ATM 437 Forecasting Practicum
The course provides students with additional forecast- ing experience. Students make at least three forecasts per week either Long Island or a city designated by the National Forecast Contest. Students write a weather discussion for each forecast and verify their forecasts to show their progress during the semester. Pre or Corequisite: ATM 347 1 credit

ATM 447 Senior Tutorial in Atmospheric Sciences
Independent readings in advanced topics to be arranged prior to the beginning of the semester. Weekly conferences are held with a faculty member. May be repeated once. Prerequisite: Permission of instructor and MSRC Undergraduate Programs Director 1-3 credits

ATM 487 Senior Research in Atmospheric Sciences
Under the supervision of a faculty member, a student majoring in atmospheric and oceanic sciences may conduct research for academic credit. A research proposal must be prepared by the student and submitted to the MSRC Undergraduate Director for approval before the beginning of the semester in which credit is to be given. A written report must be submitted before the end of the semester. May be repeated once. Prerequisites: Permission of instructor and MSRC Undergraduate Programs Director 0-6 credits

ATM 488 Internship
Participation in research off-campus laboratories, including the National Weather Service. Students are required to submit to the department a proposal at the time of registration and a report at the end of the semester. May be repeated up to a limit of 12 credits. Prerequisites: ATM 347; permission of instructor and MSRC Undergraduate Program Director 0-6 credits, S/U grading

BCP 394-H Environmental Toxicology and Public Health
Principles of toxicology are presented and problems associated with major classes of toxic chemicals to human and environmental health are examined. Case studies dealing with current waste management issues are also discussed. This course is offered as both BCP 394 and MAR 394. Prerequisites: BIO 201; CHE 131 or 141 3 credits

BCP 400 Writing in Pharmacology
See requirements for the major in pharmacology, upper-division writing requirement. Prerequisites: Pharmacology major; U3 or U4 standing; permission of instructor S/U grading

BCP 401 Principles of Pharmacology
Basic principles and mechanisms of drug distribution, absorption, metabolism, and elimination. Principles of chemical carcinogenesis and tumor promotion. Autonomic, smooth-muscle, and CNS pharmacology. Pharmacology of specific drugs of historical interest including alcohol, antibiotics, aspirin, nicotine, and morphine. Review of anticoagulants and thrombolytic agents, antiparasitics, and drugs for the treatment of allergic conditions and gout. Prerequisites: BIO 362; CHE 322 and 327; a g.p.a. of 3.00 or higher in these courses and their prerequisites. Corequisite for pharmacology majors: BCP 403 4 credits

BCP 402 Advanced Pharmacology
Advanced concepts of drug metabolism, pharmacokinetics, biochemical, and molecular mechanisms of drug action, and drug resistance in human disease states. Toxicological agents and environmental pollutants. The pharmacology of autotoxins, anti-inflammatoryatories, immunosuppressants, and antithiamatics. Rational drug design and drug receptor interactions using computer molecular modeling techniques. Prerequisites: BCP 401 and 403; minimum of B- in BCP 401 Corequisite: BCP 404 4 credits

BCP 403 Principles of Pharmacology Laboratory
The use of molecular modeling software for the understanding of structure activity relationships. In vivo studies to demonstrate the pharmacological mechanism of action of drugs acting on the autonomic, cardiovascular, and renal systems. Pharmacokinetic studies, using HPLC, to determine the rate of absorption, distribution, and excretion of therapeutic agents. Radio- and enzyme-immunoassays for the detection of circulating hormones. Cell culture techniques for drug determination and evaluation. Prerequisite: Permission of instructor Corequisite: BCP 401 2 credits

BCP 404 Advanced Pharmacology Laboratory
The use of molecular modeling software for the understanding of structure activity relationships. In vivo studies to demonstrate the pharmacological mechanism of action of drugs acting on the autonomic, cardiovascular, and renal systems. Pharmacokinetic studies, using HPLC, to determine the rate of absorption, distribution, and excretion of therapeutic agents. Radio- and enzyme-immunoassays for the detection of circulating hormones. Cell culture techniques for drug determination and evaluation. Prerequisites: BCP 401 and 403; permission of instructor Corequisite: BCP 402 2 credits

