

BIOLOGICAL SCIENCES (BISC)

- 101: Fundamentals of Biology I.** 0-3-3. Introduction to biological concepts of cell structure and physiology, genetics, evolution, and ecology.
- 102: Fundamentals of Biology II.** 0-3-3. Preq., BISC 101. Continuation of biological topics including origin of life, survey of the five kingdoms, plant and animal structure.
- 130: Biological Principles.** 0-3-3. Coreq., BISC 131. Designed for students majoring in science. Introduction to biomolecules, cells, metabolism, genetics, evolution, and ecology.
- 131: Biological Principles Laboratory.** 3-0-1. Coreq., BISC 130. Student-oriented experiments and demonstrations emphasizing biomolecules, cells, metabolism, genetics, evolution, and ecology.
- 132: Biological Diversity.** 0-3-3. Preq., BISC 130; Coreq., BISC 133. An introduction to the classification, anatomy, and physiology of prokaryotes and eukaryotes.
- 133: Biological Diversity Laboratory.** 3-0-1. Coreq., BISC 132. Investigations of the classification, anatomy, and physiology of prokaryotes and eukaryotes.
- 134: Botany.** 0-3-3. Introduction to botany, including the biology of plants, fungi, bacteria, and viruses.
- 150: Phlebotomy.** 0-2-2. Principles of specimen collection, techniques, and processing with emphasis on related issues of patient relations, medical terminology, anatomy and physiology, quality assurance, safety and compliance.
- 151: Phlebotomy Laboratory.** 10-0-2. Preq. or Coreq., BISC 150. A laboratory to accompany BISC 150. Instruction and practicum concerning specimen collection techniques of both routine and special considerations.
- 200: Principles of Genetics.** 0-3-3. Fundamental laws of heredity as applied to plants, animals, and humans.
- 201: Scientific Principles.** 0-3-3. A general course embracing the principles of the biological and physical sciences, incorporating teacher demonstration and laboratory activities.
- 205: Plant Anatomy.** 3-2-3. Preq., BISC 132, 133. A comparative study and interpretation of the internal structure of vascular plants.
- 212: Conservation and Management of Natural Resources.** 0-3-3. An introduction to the wildlife resources of North America and their interrelations with other natural resources.
- 214: Survey of Microbiology.** 4-3-4. Fundamental concepts of microbiology, emphasizing techniques and laboratory procedures used in medically related studies.
- 216: Plant Biology.** 0-3-3. Preq., BISC 130, 131. Introduction to the biology of plants including growth, morphology, physiology, genetics, diversity, and propagation.
- 217: Plant Biology Laboratory.** 3-0-1. Preq. or Coreq., BISC 216. Exploration and application of plant biology concepts and processes.
- 221: Taxonomy and Morphology of Vascular Plants I.** 3-2-3. Preq., BISC 132, 133. Survey of plant morphology, classification, identification, and field techniques. Includes a survey of common families in the SE USA.
- 222: Taxonomy and Morphology of Vascular Plants II.** 3-2-3. Preq., BISC 221. Survey of taxonomy to include a local project. Additional common vascular plant families and identification of plants in winter condition will also be included.
- 224: Human Anatomy and Physiology.** 0-3-3. Preq., Consult with your advisor. The structure and functions of the organ systems of the human body, including anatomy of the vocal and hearing mechanisms.
- 225: Human Anatomy and Physiology.** 0-3-3. Preq., Consult with your advisor. Introduction to human anatomy and physiology including structure and function of cells, tissues, organs and the integumentary, skeletal, muscular, and nervous systems.
- 226: Anatomy and Physiology Laboratory.** 3-0-1. Preq., BISC 225, or concurrent enrollment. Specially designed exercises permitting students to observe the physiology and anatomy of mammals.
- 227: Human Anatomy and Physiology.** 0-3-3. Preq., BISC 225 or equivalent. A continuation of 225. Including structure and function of circulatory, respiratory, digestive, excretory, endocrine and reproductive systems.
- 228: Anatomy and Physiology Laboratory.** 3-0-1. Preq., BISC 227, or concurrent enrollment. Additional laboratory exercises to illustrate the anatomy and physiology of animals.
- 242: Histological Sectioning.** 8 1/2-0-2. Preq., 8 semester credits of BISC. Methods of preparing tissues for microscopic examination.
- 245: Clinical Analysis.** 4 1/4-3-4. Preq., CHEM 104. Study of the laboratory methods used to evaluate the physiochemical state of the body, including a computer assisted approach to laboratory mathematics and quality assurance.
