per week. Five all-day field trips are required. Pre-requisite: A grade of 'C' or better in BIOL 213. Lab fee.

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-050 PREPATORY CHEMISTRY 3.00 Credits

This class prepares students for CHEM 111. Emphasis on chemical problem solving and SI unit conversions. Other topics include: mole concept, chemical stoichiometry, chemical formulas, nomenclature, periodic table, equation balancing and molecular geometry. Pre-requisite: MATH 023 or 025 or placement. Course fee.

CHEM-102 THE CHEMISTRY OF DAILY LIFE 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: A grade of 'C' or better in MATH 025 or satisfactory math placement. Lab fee.

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: A grade of 'C' or better in MATH 025 or satisfactory math placement. Lab fee.

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 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: A grade of 'C' or better in CHEM 111. 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-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-295 PRACTICUM IN CHEMISTRY 1.00-2.00 Credits****CHEM-299 RESEARCH ASSISTANTSHIP 1.00-12.00 Credits****CHEM-305 PHYSICAL CHEMISTRY I 3.00 Credits**

Properties of Matter, First and Second Laws of Thermodynamics, Equilibrium, Chemical Reactions, Solutions. Pre-requisite: A grade of 'C' or better in MATH 175.

CHEM-306 PHYSICAL CHEMISTRY II 3.00 Credits

Quantum theory, Atoms, Diatomic Molecules, Polyatomic Molecules, Chemical Kinetics, and Statistical Mechanics. Pre-requisite: A grade of 'C' or better in CHEM 305.

CHEM-325 QUANTITATIVE ANALYSIS 4.00 Credits

Theory and practice of classical gravimetric and volumetric chemical analyses with an introduction to instrumental techniques in the laboratory. Basic data handling and statistics, chemical equilibrium, electrochemistry. Three hours of lecture and one 4-hour laboratory per week. Pre-requisite: A grade of 'C' or better in CHEM 112. 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: A grade of 'C' or better in CHEM 325.

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: A grade of 'C' or better in CHEM 112.

CHEM-372 ORGANIC CHEMISTRY II 3.00 Credits

Continuation of Chemistry 371. Three hours of lecture per week. Pre-requisite: A grade of 'C' or better in CHEM 371.

CHEM-373 ORGANIC CHEMISTRY I LAB 1.00 Credit

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

CHEM-376 ORGANIC CHEMISTRY II LAB 2.00 Credits

Laboratory to accompany Chemistry 372. 3-hours of lab per week and information literacy. Pre-requisite: A grade of 'C' or better in CHEM 371 and CHEM 373. 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-395 PRACTICUM IN CHEMISTRY 1.00-2.00 Credits****CHEM-399 RESEARCH ASSISTANTSHIP 1.00-12.00 Credits****CHEM-454 INSTRUMENTAL ANALYSIS 4.00 Credits**

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

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: A grade of 'C' or better in CHEM 112. Lab fee.

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: A grade of 'C' or better in CHEM 371.

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: A grade of 'C' or better in CHEM 481.

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 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.

CS-110 INTRODUCTION TO INTERACTIVE DESIGN 4.00 Credits

Introduces the basic concepts of algorithm design and implementation. Topics include variables, functions, methods, parameters, control structures, and events. Emphasis is placed on logic and control structures.

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: Grade of 'C' or better in MATH 108 or equivalent placement score, AND a 'C' or better in CS 108; OR a grade of 'C' or better in MATH 170.

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-213 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: A grade of 'C' or better in CS 111 and MATH 186. Co-requisite: Math 186.

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: A 'C' or better in MATH 025 or equivalent placement score.

CS-228 LINUX AND TOOLS 3.00 Credits

An introduction to Linux-based operating systems, system applications, and shell programming. Emphasis on the productive use of system tools with a hands-on approach. Pre-requisites: A 'C' or better in MATH 025 or equivalent placement score and CS 111 as a pre-requisite or co-requisite.

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-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-312 OBJECT-ORIENTED DESIGN AND IMPLEMENTATION 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. The Linux system and compiler suite is used. Pre-requisites: A 'C' or better in CS 228 AND a 'C' or better in MATH 147A or a 'C' or better in MATH 147 or equivalent placement score.

CS-360 SOFTWARE ENGINEERING 4.00 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 213 and CS 312 as a co-requisite.

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-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-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-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 4.00 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 MATH 147 or equivalent placement scores and CS 312 as a pre-requisite or co-requisite.

CS-435 COMPUTER NETWORKS 4.00 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 MATH 147 (or equivalent placement score) AND CS 312 which can be taken as a co-requisite.

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 4.00 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 a grade of 'C' or better in MATH 147 (or equivalent placement score).

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 4.00 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 435.

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 1.00-3.00 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. Course fee.

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: MATH 025 or satisfactory math placement.

GEOG-102 INTRODUCTION TO GEOGRAPHY 3.00 Credits

This course uses the world-regional approach. That is, it is designed to offer students an introduction to the study of the interconnections among places and humans in the context of continuous change. It links geography to related physical sciences and social sciences.

GEOL-100 ENVIRONMENTAL EARTH SCIENCE 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. Lab fee. Pre-requisite: MATH 025 or satisfactory math placement.