BCP 406 Pharmacology Colloquium
Seminars on research in pharmacology and toxicology presented by faculty and distinguished scientists from academic and industrial institutions. Students are expected to develop an understanding of the scientific principles presented in the colloquium. Speakers meet with the students after the seminar to discuss research concepts and to answer questions. One-hour Journal Club/Discussion followed by one-hour seminar. May be repeated. Prerequisite: BCP 202 and 203; CHE 322; a g.p.a. of 3.00 in these courses and their prerequisites 2 credits

BCP 475 Undergraduate Teaching Practicum in Pharmacology
Prerequisites: Pharmacology major; U4 standing; permission of department 3 credits, S/U grading

BCP 487 Research in Pharmacology
Completion of an individual student research project under the supervision of a faculty member. Previously acquired laboratory course techniques and new procedures are utilized. Experimental results must be submitted to the department for grade evaluation in the format of a research report. Not for credit in addition to HHS 396, 398, and 399. May be repeated. Prerequisites: BIO 202 and 203; CHE 322 and 327; a g.p.a. of 3.00 in these courses and their prerequisites; permission of instructor and department 0-6 credits

BCP 488 Internship
Research participation in off-campus laboratories, the pharmaceutical industry, and other academic and public agencies. Repeatable up to 12 credits. Prerequisites: BIO 361; CHE 322; g.p.a. of 3.00 or higher in these courses and their prerequisites; permission of department 0-6 credits, S/U grading

BIO Biology

BIO 101-E, 102-E Biology: A Humanities Approach I, II
The major concepts of biology are presented from historical, contemporary, and critical viewpoints. These concepts include the cell, the gene, molecular biology, development, and evolution. The human implications or values associated with each concept are emphasized. Not for major credit. Prerequisite to BIO 102: BIO 101 3 credits per course

BIO 103-E Introduction to Biotechnology
Gene therapy, genetic modification, cloning, stem cells, and vaccines are covered in this course. Lectures and four supplemental laboratory activities use modern equipment and techniques to illustrate core concepts which class discussions relate to health, society, and public policy. Not for biology major credit.

BIO 111-E The Aquatic World
An introduction to the natural history of the animals and plants of the sea, rivers, and lakes, along with a consideration of water-land transitions. Weekly off-campus exhibits which students attend in addition to the regularly scheduled class time. Not for major credit. Prerequisite: High school biology 3 credits

BIO 113-E General Ecology
A survey of the principles of ecology in the context of finding solutions to local, national, and global environmental problems. Not for major credit. 3 credits

BIO 115-E Evolution and Society
The historical development of evolutionary thought, the evolutionary diversification of life, and the mechanisms of evolution are presented. The geological, genetic, and other biological principles necessary to comprehend evolutionary concepts are introduced as background. Current controversies over the evidence for evolution are reviewed. Human evolution, medical and agricultural applications of evolutionary theory, and its implications for the development of human and other social systems are considered. Not for major credit. Advisory Prerequisite: One biology course 3 credits

BIO 150-E The Living World
An exploration of life from organisms to molecules. The connections between biodiversity, molecules, and evolution are examined. Recitations/laboratories familiarize students with the tools, models, and concepts of modern biology. Two hours of lecture and one two-hour recitation/laboratory per week. Prerequisites: High school biology and chemistry; satisfaction of entry skill in mathematics requirement 3 credits

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BIO 201-E Fundamentals of Biology: Organisms to Ecosystems
An introduction to the major groups of living organisms. Structure, functions, the ecological roles of organisms in communities and ecosystems, and their evolutionary history are covered. Genetics and demography are discussed in the context of evolution by natural selection. Three hours of lecture and one three-hour laboratory per week. Prerequisite: BIO 150 3 credits