- 250: Introduction to Clinical Laboratory Sciences.** 4-1-2. Introduction to the curriculum and profession including computer utilization in problem solving, professional awareness, pre-clinical/clinical articulations, and information sources in medical technologies.
- 260: Microbiology.** 4-3-4. Preq., CHEM 100, 101; BISC 130, 131. Designed for students majoring in science. Course will cover topics in clinical, applied, environmental, and eukaryotic microbiology.
- 262: Bacterial Identification Methods and Applications.** 0-3-3. Preq., BISC 260. Course covers principles of physical, biochemical, and molecular methods in identifying bacteria.
- 275: Aquatic Bioassays.** 0-1-1. Internet-based course centering on governmental regulations concerning bioassays to test for toxicity in waste effluents released into natural waters in the United States. Also listed as ENSC 275.
- 284: Introduction to Marine Science.** 8-3-4. Preq., BISC 132, 133. Introduction to chemical, geological, and biological processes in the oceans and coastal environments; interrelationships of humans and the marine environment. Five weeks spent at the Louisiana Universities Marine Consortium Coastal Laboratory.
- 285: Introduction to Marine Zoology.** 8-3-4. Preq., BISC 132, 133. Survey of marine animals, particularly those of the Louisiana Gulf Coast, including classification, morphology, physiology, and ecology. Five weeks at the Louisiana Marine Consortium Coastal Laboratory.
- 290: Comparative Anatomy of Vertebrates.** 8 1/2-2-4. Preq., BISC 132, 133. Comparative anatomy and evolution of the vertebrates.
- 310: Genetics.** 4 1/4-2-3. Preq., BISC 132, 133. Principles of inheritance in plants and animals at the biochemical, cellular, organismal, and population levels.
- 313: Ecology.** 4 1/4-2-3. Preq., BISC 132, 133. An overview of the interactions of plants, animals, and non-living factors as they influence individuals, populations, communities, and ecosystems.
- 315: Cell Biology.** 0-3-3. Preq., BISC 132, 133. Detailed study of the structural and functional organization of the cell and the interactions of the organelles with respect to metabolism and heredity.
- 317: Wildlife Management Principles.** 4 1/4-2-3. Preq., BISC 132, 133, and computer literacy. A review of the techniques used in the identification, study, and management of wildlife and their habitat.
- 320: Animal Physiology.** 0-3-3. Preq., BISC 132, 133. (BISC 290 strongly recommended). A general and comparative approach to the principles and concepts of physiology which apply to animal systems.
- 321: Animal Physiology Laboratory.** 4-0-1. Laboratory studies in animal physiology.
- 330: Plant Pathology.** 3-2-3. Preq., BISC 132, 133. A study of plant diseases and disorders.
- 335: Microbial Physiology.** 3-3-4. Preq., BISC 260 and CHEM 250. Basic biochemical and physiological activities of microorganisms.
- 341: Hematology.** 4 1/2-2-3. 8 semester credits of BISC. Quantitative and qualitative methods for determining the condition of cellular blood and a study of its histology, morphology and physiology.
- 346: Medical X-Ray Technology.** 3-1-2. Preq., BISC 130. Methods of obtaining routine radiographs, stressing proper positions and darkroom techniques.
- 360: Biological Problems.** 1 - 3 hour(s) credit (6). Preq., Junior standing and written permission of instructor. An introduction to the principles of research.
- 361: Laboratory Assisting.** 1-3 hour(s) credit (3). Preq., Junior standing and written permission of instructor. Experience in biological science laboratory assisting in student instruction and practice.
- 401: Parasitology.** 3-2-3. Preq., BISC 132, 133. Protozoan and helminthic parasites of medical and veterinary importance to humans with emphasis on morphology, life cycles, pathogenesis, diagnosis, and control.
- 402: Immunology.** 0-3-3. Preq., BISC 260. A study of antigens and antibodies including the chemical basis of antigen-antibody specificity, mechanisms of hypersensitivity, immunological modulators, and immunological diseases.
- 404: Immunology Laboratory.** 3-0-1. Preq. or Coreq., BISC 402. Laboratory exercises in immunology to include precipitation, agglutination procedures, isotopic and nonisotopic immunoassays, reagent preparation and validation.
- 405: Plant Physiology.** 3-2-3. Preq., BISC 132, 133, CHEM 102 or 121. Study of life processes and functions of plants. (G)

