School of Biomedical Engineering, Science and Health Systems
Undergraduate Course Descriptions

Biomedical Engineering & Science Courses

**BMES 125 - Foundns of Biomed Engineering**
This course provides students with an introduction to the fields of biomedical engineering at Drexel while covering aspects of evolutionary theory, complexity and systems biology important to biomedical engineers.
Credits: 2.00
College: Sch.of Biomed Engr,Sci & Hlth
Department: Sch of Biomedical Engineering
Restrictions:
Must be enrolled in one of the following Program Level(s):
Undergraduate Quarter
May not have the following Classification(s):

**BMES 212 - The Body Synthetic**
The Body Synthetic introduces concepts underlying biological and engineering principles involved in the design and construction of prosthetic devices used to replace various parts of the human body.
Credits: 3.00
College: Sch.of Biomed Engr,Sci & Hlth
Department: Sch of Biomedical Engineering
Restrictions:
Must be enrolled in one of the following Program Level(s):
Undergraduate Quarter
Pre-Requisites: TDEC 122 Minimum Grade: C

**BMES 221 - Engineering Principles of Living Systems I**
This course introduces students to the fundamental engineering principles of cell and tissue function using bone as the focus of study. Topics covered include the development and function of osteoblasts, collagen formation and mechanics, mineralization, cell and tissue regulation, and skeletal biomechanics.
Credits: 4.00
College: Sch.of Biomed Engr,Sci & Hlth
Department: Sch of Biomedical Engineering
Restrictions:
Must be enrolled in one of the following Program Level(s):
Undergraduate Quarter
May not have the following Classification(s):
Pre-Requisites: TDEC 122 Minimum Grade: C and BMES 125 Minimum Grade: C

**BMES 222 - Engineering Principles Living Systems II**
This course introduces students to the fundamental engineering principles of cell and tissue function using skeletal neuromuscular junction as the focus of study. Topics covered include the form and function of skeletal muscle, muscle biophysics and biomechanics, bioenergetics, membrane electrophysiology, and Ach pharmacology. This is a writing intensive course.
Credits: 4.00
College: Sch.of Biomed Engr,Sci & Hlth
Department: Sch of Biomedical Engineering

**BMES 301 - Lab I: Exp Biomechanics**
This course deals with experimental aspects of biomechanics, specifically with the testing mechanical properties of biological tissues.
Credits: 2.00
College: Sch.of Biomed Engr,Sci & Hlth
Department: Sch of Biomedical Engineering
Restrictions:
May not be enrolled in one of the following Program Level(s):
Continuing Education
May not have the following Classification(s):
Freshman
Sophomore
Pre-Requisites: TDEC 112 Minimum Grade: C and TDEC 113 Minimum Grade: C and TDEC 114 Minimum Grade: C and TDEC 115 Minimum Grade: C and TDEC 211 Minimum Grade: C

**BMES 302 - Lab II: Biomeasurements**
This course introduces students to the measurement of physiological/biological/functional signals. Four specific signals will be collected and analyzed. Students are expected to analyze type of signal to be collected, possible measurement techniques and potential data analysis and then collect and analyze each signal.
Credits: 2.00
College: Sch.of Biomed Engr,Sci & Hlth
Department: Sch of Biomedical Engineering
Restrictions:
May not be enrolled in one of the following Program Level(s):
Continuing Education
May not have the following Classification(s):
Freshman
Sophomore
Pre-Requisites: BMES 221 Minimum Grade: C and BMES 222 Minimum Grade: C and BMES 232 Minimum Grade: C and ECE 201 Minimum Grade: C and TDEC 231 Minimum Grade: C

**BMES 303 - Lab III: Biomed Electronics**
This course introduces students to the widespread application of electronics and electronic devices in biomedical engineering. The course reinforces concepts learned in ECE 201 with hands-on experimentation related to biomedical applications such as telemedicine and medical devices.
Credits: 2.00
College: Sch.of Biomed Engr,Sci & Hlth
Department: Sch of Biomedical Engineering
Restrictions:
May not be enrolled in one of the following Program Level(s):
Continuing Education
May not have the following Classification(s):
Freshman
Sophomore
Pre-Requisites: ECE 201 Minimum Grade: C and TDEC 231 Minimum Grade: C