BIO 202-E Fundamentals of Biology: Molecular and Cellular Biology
The fundamentals of cell biology, biochemistry, and genetics. The biochemical and molecular bases of cell structure, energy metabolism, gene regulation, heredity, and development in living organisms from bacteria to man are discussed. Three hours of lecture and one three-hour laboratory per week. Prerequisite: BIO 150 or BME 100 Pre- or Corequisites: CHE 123 or 131 or 141; MAT 125 or higher or AMS 151 4 credits

BIO 203-E Fundamentals of Biology: Cellular and Organ Physiology
The fundamentals of cell and organ physiology in mammalian and non-mammalian organisms. The structure and function of cell membranes and the physiology of cell-to-cell signaling, cellular respiration, and homeostasis of organs and organisms are examined with an emphasis on the comparative physiology of vertebrates and invertebrates. Three hours of lecture and one three-hour laboratory per week. Prerequisite: BIO 150 or BME 100 Pre- or Corequisites: CHE 123 or 131 or 141; MAT 125 or higher or AMS 151 4 credits

BIO 208-H Cell, Brain, Mind
An introduction to the human brain and how it is the target of diseases, drugs, and psychological disturbances. The course explores these topics through a knowledge of basic cell neurobiology. The implications of brain science for human behavior in society are also considered. Not for major credit. Prerequisite: BIO 101 or 150 Advisory Prerequisite: High school chemistry 3 credits

BIO 210-E Human Physiology
The basic principles of human physiology. The subject matter covered includes presentations on the anatomical organization, physiological functions of central and peripheral nervous systems; skeletal and smooth muscle; cardiovascular, respiratory, and renal systems; and endocrine and reproductive systems. The course is designed for pre-nursing students. May not be taken for credit by biology majors. Three hours of lecture and one three-hour laboratory per week. Not for credit in addition to BIO 203 or 328. Prerequisites: BIO 150; CHE 123, 131 or 141; ANP 300 4 credits

BIO 310 Cell Biology
The cell is studied as the unit of structure, biochemical activity, genetic control, and differentiation. The principles of biochemistry and genetics are applied to an understanding of nutrition, growth, and development. Prerequisites: C or higher in BIO 202 and 203; CHE 321 or 331 3 credits

BIO 311 Techniques in Molecular and Cellular Biology
Techniques used in recombinant DNA and cell biology research. Topics include DNA manipulation and analysis, protein expression and analysis, and advanced microscopy. Prerequisites: BIO 202; CHE 132 or 142; MAT 125 or higher or AMS 151; or permission of instructor 3 credits

BIO 312 Bioinformatics and Computational Biology
This course uses computational methods to analyze current problems and solutions in molecular biology research. Students are exposed to algorithms and tools available for both protein and larger scale genome research. Emphasis is on practical application. Laboratories allow students to apply their knowledge to real-life molecular biology problems. Prerequisites: BIO 202; MAT 126 or 132 or 142 or AMS 161 3 credits

BIO 314 Biological Clocks
The temporal dimension of biological organization focusing on the cellular and molecular timekeeping mechanisms characteristic of living systems. Topics include a survey of circadian rhythms and their properties in eukaryotic microorganisms; cell cycle clocks; the quest for anatomical loci; dissection of clocks by chemical and molecular genetic techniques; entrainment and coupling pathways; biochemical and molecular models of circadian oscillators; pacemaker dysfunction; cellular aspects of chrono-pharmacology and chronotherapy; and cellular clocks in development and aging. Prerequisite: BIO 310 or 325 or 361 or 374 3 credits

BIO 315 Microbiology
The organization, structure, energetics, and reproduction of microorganisms. Interactions of bacteria and viruses are discussed. Prerequisites: BIO 201 and 202; CHE 322 or 326 3 credits

BIO 316 Molecular Immunology
Structure, function, and organization of the immune response at the molecular and cellular levels. Molecular mechanisms of immunological responses to microorganisms and various disease states are explored. Prerequisites: BIO 202 and 203 Pre- or Corequisite: CHE 322 or 326 3 credits