- 406: Pathogenic Bacteriology.** 3-3-4. Preq., BISC 260. Bacteria pathogenic to humans; principles of infection and immunity in humans and other animals.
- 407: Histology.** 8 1/2-1-3. Preq., BISC 320, 321, or equivalent. Microscopic study of animal tissues with emphasis on functional and structural interrelationships. (G)
- 408: Bacterial Genetics.** 3-2-3. Preq., BISC 260, 310. Topics include nucleic acid effectors in prokaryotes, mutations, phage genetics, and molecular methods of studying gene structure/function.
- 409: Virology.** 3-2-3. Preq., CHEM 250. Viruses and their relationship to disease in plants, animals, and bacteria. (G)
- 410: Advanced Genetics.** 4 1/4-2-3. Preq., BISC 310 or consent of the instructor. Principles and methods for analyzing biochemical and chromosomal polymorphisms, metabolic pathways, pedigrees, and population differentiation with emphasis on humans. (G)
- 411: Developmental Biology.** 6-2-3. Preq., BISC 132, 133. A study of gametogenesis, fertilization, and the embryological development of organisms using descriptive and experimental approaches. (G)
- 412: Environmental Plant Physiology.** 0-3-3. Preq., BISC 132 or equivalent. Study of the plant's response to the biotic and abiotic environment. Topics include the plant environment, phytoremediation, and the physiology of plant stress. (G)
- 413: Advanced Ecology.** 0-3-3. Preq., BISC 313. An in-depth study of the interactions of the plant and animal communities with their environments. (G)
- 414: Entomology.** 3-2-3. Preq., BISC 101, or 102, or 130. Study of insect structure, classification, life cycles, and control practices, with emphasis on economic pests. (G)
- 420: Environmental Animal Physiology.** 0-3-3. Preq., 12 hours of BISC including 320. Functional adaptations of animals to their environments, with emphasis on vertebrates. (G)
- 421: Mycology.** 4 1/4-2-3. Preq., BISC 132, 133. A survey of the Kingdom Fungi with emphasis on Ascomycete and Basidiomycete anatomy, morphology, and field identification. (G)
- 422: Molecular Biology.** 0-3-3. Preq., BISC 132, 133. Emphasis on eukaryotic DNA, RNA structures, mechanisms of replication, transcription, translation, regulation, and control of gene expression.
- 424: Medical Mycology.** 0-2-2. Preq., BISC 132, 133. A study of yeast, molds, and other fungi pathogenic to humans and animals. (G)
- 426: Evolution.** 0-3-3. Preq., BISC 130, 131, or equivalent. A study of the concepts, problems, and methods involved in the formulation of modern evolutionary theory.
- 428: Wetland Ecology.** 0-3-3. Study of wetland characteristics and the ecological processes occurring within wetlands. Wetland delineation, restoration, construction and regulation will also be covered. Also listed as FOR 428.
- 429: Ichthyology.** 4 1/4-2-3. Preq., BISC 132, 133. Systematics, anatomy, and ecology of fish with emphasis on local freshwater species. (G)
- 430: Herpetology.** 4 1/4-2-3. Preq., BISC 132, 133. The taxonomy, distribution, life histories, and ecology of the herpetiles, with special emphasis on those species found in Louisiana. (G)
- 432: Mammalogy.** 4 1/4-2-3. Preq., BISC 132, 133. The identification, taxonomy, characteristics, and general biology of mammals with emphasis upon those of North America. (G)
- 433: Ornithology.** 4 1/4-2-3. Preq., BISC 132, 133. Identification, taxonomy, characteristics, and general biology of birds, with emphasis upon those of North America. (G)
- 434: Limnology.** 4 1/4-2-3. Preq., BISC 132, 133. The study of the chemical, physical, and biotic aspects of freshwater environments. (G)
- 435: Pond Management.** 4 1/4-2-3. Preq., BISC 132, 133, 434. A detailed study of biotic adaptations and biotic and chemical controls in pond ecosystems with emphasis on aquatic vertebrates. (G)
- 436: Field Botany Problems.** 30-0-3. Preq., Junior standing and permission of instructor. A field trip experience for study of aquatic and terrestrial plant communities. Offered on demand. (G)
- 437: Field Zoology Problems.** 30-0-3. Preq., Junior standing and permission of instructor. A field trip experience for studying the natural history of animal species. Offered on demand. (G)
- 438: Marine Microbiology.** 8-3-4. Preq., BISC 130, 131, 132, 133. Introduction to the marine and estuarine microbes, especially bacteria and fungi; covers classification, methodology, role in marine ecosystems, biogeochemical cycles and diseases of marine animals. Five weeks at a Louisiana Universities Marine Consortium coastal laboratory.
- 439: Marine Science for Teachers.** 2-8-3. Survey of the marine sciences, techniques for teaching marine science at secondary and elementary school levels. Five weeks at the Louisiana Universities Marine Consortium Coastal Laboratory.
- 441: Wildlife Management Internship.** 3 hours credit, 40 hours per week. Work experience in the use of the equipment, materials, and procedures in wildlife management.
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- 444: Environmental Microbiology.** 4-2-3. Preq., BISC 260. Basic and contemporary aspects of soil, water, and industrial microbiology.
- 445: Immunohematology.** 3-1-2. Preq. BISC 402 or consent of instructor. Principles of donor screening, immunological testing for compatibility, tests for infectious agents and record keeping associated with transfusion medicine.
- 446: Instrumentation.** 3-2-3. Preq. 12 SCH of biological or chemical sciences. Emphasizes the operational theory, use, and maintenance of instruments appropriate to biological investigation through didactic and laboratory exercises.
- 447: Principles of Pharmacology.** 0-3-3. Preq. 8 credit hours of biological and/or chemical sciences. The classification, modes of action, and therapeutic utility of common pharmacological agents are described.
- 449: Biological and Clinical Applications of Radioisotopes.** 3-1-2. Preq., CHEM 104. Intensive training in the use of specialized equipment for measuring ionizing radiations used in biological systems.
- 450: Biological Topics.** 1-4 hour(s) credit (8). An opportunity to observe and discuss topics of current interest in the biological and/or medical sciences. Offered on demand.
- 455: Wildlife Diseases.** 0-3-3. Preq., BISC 132, 133. Study of viral, bacterial, fungal, and metazoan causative agents of disease of wildlife. (G)
- 458: Environmental Law.** 0-3-3. Preq., BISC 130, 131, or approval instructor. A review and analysis of state and federal laws, conventions, and international treaties that influence natural resource management. (G)
- 459: Food and Dairy Microbiology.** 3-3-4. Preq., BISC 260. Microorganisms of importance in the food and dairy industry including methods for rapid detection of food borne pathogens.
- 460: Analytical Thinking.** 0-3-3. Development of skills for science problem-solving, critical thinking, and communication. (G)
- 465: Forensic Anthropology.** 0-3-3. Introduction to forensic anthropology, including intensive study of human skeletal anatomy and variation, archaeological and taphonomic methods and techniques, and crime scene investigation.
- 466: Medical Anthropology.** 0-3-3. Introduction to medical anthropology, including non-western perspectives on disease causation and curing, paleopathology, ethnomedicine, ethnopsychiatry, shamanism, alternative medicine and biocultural approaches to health problems.
- 467: Biological Anthropology.** 0-3-3. Introduction to physical anthropology, including primate anatomy and behavior, human origins and evolution, human adaptation and variation, applied anthropology, and the interrelationship between biology and culture.
- 470: Medical Ethics.** 0-3-3. Reading and discussions of the application of various principles of ethics to questions of medical practice. (G)
- 475: Scientific Inquiry.** 0-2-2. Focus will be on the pursuit of scientific knowledge, emphasizing materials and methods employed. A chronological approach will correlate historical settings with the persons who experienced triumph and tragedy in their endeavors.
- 477: Practica/Internship/Cooperative Education in Biological Sciences.** 1-3 hours credit. May be repeated once. (Pass/Fail). On site, supervised, structured work experiences located within a 100 mile radius of Ruston. Application and supervision fee required.
- 478: Practica/Internship/Cooperative Education in Biological Sciences.** 1-3 hours credit. May be repeated once. (Pass/Fail). On site, supervised, structured work experiences located within a 101-200 mile radius of Ruston. Application and supervision fee required.
- 479: Practica/Internship/Cooperative Education in Biological Sciences.** 1-3 hours credit. May be repeated once. (Pass/Fail). On site, supervised, structured work experiences located beyond a 201-mile radius of Ruston. Application and supervision fee required.