BMES 304 - Lab IV: Ultrasound Images
This course introduces students to the engineering principles of acoustical measurements by combining hands-on laboratory experiences with lectures. Students will learn the engineering/physical principles of measuring sound velocity in different materials, attenuation, and directivity of a circular transducers.
Credits: 2.00
College: Sch.of Biomed Engr,Sci & Hlth
Department: Sch of Biomedical Engineering
Restrictions:
May not be enrolled in one of the following Program Level(s):
Continuing Education
May not have the following Classification(s):
Freshman
Sophomore
Pre-Requisites: BIO 201 Minimum Grade: C and BIO 203 Minimum Grade: C and ECE 201 Minimum Grade: C and TDEC 231 Minimum Grade: C

BMES 310 - Biomedical Statistics
This course is designed to introduce biomedical engineering students to the fundamentals of biostatistics necessary for medical research. Topics covered include measurements, sampling, basic hypothesis testing, analysis of variance and regression. Medical applications are emphasized.
Credits: 4.00
College: Sch.of Biomed Engr,Sci & Hlth
Department: Sch of Biomedical Engineering
Restrictions:
Must be enrolled in one of the following Program Level(s):
Undergraduate Quarter
Pre-Requisites: TDEC 114 Minimum Grade: C and TDEC 222 Minimum Grade: C and TDEC 232 Minimum Grade: C

BMES 315 - Exp Design in Biomed Research
This course is designed to introduce students to the fundamental principles of experimental design and statistical analysis as applied to biomedical research with animals and humans. Topics to be covered include experimental design, clinical design, and protocol submission and review.
Credits: 4.00
College: Sch.of Biomed Engr,Sci & Hlth
Department: Sch of Biomedical Engineering
Restrictions:
Must be enrolled in one of the following Program Level(s):
Undergraduate Quarter
Pre-Requisites: BMES 310 Minimum Grade: C

BMES 330 - Biorhythm Pharm/Toxicol
This course covers the fundamentals of biological rhythms with particular emphasis on the influence these cycles have on the susceptibility of organism to physical, chemical, and/or toxic agents.

BMES 331 - Computers in Health Systems I
Introduces the allied health professional to basic computer applications on personal computers. Includes word processing, spreadsheets, databases, and networking (e.g., e-mail and information search and retrieval) in a primarily Windows environment. Designed for individuals with little or no computer background. Students are encouraged to bring in their own work-related problems or projects to provide immediate application of knowledge learned to the student's professional healthcare environment.
Credits: 3.00
College: Sch.of Biomed Engr,Sci & Hlth
Department: Sch of Biomedical Engineering
Restrictions:
May not be enrolled in one of the following Program Level(s):
Continuing Education
May not have the following Classification(s):
Freshman
Sophomore
Pre-Requisites: BIO 201 Minimum Grade: C

BMES 332 - Computers in Health Systems II
Continues the general overview of computers for people in the allied health professions, using specific examples from health care. Offers further study of and practice with special scientific (e.g., statistics, graphing) and medical clinical decision-support software. Introduces algorithms and formal programming methods.
Credits: 3.00
College: Miscellaneous
Department: Sch of Biomedical Engineering
Restrictions:
May not be enrolled in one of the following Program Level(s):
Continuing Education
May not have the following Classification(s):
Freshman

BMES 333 - Biomedical Informatics I
Introduces information and information handling systems for people in the allied health professions, with specific examples drawn from health care. Covers locating, manipulating, and displaying information in the health system setting.
Credits: 3.00
College: Sch.of Biomed Engr,Sci & Hlth
Department: Sch of Biomedical Engineering
Restrictions:
Must be enrolled in one of the following Program Level(s):
Undergraduate Quarter
May not have the following Classification(s):
Freshman
Sophomore

BMES 336 - Hosp & Pat Info/Informatics II
Continues BMES 335. Emphasizes medical records and hospital and patient information handling. Examines the problems of patient information flow within the health care system. Introduces conventional and proposed patient and hospital information systems. Credits: 3.00
College: Sch.of Biomed Engr,Sci & Hlth
Department: Sch of Biomedical Engineering
Restrictions:
May not be enrolled in one of the following Program Level(s):
Continuing Education
May not have the following Classification(s):
Pre-Requisites: BMES 335 Minimum Grade: C