BIO 317 Principles of Cellular Signaling
Basic principles of cellular signaling and maintenance of cellular and organismic homeostasis through intra- and intercellular signaling mechanisms. Emphasis is on relationships between nuclear events and ongoing processes of the cell. The roles of membrane receptors and second-messenger pathways in mediating such diverse events as bacterial chemotaxis, protozoan locomotion, and secretion are discussed. Prerequisites: C or higher in BIO 202 and 203 3 credits

BIO 318-H Bioethics and Policy
Current topics in ethics and policy in medicine and science are presented, discussed, and debated. Guest lectures with specialized expertise are interspersed with student debates on the pros and cons of the issues. Issues such as the use of stems cells, in vitro fertilization, patient rights, public health, and conflicts of interest are discussed. Prerequisite: BIO 201 or 202 or 203 Advisory Prerequisite: PHI 104 3 credits

BIO 320 General Genetics
An advanced course in genetics for biology majors. General areas to be discussed include transmission genetics, cytogenetics, immunogenetics, molecular genetics, population genetics, and quantitative genetics. Prerequisite: BIO 202 Pre- or Corequisite: CHE 131 or 141 3 credits

BIO 325 Animal Development
An overview of animal embryonic development, emphasizing molecular mechanisms regulating embryonic growth and differentiation. General areas to be discussed include molecular basis of human birth defects, cloning, identification of developmental genes, establishing polarity in Drosophila and vertebrates, regulation of cell differentiation, morphogene- sis and organ development, development of cancer. Prerequisite: C or higher in BIO 202 3 credits

BIO 327 Developmental Genetics Laboratory
Exploration of the fundamental concepts in develop- mental biology and genetics through a combination of classical and modern molecular genetic approaches. Experiments are conducted using Xenopus and Drosophila, two important animal models for research in developmental biology and genetics. Students gain hands-on experience with the approaches used to investigate processes that control embryonic develop- ment on these two model systems, including the use of modern molecular methods for examining the reg- ulation of gene expression during development. Exposure to the genetic approaches that are available in the Drosophila system will include participation in a genetic screen for new mutations. Prerequisite: BIO 325 Pre- or Corequisite: BIO 320 3 credits

BIO 328 Mammalian Physiology
The basic principles of mammalian physiology. The subject matter includes circulation, respiration, nutri- tion, excretion (and their control by the nervous and endocrine systems), and sensation and coordination. May not be taken for credit in addition to HBY 350. Prerequisite: BIO 203 Advisory Prerequisite: CHE 132 or 142 3 credits

BIO 334 Principles of Neurobiology
The ionic basis of nerve potentials, the physiology of synapses, sense organs and effectors, and the integrative action of the nervous system are discussed. Prerequisites: BIO 203; CHE 131 or 141 3 credits

BIO 335 Animal Physiology Laboratory
Laboratory exercises designed to illustrate principles learned in BIO 328. Topics include muscles and hor- mones, physiological activities of nerves, circulation, respiration, excretion, digestion, sensory function, and central processes of coordination. One hour of lec- ture, one hour of recitation, and one three-hour labora- tory per week. Prerequisites: CHE 132, 133 Pre- or Corequisite: BIO 328 3 credits

BIO 338 From Synapse to Circuit: Self-organization of the Brain
Exploration of basic neural and synaptic mechanisms and the operation of representative brain circuits, using both theoretical approaches and experimental evidence. Particular attention is given to Hebb’s Rule, its cellular basis, its consequences for circuit self-orga- nization, and its limits. A solid background in a math- ematical, physical, or biological science is desirable, but most relevant background material is covered in the course. Prerequisite: BIO 203 or CHE 132 or PHY 122 Advisory Prerequisite: BIO 334 3 credits