480: Undergraduate Seminar. 0-1-1. Preq., Senior standing. Required of all senior BISC majors. Supervised study, reports, and discussion of current biological literature.

483: Marine Botany. 8-3-4. Preq., BISC 132, 133. Study of marine and coastal algae and vascular plants including classification, morphology, life cycles, and ecology. Five weeks at the Louisiana Universities Marine Consortium Coastal Laboratory.

484: Marine Vertebrate Zoology. 8-3-4. Preq., BISC 132, 133, plus 8 additional hours of biology. General study of the marine chordates with particular emphasis on fishes, including classification, structure, function, and ecology. Five weeks at the Louisiana Universities Marine Consortium Coastal Laboratory.

485: Marine Ecology. 8-3-4. Preq., BISC 132, 133; CHEM 102, 104. Relationships of marine estuarine organisms to environmental factors; interactions among organisms, communities and ecosystems of the Louisiana coastal zone. Five weeks at the Louisiana Universities Marine Consortium Coastal Laboratory.

486: Marine Invertebrate Zoology. 8-3-4. Preq., BISC 132, 133. General study of the classification, structures, function, and ecology of marine and estuarine invertebrates, emphasizing those of the Louisiana Gulf Coast. Five weeks at the Louisiana Universities Marine Consortium Coastal Laboratory.

501: Graduate Parasitology. 3-2-3. Biology, physiology, morphology, and ecology of the major parasites of humans and domestic animals.

502: Research Methods in Biological Sciences. 0-3-3. Preq., graduate status. An introduction for graduate students to basic methods used in research in the biological sciences.

504: Advanced Microbial Physiology. 3-3-4. Preq., BISC 335. An advanced course on the physiology of bacteria, including bacterial growth and variation, cytology, nutrition, respiration, and temperature effects.

505: Advanced Plant Physiology. 3-2-3. Preq., BISC 405. Principles that underlie interpretation of the physical and metabolic processes of plants. Offered on demand.

509: Biological Sciences Seminar. 0-1-1 (2). Survey of literature on current topics in either Bacteriology, Botany, Microbiology, or Zoology, where appropriate.

512: Advanced Immunology. 6-1-3. Preq., consent of the instructor. An advanced study of the activities of antigens and antibodies.

513: Ecological Topics. 0-3-3 (6). Preq., BISC 313, or 413. An advanced study of selected ecological topics. Offered on demand.

516: Contemporary Topics. 1-4 hour(s) credit. An opportunity to examine and discuss a variety of timely topics pertaining to the biological sciences. May be repeated with a change in subject matter.

517: Applied Biological Sciences Research. 6-1-3. Preq., BISC 502. Laboratory or field studies for non-thesis Master of Science students in the biological sciences. Provides graduate training in applied research skills.

522: Graduate Molecular Biology. 0-3-3. Emphasis on protein structure and function, DNA and RNA, replication, transcription, translation, and control of gene expression. Molecular techniques including transformation, plasmids, PCR, and blotting.

524: Advanced Plant Taxonomy. 3-2-3. Preq., BISC 222. Problems of nomenclature and recent concepts of plant classification. Offered on demand.

526: Graduate Histology. 8 ½-3. Microscopic study of animal tissues with an emphasis on structural and functional relationships.

528: Advanced Wetland Ecology. 0-3-3. Study of wetland characteristics and the ecological processes occurring within wetlands. Wetland delineation, restoration, construction, and regulation will also be covered. Cross-listed as FOR 528.

530: Biological Sciences Special Problems. 1-6 hours. Preq., written permission of instructor and Advisory Committee Chairperson. No more than 6 hours credit combined with BISC 540 and 541.