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 100. Lab fee.

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 100. Lab fee.

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 100. Lab fee.

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. Lab fee.

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 100. Lab fee.

GEOL-390 DIRECTED STUDY IN GEOLOGY 1.00-12.00 Credits**GEOL-392 SPECIAL TOPICS IN GEOLOGY 1.00-12.00 Credits****GEOL-394 INTERNSHIP IN GEOLOGY 12.00 Credits****GEOL-395 PRACTICUM IN GEOLOGY 1.00-12.00 Credits****GEOL-399 RESEARCH ASSISTANTSHIP 1.00-3.00 Credits****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 100.

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.

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 1.00-2.00 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-108 INTERMEDIATE ALGEBRA 4.00 Credits

Function emphasis. Full integration of graphing technology and computer algebra system. Systems of linear equations and linear inequalities. Absolute value equations. Polynomials and polynomial functions. Exponential and logarithmic functions. Radical equations and functions. Quadratic equations and functions. Rational equations and functions. Pre-requisite: A Grade of 'C' or better in MATH 025 or satisfactory placement score. Course fee.

MATH-123 MATHEMATICS AS A LIBERAL ART 3.00 Credits

This course introduces students to the form and function of mathematics and its relationship to other studies. Students will examine a topic outside of mathematics, study the formal properties of the mathematics employed, and apply the mathematics to the original and similar areas of potential interest. Sample topics include apportionment, cryptography, finance, operations management, population growth, public opinion surveys, land surveying, and voting methods and strategies. Pre-requisite: A grade of 'C' or better in MATH 023 or MATH 025, or satisfactory placement score. Course fee.

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. Cross-listed with MTHPT 130. Pre-requisite: A grade of 'C' or better in MATH 025 or MTHPT 103 or satisfactory placement score. Course fee.

MATH-147 PRECALCULUS 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 147A plus MATH 147B. Pre-requisite: A grade of 'C' or better in MATH 108 or satisfactory placement score. Course fee.

MATH-147A PRECALCULUS ALGEBRA 3.00 Credits

Emphasis on the concept of real-valued functions as mathematical entities, 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 translation of axes. Students will engage in multi-step algebraic manipulation of complicated functional expressions. Pre-requisite: A Grade of 'C' or better in MATH 108 or satisfactory placement score. Course fee.

MATH-147B PRECALCULUS 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 147A.

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-157 FOUNDATIONS OF ELEMENTARY MATHEMATICS 3.00 Credits

An overview of the mathematics taught in grades K-8. Topics from set theory, logic, number theory, and functions. Stresses skills and cognitive understanding. Pre-requisite: A grade of 'C' or better in MATH 108 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: MATH 147 or MATH 147A and MATH 147B with a grade of 'C' or better, 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 108 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-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 108 or satisfactory placement score.

MATH-257 FOUNDATION OF ELEMENTARY MATHEMATICS II 3.00 Credits

Continuation of MATH 157. Emphasis on conceptual understanding, and communication of mathematical principles. Content emphasis on probability, statistics, geometry, and algebraic structures. Pre-requisite: A grade of 'C' or better in MATH 157.

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, Stoke's 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, Gaussian elimination, matrices vector spaces, linear independence, basis, dimension, inner products, orthogonal projections, orthonormal bases. Determinants, 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-386 POSTULATION GEOMETRY 3.00 Credits

Postulates of Euclid and Hilbert, nonEuclidian geometry and projective geometry. Understanding of high school geometry is emphasized. Pre-requisite: A grade of 'C' or better in MATH 170.

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

Groups, subgroups, permutation groups, homomorphism and quotient groups. Rings, subrings, ideals and quotient rings. Polynomials, integral domains and fields of quotients. Introduction to Galois Theory. Pre-requisite: A grade of 'C' or better in MATH 300.

MATH-461 ABSTRACT ALGEBRA II 3.00 Credits

Rings, subrings, ideals and quotient rings. Polynomials, integral domains and fields of quotients. Field extensions and splitting fields. Fundamental Theorem of Galois Theory. Pre-requisite: A grade of 'C' or better in MATH 460.

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

Axioms for the real numbers. Limits of sequences, limits of functions, continuity, compactness, the derivative and the Riemann integral. Pre-requisite: A grade of 'C' or better in MATH 300.

MATH-481 REAL ANALYSIS II 3.00 Credits

Riemann-Stieltjes integration. Functions of bounded variation. Differentiation and Integration in n-space. Lebesgue integration. Pre-requisite: A grade of 'C' or better in MATH 481.

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-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. Lab fee.

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-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-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. Lab fee.

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. Lab fee.

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: A grade of 'C' or better in MATH 108 or MATH 137 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. Lab fee.

PHYS-211 ENGINEERING PHYSICS I 4.00 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 three hours of lecture and one 3-hour laboratory per week. Pre-requisite: A grade of 'C' or better in MATH 170. Lab fee.

PHYS-212 ENGINEERING PHYSICS II 4.00 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 three hours of lecture and one, three-hour laboratory per week. Pre-requisites: a grade of 'C' or better in MATH 175. Lab Fee.

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 211.

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