BIO 339 Molecular Development of the Nervous System
An introduction to the molecular events that underlie development and plasticity of both the peripheral and central nervous systems, with a focus on neuronal mechanisms. Molecular and genetic approaches to the analysis of neural induction, neuronal differentiation, neuronal death and survival, neurotrophic fac- tors, synapse formation, and plasticity are presented. Prerequisite: BIO 202 Advisory Prerequisite: BIO 203 or 325 3 credits
BIO 340 Zoology
Aspects of the natural history, morphology, and evolution of selected marine invertebrates, arthropods, and vertebrates. Three hours of lecture and one three-hour laboratory per week. Not for credit in addition to BIO 343 or 344 or 346 if passed with C or higher.
Prerequisite: BIO 111 or 211 or MAR 104
3 credits

BIO 341 Plant Diversity
An introduction to the study of plants, especially green plants, including the origin and evolution of land plants. Topics include cellular structure and function, photosynthesis and respiration, gross anatomy, taxonomy and the diversity of organisms, plant ecology, and agriculture. Three hours of lecture and one three-hour laboratory per week.
Prerequisites: BIO 201 and 203
3 credits

BIO 343 Invertebrate Zoology
Aspects of the diversity, comparative and functional morphology, natural history, evolution, and water-land transitions of invertebrates exclusive of arthropods. Three hours of lecture and one three-and-one-half hour laboratory per week.
Prerequisite: BIO 201 or MAR 104
4 credits

BIO 344 Chordate Zoology
Introduction to the diversity, natural history, and evolution of chordates, emphasizing the living vertebrates. Three hours of lecture or discussion and one three-hour laboratory per week. Not for credit in addition to BIO 346 if passed with C or higher.
Prerequisite: BIO 201
3 credits

BIO 346 Aquatic Arthropods and Vertebrates
Aspects of the diversity, comparative and functional morphology, natural history, and evolution of arthropods and vertebrates. Water-land transitions are considered. Three hours of lecture and one three-and-one-half hour laboratory per week. Not for credit in addition to BIO 344 if passed with C or higher.
Prerequisite: BIO 201 or MAR 104
4 credits

BIO 350-H Darwinian Medicine
The ecology and evolution of disease, including evolution of human resistance to infection by pathogens, pathogen evolution in response to natural and technological defenses, and the ecological context of disease. Evolutionary phenomena are treated from molecular, organismal, populational, and environmental perspectives.
Prerequisites: BIO 201 and 202
3 credits

BIO 351-H Ecology
An examination of the interactions of living organisms with their physical and biological environments. Special attention is given to population dynamics and the interactions among organisms that determine the structure, function, and evolutionary development of biological communities.
Prerequisite: BIO 201; completion of biology major’s mathematics requirement (MAT 126) or permission of instructor
3 credits

BIO 352 Ecology Laboratory
Stresses the collection, analysis, and interpretation of ecological data, mostly in terrestrial settings. Laboratory and field exercises demonstrate the operation of general ecological principles in specific populations and communities. One lecture, one three-hour field trip or laboratory, and one hour of recitation per week. Three all-day Saturday field trips.
Pre- or Corequisites: BIO 351; or permission of instructor
3 credits

BIO 353 Marine Ecology
A survey of biotic responses to ecological challenges in different marine realms. Controls of diversity and trophic structure in the marine ecosystem, historical aspects of marine realms, productivity in the oceans, plankton, soft-bottom communities, intertidal habitats, coral reefs, deep-sea environments, and effects of pollution in the ocean are discussed. This course is offered as both BIO 353 and GEO 353.
Prerequisite: BIO 201 or MAR 104
Advisory Prerequisite: BIO 343
3 credits

BIO 354 Evolution
A detailed discussion of the mechanisms of evolution, focusing on the ways in which genetic changes in populations lead to adaptation, speciation, and historical patterns of evolutionary change.
Prerequisite: BIO 201 and 202, or BIO 320
3 credits

BIO 356 Applied Ecology and Conservation Biology Laboratory
A computer laboratory course introducing students to ecological risk analysis and conservation biology. Laboratories are based on interactive software. Computer simulation techniques for addressing problems in applied ecology are emphasized.
Prerequisites: BIO 201 or 202 or 203; MAT 126 or higher
2 credits