535: Current Topics in Biological Sciences. 0-1-1 (4). Preq., graduate status. An interactive discussion of current issues and problems in the biological sciences. May be repeated for credit with change of course content.

540: Biological Sciences Internship. 40-0-3. Preq., Graduate standing, consent of Advisory Committee Chairperson and Instructor. Career-oriented job experiences. No more than 6 hours credit combined with BISC 530, 540, or 541.

541: Biological Sciences Internship. 40-0-3. Preq., Graduate standing, consent of Advisory Committee Chairperson and Instructor. Career-oriented job experiences. No more than 6 hours credit combined with BISC 530, 540, or 541.

545: History of Zoology. 0-3-3. The historical development of the science of zoology, the persons who contributed to this development, and the nature of the times which produced them. Offered on demand.

551: Research and Thesis. Registration in any quarter may be for 3 semester hours credit or multiples thereof. Maximum credit allowed is six hours.

565: Graduate Forensic Anthropology. 0-3-3. Introduction to forensic anthropology, including intensive study of human skeletal anatomy and variation, archaeological and taphonomic methods and techniques, and crime scene investigation.

566: Graduate Medical Anthropology. 0-3-3. Anthropology of medicine emphasizing non-western perspectives of disease causation and curing, ethnic psychoses, ethnobotany, human disease history, alternative medicine and biocultural approaches to health issues.

567: Graduate Biological Anthropology. 0-3-3. Biological anthropology emphasizing primate anatomy, behavior and systematics, the human fossil record, evolution of human behavior, human adaptation, and the relationship of biology to culture.

570: Graduate Medical Ethics. 0-3-3. Intensive discussions, presentations, and readings concerning the theories of ethics and their applications to the practices of the health professions.

BIOMEDICAL ENGINEERING (BIEN)

100: Introduction to Biomedical Engineering. 3-0-1. Development of the field of Biomedical Engineering, including job opportunities, the Biomedical Engineering Curriculum, professionalism and ethics, dimensions and units, Biomedical Engineering analysis and design.

202: BME Principles I. 0-1-1. Coreq., CHEM 102, BISC 225; Preq., MATH 240. Basic qualitative and quantitative principles of biomedical engineering are presented. The general field of biomedical engineering is reviewed with introduction of conservation and modeling concepts.

203: BME Principles II. 0-1-1. Coreq., BISC 227; Preq., BIEN 202. An introduction to the role of engineering in analyzing physiological systems and in designing devices and instrumentation to study and treat biomedical problems.

204: BME Principles III. 0-1-1. Preq., BIEN 203. A continued introduction to the role of engineering in analyzing physiological systems and in designing devices and instrumentation to study and treat biomedical problems.

225: Biomedical Systems. 0-3-3. Preq., ENGR 221 and credit or registration in MATH 243. Analysis techniques for frequency and time domain signals that occur in linear and non-linear physiological systems. Lumped modeling of physiological phenomena.

230: Biomaterials. 0-2-2. Preq., BIEN 203. Compatibility of materials for use in biomedical applications.

301: Biomedical Fluid Mechanics and Biomedical Energy Transport. 0-3-3. Preq., BIEN 202, MATH 245, PHYS 202, BISC 321, and ENGR 222. The principles of fluid mechanics and thermal energy exchange (momentum and energy balances) in biomedical systems. Analysis of engineering and physiological systems and incorporation of these principles into design of such systems.

303: Biomedical Systems & Controls. 0-3-3. Preq., BIEN 204, ELEN 223, MATH 244, PHYS 202. Frequency domain transformation and analyses, control mechanisms, physiological control systems.

310: Introduction to Clinical Engineering. 3-2-3. Preq., BIEN 202. A foundation course in medical and clinical terminology, medical instrumentation, medical sciences, hospital procedure and medical practice from an engineering perspective.

320: Bioenergetics. 0-3-3. Preq., MATH 242, PHYS 201, BIEN 204. The student is introduced to the concept of bioenergetics—the thermodynamics of living systems. The laws of thermodynamics are emphasized and applied to biological systems.

325: Bioinstrumentation. 3-2-3. Preq., BIEN 225, PHYS 202, BISC 227, Coreq. or credit for MATH 243. Analysis and design of biomedical instrumentation. Basic circuitry, electronics and laboratory techniques including transducers, biopotentials, amplifiers, measurement and safety.

400: Biomedical Engineering Seminar. 3-0-1. Preq., Senior standing. Instruction and practice in conference-type discussions of technical and professional matters of interest to biomedical engineers.

401: Biomedical Mass Transport. 0-3-3. Preq., BIEN 301. The principles of mass balances and transport phenomena in biomedical systems. Analysis of engineering and physiological systems and incorporation of these principles into the design of such systems.

402: Biomedical Engineering Design I. 0-2-2. Preq., BIEN 325, 400, 401, 420; ENGL 303. Individualized design projects requiring integration and

- synthesis of prior engineering, life science, design and analytical skills. Utilization of the engineering design process and consideration of biomaterials, biomechanics, human factors, ethical and legal concerns, and oral and written communication skills.
- 403: Analysis and Design of Physiological Control Systems.** 0-3-3. Preq., BIEN 325, 401, ELEN 321. Methods for analyzing and designing linear feedback systems. Physiological control mechanisms presented qualitatively and quantitatively. Design of systems involving physiological systems.
- 404: Biomedical Engineering Design II.** 0-2-2. Preq., BIEN 402. A continuation of BIEN 402.
- 410: Clinical Engineering Internship.** 20-20-6. Preq., BIEN 310 or equivalent and consent. A practical exposure to the health care delivery system. Application of engineering principles to problems unique to that system.
- 420: Biomaterials and Biomechanics.** 0-3-3. Preq., BIEN 301, ENGR 220. Properties of living tissue. Biocompatibility. polymers, metals, and ceramics as biomaterials. Implants for hard and soft tissue. Fundamentals of biomechanics.
- 425: Advanced Biomedical Instrumentation Systems.** 3-2-3. Preq., BIEN 325, or consent. Further analysis and design of biomedical instrumentation. Practical aspects of ideal and real operational amplifiers, and an introduction to microprocessor interfacing.
- 430: Biomechanics.** 0-3-3. Preq., BIEN 230, 301. Mechanical properties and reactions of biological tissues and organs. Analysis of stress, strain and strain rate for biological and bio-artificial components.
- 435: Senior Biomedical Engineering Laboratory.** 3-0-1. Preq., BIEN 401, 403, and 430. Laboratory experiments that demonstrate concepts and techniques in biofluid mechanics, biomechanics, biological mass transport and tissue engineering.
- 440: Computer Applications for Biomedical Engineers.** 0-3-3. Preq., BIEN 202, ENGR 102. The course is designed specifically to training the student in the use of the digital computer for the solution of problems related to Biomedical Engineering. (G)
- 450: Special Topics.** 1-4 semester hours credit. May be repeated for credit. Preq., senior standing and consent of instructor. Problems covering selected topics of current importance or special interest or need.
- 455: Biotechnology and Bioprocesses.** 0-3-3. Preq., BIEN 301, 401. Introduction to biotechnology and bioprocesses. Microbiology and biochemical reactions are reviewed. Enzyme kinetics, microbial growth transport phenomena, and design of biochemical reactors are studied. Cross-listed with CHEN 455. (G)
- 500: Systems Physiology for Biomedical Engineers.** 0-4-4. Preq. Graduate standing and permission of the instructor. Principles of human physiology, including cellular physiology, and the nervous, muscular, cardiovascular, and respiratory systems for engineers. Graduate core course.
- 501: Physiological Modeling I.** 0-3-3. Preq., BIEN 500 and Differential Equations, or consent of instructor. Principles and applications of transport phenomena to biomedical systems and devices. Distributed, lumped, and lumped-distributed modeling. Graduate core course.
- 502: Biotransport Phenomena.** 0-3-3. Preq., BIEN 501. A continuation of BIEN 501.
- 503: Physiological Modeling II.** 0-3-3. Preq., BIEN 501 or consent of instructor. Application of mathematical modeling and engineering analysis to physiological components and systems. Feedback mechanisms for homeostasis. Computer project implementation. Graduate core course.
- 510: Bioinstrumentation.** 0-4-4. Preq., Graduate standing and consent of instructor. Introduction to medical instrumentation systems, biosensors, biopotentials, signal conditioning, analog-to-digital conversion, and signal processing. Graduate core course.
- 515: Biosensors and Their Applications.** 4-2-3. Permission of instructor. Introduction to biosensors in general with special emphasis on oxygen biosensors and their development. Surgical techniques and laboratory procedures for animal experimentation.
- 540: System Analysis and Mathematical Modeling of Physiological Phenomena.** 0-3-3. Preq., permission of instructor. The course deals with the analysis of biological systems and the theory behind the development and solution of mathematical models for the description of biological system behavior.
- 550: Special Topics.** 3 hours credit. Preq., Permission of instructor. May be repeated for credit. Selected topics dealing with advanced subjects in Biomedical Engineering.

- 551: Research and Thesis in Biomedical Engineering.** 0-0-3. Preq., open to M.S. Graduate Students in Biomedical Engineering. Registration in any quarter may be for 3 semester hours credit or multiples thereof. Maximum credit allowed is six semester hours.
- 555: Practicum.** 0-3-3 (6). Preq., 12 semester hours of graduate work. Analytical and/or experimental solution of an engineering problem; technical literature survey required; development of engineering research techniques.
- 556: Biomedical Engineering Internship.** 20-0-6. Preq., permission of instructor. Graduate level internship emphasizing application of engineering design principles in a research, health care or rehabilitation setting.
- 557: Special Topics: Biomedical Engineering.** 0-3-3 (9). The topic or topics will be selected by the instructor from the various sub-areas of biomedical engineering. May be repeated as topics change.
- 560: Review of Assistive Technology in Rehabilitation.** 0-3-3. Preq., permission of instructor. Study of physical disabilities and the rehabilitation process.
- 562: Rehabilitation Engineering & Assistive Technology I.** 3-2-3. Preq., BIEN 560. Assessment and the development of engineering solutions in rehabilitation. Emphasis on seating and positioning, mobility, work, and activities of daily living.
- 563: Rehabilitation Engineering & Assistive Technology II.** 3-2-3. Preq., BIEN 560. Assessment and the development of engineering solutions in rehabilitation. Emphasis on transportation and augmentative communication.
- 570: Artificial Intelligence Applications in Biomedical Engineering.** 0-3-3. Preq., Prior introduction to artificial intelligence fundamentals. Artificial intelligence and expert systems application in medical and biomedical problems. Fundamental contributions of medical expert systems.
- 575: Artificial Neural Networks.** 0-3-3. Presentation of foundational concepts and constructs used to analyze and characterize artificial neural network paradigms, their attributes, their applications and their implementations.
- 599: Graduate Seminar.** 0-1-1. (Pass/Fail). Issues in graduate education. Presentations of current topics in research, teaching, and practice. May be repeated for credit.
- 651: Special Topics: Research.** 0-0-3. Preq., open to Ph.D. candidates in Biomedical Engineering who have not completed their academic language and General Comprehensive Examination requirements. This course represents a limited research project, which will lead to a comprehensive and well-designed dissertation research proposal. A grade will be submitted at the end of each quarter for this course.