BIO 358-H Biology and Human Social and Sexual Behavior
Major features of human social and sexual behavior are examined from a biological perspective. Implications from ethology, evolutionary biology, and neurobiology are synthesized into a picture of human nature and behavior. Implications of this picture for human sexual and social behavior are discussed.
Prerequisites: U3 or U4 standing; one of the following: BIO 101, 201, 202, or 203
3 credits

BIO 359 Behavioral Ecology
A consideration of the patterns of animal behavior in relation to ecological circumstances and evolutionary history. Vertebrate examples are emphasized.
Prerequisites: BIO 201 and 202
3 credits

BIO 361, 362 Biochemistry I, II
Biochemistry I surveys the major chemical constituents of the cell, including carbohydrates, lipids, and proteins. Emphasis is on enzyme structure, enzyme kinetics, reaction mechanisms, and metabolic pathways. Biochemistry II treats nuclear acid structure, replication, and transcription, both in vivo and in vitro. The machinery of protein synthesis is also covered, including amino acid activation; transfer RNA; ribosomes; the genetic code; and peptide chain initiation, elongation, and termination.
Prerequisites: C or higher in BIO 202; CHE 322, 326 or 332
3 credits per course

BIO 365 Biochemistry Laboratory
A series of laboratory experiments and discussions designed particularly to complement BIO 361 and 362. This laboratory covers such topics as enzyme kinetics, spectrophotometry, recombinant DNA technology, the polymerase chain reaction and genotyping, cellular extraction of DNA, RNA, and proteins, and analytical biochemistry. Four hours of laboratory and discussion per week.
Pre- or Corequisites: BIO 310 or 361
2 credits

BIO 367 Molecular Diversity Laboratory
Hands-on experience with methods to detect and analyze molecular (DNA, RNA, protein) variation to study ecology, adaptation, and evolutionary history using natural populations of Drosophila, plankton, and other locally available species.
Prerequisites: BIO 201, 202, and 354
Advisory Prerequisite: BIO 361
3 credits

BIO 380 Entomology
A survey of the anatomy, development, classification, biogeography, physiology, ecology, and evolution of the insects. The laboratory stresses a knowledge of insect diversity and morphology. Three hours of lecture and three hours of laboratory per week.
Prerequisites: BIO 201 and 202
5 credits

BIO 385-H Plant Ecology
Basic ecological principles as applied to the biology of individual plants, plant populations, communities, and ecosystems in relation to their environments. Examples from Long Island pine barrens, tropical rainforests, beaches, deserts, and other plant communities are studied. Examination of the connections between human societies and plant communities, which are rapidly being altered or destroyed worldwide.
Prerequisite: BIO 201
Advisory Prerequisite: BIO 351
3 credits

BIO 386-H Ecosystem Ecology and the Global Environment
Ecosystem ecology with an emphasis on biogeochemical cycling in oceans and on land, as well as on biosphere-atmosphere interactions. Topics include earth system processes such as climate and atmospheric composition, the hydrological cycle, cycling of chemicals such as nutrients and metals in the oceans, the soil cycle, and the fate and transport of materials in the atmosphere. Natural and perturbed systems are discussed. This course is offered as both BIO 386 and ENS 311.
Prerequisites: BIO 201; CHE 131 or 141
Advisory Prerequisite: MAR 104
3 credits

BIO 401-405 Seminars in Biology
Discussions of a specific area of current interest in biology. The work of each semester covers a different area of biology. Seminar Supplements to this Bulletin contains topic descriptions when courses are offered. May be repeated as the topic changes.
Prerequisite: Permission of instructor
2-3 credits per course

BIO 407 Colloquium in Ecology and Evolution for Biology Majors
Students attend the weekly departmental colloquia in ecology and evolution. The content of each session is discussed during a separate class meeting. Conducted as a seminar.
Prerequisites: BIO 201, 202 and 203; at least one course from biology major areas 4 or 5 with grades of B or higher; CHE 132 or 142; U3 standing as a biology major
2 credits

BIO 444, 446, 447, 449 Readings in Biological Sciences
BIO 444 Readings in Biology and Society
BIO 446 Readings in Neurobiology and Physiology
BIO 447 Readings in Molecular, Cellular, and Developmental Biology
BIO 449 Readings in Ecology and Evolution
Tutorial readings in the biological sciences. These courses may be repeated, but not more than two credits may be used toward biology major requirements. Limit of one topic per semester.
Prerequisites to BIO 444, 446, and 449: Written permission of instructor and undergraduate studies committee.
Prerequisites to BIO 447: Permission of instructor and Department of Biochemistry and Cell Biology
1-2 credits per course, S/U grading
BIO 475, 476 Undergraduate Teaching Practica in College Biology I, II
Study of the literature, resources, and teaching strategies in a field of biology, coordinated with a supervised clinical experience in instruction. Not for major credit. Students may not serve as teaching assistants in the same course twice.
Prerequisites to BIO 475: Permission of instructor and undergraduate studies committee
Prerequisites to BIO 476: BIO 475; permission of instructor and undergraduate studies committee
0-3 credits per course; SU grading

BIO 484, 486, 487, 489 Research in Biological Sciences
BIO 484 Research in Biology and Society
BIO 486 Research in Neurobiology and Physiology
BIO 487 Research in Molecular, Cellular, and Developmental Biology
BIO 489 Research in Ecology and Evolution
In these courses, the student works under the supervision of a faculty member in developing an individual project that makes use of the knowledge and techniques acquired in previous courses. The student prepares an appropriate report on the project. Any of the courses may be taken for more than two semesters, but no more than four credits of research may be used for biology major requirements. Limit of one topic per semester.
Prerequisites to BIO 484, 486, and 489: Written permission of instructor and undergraduate studies committee. Request for approval of the undergraduate studies committee must be submitted no later than two days prior to the last day of the add period as scheduled in the academic calendar.
Prerequisites to BIO 487: Permission of instructor and Department of Biochemistry and Cell Biology
0-6 credits per course; SU grading

BIO 488 Internship in Biological Sciences
May be repeated up to a limit of 12 credits. Not for biology major credit.
Prerequisites: BIO 201, 202, 203; CHE 132; permission of faculty sponsor and biology internship committee
0-6 credits, SU grading

BME

Biomedical Engineering

BME 212 Laboratory Methods in Biomedical Engineering
Introduction to data collection and analysis in the context of biophysical measurements commonly used by biomedical engineers. Laboratory measurements, hypothesis testing, linear regression, and analysis of variance are introduced in an application-oriented manner. Data collection methods using various instruments, A/D boards, and PCs as well as LabView, a powerful data collection and computer package. Not for credit in addition to the discontinued BME 399.
Prerequisites: MAT 125 or 131 or 141; BME 100; BME major
3 credits

BME 300 Writing in Biomedical Engineering
See requirements for the major in Biomedical Engineering, upper-division writing requirement.
Prerequisites: WRT 102; US or U4 standing; BME major
Corequisite: Any 300-level BME course
SU grading

BME 301 Bioelectricity
Theoretical concepts and experimental approaches used to characterize electric phenomena that arise in live cells and tissues. Topics include excitable membranes and action potential generation, cable theory, equivalent dipoles and volume conductor fields, bioelectric measurements, electrodes and electric stimulation of cells and tissues.
Prerequisites: ESE 271; ESE 111 (or CSE 130 or ESE 124 or MEC 111 or MEC 112); BIO 202 or 203
3 credits

BME 303 Engineering Methods in Biomechanics
Implements the principles of mechanics and dynamics that apply to living organisms, from cells to humans to sequoia trees. The behavior of organisms is examined to observe how they are constrained by the physical properties of biological materials. Locomotion strategies (or the lack thereof) are investigated for the forces and range of motions required and energy expenditures. Includes the relationship between form and function to illustrate how form dominates behavior. Presents the physiological effects of mechanical stresses on organs, pathways that develop from abnormal stress, and how biophysical growth and adaptation arise as a natural response to the mechanics of living.
Prerequisite: MEC 290
Pre- or Corequisite: BIO 202 or 203
3 credits