BUSINESS COMMUNICATION (BSCM)

- 305: Communication.** 0-3-3. Preq., ENGL 102. Theory and nature of communication in organizational settings, interpersonal communication, written business communication, listing, communications. Analysis of business problems and preparation of written/oral solutions.
- 435: User Interfacing.** 0-3-3. Preq., BSCM 305, and CIS 310, 339. The unique interpersonal skills of a system analyst are explored throughout the life cycle of a system development.
- 520: Directed Research and Readings.** 0-3-3. Research methodology; problems requiring independent organization of research, implementation, outline of solution, and preparation of reports. Emphasis placed on problem solving for policy-making decisions.
- 620: Business Research Methods.** 0-1-1. A study of research methodology used in business administration, a review of research completed in respective DBA areas, and the development of a dissertation proposal. (May be repeated for a total of 3 hours credit.)

BUSINESS LAW (BLAW)

- 255: Legal Environment of Business.** 0-3-3. Studies relations and effect of law on business, society, and the individual, including ethical considerations, history, court system, torts, government regulation, contracts, and business organization.
- 356: Commercial Law.** 0-3-3. A study of specific topics of law essential to the business decision-making process. Areas of law covered include contracts, commercial paper, agency, and sales.
- 410: Business Law for Accountants.** 0-3-3. Preq., BLAW 255 and senior standing. A concentrated study of all topical areas of business law. Coverage includes contracts, credit transactions, governmental

regulations, business organizations, bankruptcy, and property and related topics. (G)

441: Real Property. 0-3-3. Preq., BLAW 255. Estates in land, titles, deeds, mortgages, leases, land contracts, minerals, easements and successions.

445: Legal Aspects of Government and Business. 0-3-3. Preq., BLAW 255 or special permission of the instructor. A study of landmark law cases with special emphasis placed on guideline interpretive decisions of significance to management.

CHEMICAL ENGINEERING (CMEN)

202: Chemical Engineering Calculations. 3-2-3. Coreq., ENGR 122, MATH 242. Problems and recitation in material and heat balances involved in chemical processes. Application of Chemical Engineering and chemistry to manufacturing in chemical industries.

213: Unit Operations-Design I. 0-3-3. Preq., CMEN 202, 254, MATH 244. Design procedures for equipment and processes involving fluid flow and fluid mixing, with emphasis on computer assisted design techniques.

254: Laboratory Measurements and Report Writing. 3-0-1. Preq., CMEN 202 and completion of integrated freshman engineering curriculum. A study of applied analytical and statistical procedures and measurement of process variables in chemical processing and an introduction to technical report writing.

304: Transport Phenomena. 0-3-3. Preq., CMEN 213, 313, 413, MATH 245. Fundamental principles of energy, mass, and momentum transfer and transport processes.

313: Unit Operations-Design II. 0-3-3. Preq., CMEN 213 or consent of instructor. Design procedures for equipment and processes involving heat transfer, with emphasis on computer assisted design techniques.

332: Chemical Engineering Thermodynamics II. 0-3-3. Preq., ENGR 222. Estimation of thermodynamic properties from equations of state. Application of thermodynamic equilibria to physical and chemical equilibria. Energy analysis of processes.

353: Chemical Engineering Junior Laboratory. 3-0-1. Preq., CMEN 254, 313, and ENGL 303. Laboratory study of fluid phenomena, heat transfer processes and equipment, and evaporation.

402: Chemical Reaction Engineering. 0-3-3. Preq., CHEM 312; senior standing in CMEN. Homogeneous and heterogeneous chemical reaction kinetics, applications to ideal and real reactor types. (G)

407: Instrumentation and Automatic Process Control. 3-2-3 Preq., senior standing in CMEN. Survey of process instrumentation methods, and the analysis and design of feedback, feed forward, and cascade control systems. (G)

408: Pulp and Paper Processes. 0-3-3. Preq., senior standing in CMEN. Introduction to the pulp and paper industry, its terminology, technology and economics. Conversion of various cellulosic materials into unbleached pulp and paper products. (G)

411: Environmental Chemodynamics. 0-3-3. Preq., CMEN 413 and senior standing in CMEN. A study of the modeling and prediction of the movement and fate of synthetic chemicals in the air-water-earth environments. Cross-listed with CVEN 411. (G)

413: Unit Operations-Design III. 0-3-3. Preq., CMEN 313. Application of design procedures for equipment and processes involving evaporation, distillation, leaching, extraction, gas absorption and desorption, with emphasis on computer assisted design techniques.