BME 304 Genetic Engineering
Introduction to production engineering with specific focus on the production of genetically engineered products. How cost, time, efficiency, and quality influence the selection of production techniques. Structure and function of DNA and the flow of genetic information.
The methodology involved in recombinant DNA technology and the application of these technologies to cloning and genetic modification of plants and animals, production of pharmaceuticals, and gene therapy.
Prerequisites: BME 100; BIO 202 or 203
3 credits

BME 305 Biofluids
The fundamentals of heat transfer, mass transfer, and fluid mechanics in the context of physiological systems. Techniques for formulating and solving biofluid and mass transfer problems with emphasis on the special features and the different scales encountered in physiological systems, from the organ and the tissue level down to the molecular transport level.
Prerequisites: AMS 361 and MEC 262
Pre- or Corequisite: BIO 202 or 203
3 credits

BME 313 Virtual Bioinstrumentation
Basic concepts of biomedical instrumentation and medical devices with a focus on the virtual instrumentation in biomedical engineering using the latest computer technology. Topics include basic sensors in biomedical engineering, biological signal measurement, conditioning, digitizing, and analysis. Advanced applications of LabView, a graphics programming tool for virtual instrumentation. Helps students develop skills to build virtual instrumentation for laboratory research and prototyping medical devices.
Prerequisite: BME 212
3 credits

BME 353 Biomaterials: Manufacture, Properties, and Applications
The engineering characteristics of materials, including metals, ceramics, polymers, composites, coatings, and adhesives, that are used in the human body. Emphasizes the need of materials that are considered for implants to meet the material requirements specified for the device application (e.g., strength, modulus, fatigue and corrosion resistance, conductivity) and to be compatible with the biological environment (e.g., nontoxic, noncarcinogenic, resistant to blood clotting in the cardiovascular system). This course is offered as both ESM 353 and BME 353.
Prerequisite: ESG 332
3 credits

BME 381 Nanofabrication in Biomedical Applications
Theory and applications of nanofabrication. Reviews aspects of nanomachines in nature with special attention to the role of self-lubrication, intracellular or interstitial viscosity, and protein-guided adhesion. Discusses current nanofabricated machines to perform the same tasks and considers the problems of lubrication, compliance, and adhesion. Self-assembly mechanisms of nanofabrication with emphasis on cutting-edge discovery to overcome current challenges associated with nanofabricated machines.
Prerequisites: CHE 132 and BME 305
Pre- or Corequisite: BIO 202 or 203
3 credits

BME 404 Essentials of Tissue Engineering
Topics covered are developmental biology (nature’s tissue engineering), mechanisms of cell and cell-matrix interactions, biomaterial formulation, characterization of biomaterial properties, evaluation of cell interactions with biomaterials, principles of designing an engineered tissue. Considers manufacturing parameters such as time, rate, cost, efficiency, safety, and desired product quality as well as regulatory issues.
Prerequisites: BIO 202 or 203; CHE 152
3 credits

BME 420 Computational Biomechanics
Introduces the concepts of skeletal biology; mechanics of bone, ligament, and tendon; and linear and nonlinear properties of biological tissues. Principles of finite difference methods (FDM) and finite elements method (FEM) to solve biological problems. Both FDM and FEM are applied to solve equations and problems in solid and porous media. Requires knowledge of Fortran or C programming.
Prerequisites: BME 303; BME 305; MEC 363
3 credits

BME 430 Engineering Approaches to Drug and Gene Delivery
Introduction to the application of engineering principles and biological considerations in designing drug delivery systems for medical use. The concept of biocompatibility and its implications in formulating controlled release devices are illustrated. Emphasis on the use of biodegradable materials to design drug delivery systems for site-specific applications.
Prerequisites: AMS 161 or MAT 132 or 142; BIO 202 or 203; BME 304
3 credits

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