415: Theory and Practice of Radiation Protection and Shielding. 0-3-3. Preq., senior standing. An introduction to principles of dosimetry. The concepts of probability of causation, risk assessment, and methods of establishing exposure limits will be discussed. (G)

430: Chemical Plant Design I. 0-2-2. Preq., senior standing in CMEN, ECON 215. An introduction to applied process economics and to process hazards, their identification and reduction.

432: Chemical Plant Design II. 0-2-2. Preq., senior standing in CMEN and CMEN 430. Comprehensive problems are assigned, the solution of which enables one to calculate dimensions and capacities of required plant equipment. Computer applications.

434: Chemical Plant Design III. 0-2-2. Preq., CMEN 432. CMEN 432 continued.

435: Polymer Engineering. 0-3-3. Preq., Senior standing in CMEN or consent of the instructor. Polymer technology and processes including polymer structure, states, and transitions; kinetics of polymerization; molecular weight determination; viscous flow; mechanical properties; polymer degradation; analysis and identification. (G)

442: Process Optimization. 0-3-3. Preq., senior standing in CMEN. An objective study of the present status of optimization methodology as

applied to the chemical process industries. Both deterministic and non-deterministic systems are considered. (G)

443: Air Pollution Control Design. 0-3-3. Preq., Senior standing in CMEN or consent of instructor. An overview of the air pollution problem. Design of devices to control emissions (VOC's, NO_x, SO₂, particulates, etc.) Cost estimation of air pollution control systems. (G)

450: Special Problems. 1-4 semester hours credit. Preq., senior standing in CMEN. Problems covering selected topics of current importance or special interest or need. (G)

451: Senior Chemical Engineering Laboratory. 6-0-2. Preq., CMEN 353 and 413 or consent of instructor. Laboratory work in humidification, drying, distillation, absorption, extraction, and kinetics.

452: Special Projects Laboratory. 1 hour credit. Preq., senior standing in CMEN. Selected comprehensive problems. Study and/or laboratory development of: industrial unit operations; new chemical processes; improvement of established processes; economic evaluations. Theoretical studies.

455: Biochemical Engineering. 0-3-3. Preq., CMEN 402 or consent of instructor. Introduction to biotechnology and bioprocesses. Microbiology and biochemical processes are reviewed. Enzyme kinetics, microbial growth transport phenomena, and design of biochemical reactors are studied. Cross-listed with BIEN 455. (G)

456: Hazardous Waste Management. 0-3-3. Preq., senior standing in CMEN. A study of the legislation, regulation, technology, and business matters relating to hazardous waste management. (G)

475: Combustion, Fires and Explosions. 0-3-3. Preq., senior standing in CMEN. Nature of combustion, controlled and free burning fires, and evaluation of explosion hazards. (G)

501: Advanced Unit Operations. 0-3-3. Design calculations applicable to various unit operations including drying, humidification, absorption, adsorption, distillation, heat exchangers, ion exchange, cooling towers and filtration.

504: Advanced Chemical Engineering Kinetics. 0-3-3. Homogeneous reactions. Catalytic reactions. Mass and heat transfer in catalytic beds. Catalytic reactor design. Uncatalyzed heterogeneous reactions.

513: Transport Phenomena. 0-3-3. A course in which advanced concepts on momentum, energy, and mass transport is explored. Emphasis is placed on unsteady state behavior, turbulence, and recent developments in the literature.

521: Energy Analysis of Industrial Processes. 0-3-3. Preq., An undergraduate course in thermodynamics. The application of the concept of exergy, or energy availability, to the systematic analysis of processes and plants to make most efficient use of limited energy resources.

522: Advanced Thermodynamics. 0-3-3. The relations of thermodynamic properties are developed. Problems on the expansion and compression of non-gases, liquefaction, low temperature separation are studied.

524: Seminar. 0-1-1 each. Surveys, investigations, and discussions of current problems in Chemical Engineering.

550: Special Problems. 1-4 semester hours. Preq., consent of instructor. Selected topics dealing with advanced problems in chemical engineering and design of equipment. The problems and projects will be treated by current methods used in professional practice.

551: Research and Thesis in Chemical Engineering. Registration in any quarter may be for three semester hours credit or multiples thereof. Maximum credit allowed is six semester hours.

555: Practicum. 0-3-3 (6). Preq., 12 semester hours of graduate work. Analytical and/or experimental solution of an engineering problem; technical literature survey required; development of engineering research techniques.

557: Special Topics: Chemical Engineering. 0-3-3 (9). The topic or topics will be selected by the instructor from the various sub-areas of chemical engineering. May be repeated as topics change.

CHEMISTRY (CHEM)

100: General Chemistry. 0-2-2. Preq., or Coreq., MATH 101, or 111, or 240. Fundamental principles of chemistry: Chemistry and measurement, atomic symbols and chemical formulas, stoichiometry, gases and thermochemistry.

101: General Chemistry. 0-2-2. Preq., CHEM 100. Continuation of CHEM 100: Atomic and molecular structure, theories of molecular bonding, liquids, solids and solutions.

102: General Chemistry. 0-2-2. Preq., CHEM 101. Continuation of CHEM 101: Rates of reaction, study of chemical equilibria including those