BMES 338 - Biomedical Ethics and Law
Introduces the wide spectrum of ethical, regulatory, and legal issues facing health care practitioners and health-related research workers. Helps students become aware of the ethical and legal issues involved in their work. Helps students understand how legal and ethical decisions should be made in health-related matters, as well as what sources of help and guidance are available. Credits: 3.00
College: Sch.of Biomed Engr,Sci & Hlth
Department: Sch of Biomedical Engineering
Restrictions:
Must be enrolled in one of the following Program Level(s):
Undergraduate Quarter
May not have the following Classification(s):
Freshman

BMES 340 - Health Care Administration
This course provides students with an analysis of health care administration process, including: planning, organizing, designing, decision-making, leading, and controlling. Presents methods and techniques that can contribute to the effective performance of administrative duties. Credits: 3.00
College: Sch.of Biomed Engr,Sci & Hlth
Department: Sch of Biomedical Engineering
Restrictions:
Must be enrolled in one of the following Program Level(s):
Undergraduate Quarter
Pre-Requisites: BMES 338 Minimum Grade: C

BMES 350 - Med & Bio Effects Of Light
Examines the role of environmental lighting in human physiological and psychological processes. Topics include vitamin D synthesis and calcium regulation; light effects on bilirubin in newborns; photoactivation and DNA in skin; effects of nonionizing radiation on the immune systems; environmental lighting and human vision; light effects on biological rhythms and sleep; photosensitivity diseases related to interior lighting; the therapeutic uses of light; and light and the aging eye. Credits: 3.00
College: Sch.of Biomed Engr,Sci & Hlth
Department: Sch of Biomedical Engineering
Restrictions:
May not be enrolled in one of the following Program Level(s):
Continuing Education
May not have the following Classification(s):
Freshman
Pre-Requisites: BIO 203 Minimum Grade: C

BMES 363 - Robotics in Medicine I
This course provides an introduction to the use of haptics (the use of somatoa sensory information) in the design of robotic devices in surgery. Topics covered include actuators, sensors, nonportable feedback, portable force feedback, tactile feedback interfaces, haptic sensing and control systems. Credits: 3.00
College: Sch.of Biomed Engr,Sci & Hlth
Department: Sch of Biomedical Engineering
Restrictions:
Must be enrolled in one of the following Program Level(s):
Undergraduate Quarter
Pre-Requisites: MEM 238 Minimum Grade: C

BMES 365 - Robotics in Medicine II
This course covers the use of robots in surgery and included aspects of safety, robot kinematics, analysis of surgical performance using robotic devices, inverse kinematics, velocity analysis and acceleration analysis. Various types of surgeries in which robotic devices are or could be used are presented on a case study basis. Credits: 3.00
College: Sch.of Biomed Engr,Sci & Hlth
Department: Sch of Biomedical Engineering
Restrictions:
Must be enrolled in one of the following Program Level(s):
Undergraduate Quarter
Pre-Requisites: BMES 363 Minimum Grade: C

BMES 375 - Computational Bioengineering
This course introduces undergraduate students to the mathematical and computational analysis of biological systems. The systems analyzed include the genome, protein and gene networks, cell division cycles, and cellular level disease. Mathematical tools include matrix algebra, differential equations, cellular automata, cluster analysis, etc. Credits: 4.00
College: Sch.of Biomed Engr,Sci & Hlth
Department: Sch of Biomedical Engineering
Restrictions:
May not be enrolled in one of the following Program Level(s):
Pre-Requisites: BMES 222 Minimum Grade: C and BIO 201 Minimum Grade: C and BIO 203 Minimum Grade: C and MATH 290 Minimum Grade: C and TDEC 221 Minimum Grade: C

BMES 381 - Junior Design Seminar I
This is the first course in a two-course sequence intended to present the basics of engineering design, project management, product development and translational research. This first course focuses on engineering design and product development. A case-study approach is used to illustrate best practices and common mistakes in engineering design. Credits: 2.00
College: Sch.of Biomed Engr,Sci & Hlth
Department: Sch of Biomedical Engineering
Restrictions:
Must be enrolled in one of the following Program Level(s):
Graduate Quarter
Undergraduate Quarter
May not have the following Classification(s):
Freshman
Pre-Junior
Sophomore

BMES 382 - Junior Design Seminar II
This is the second course in a two-course sequence intended to present
the basics of engineering design, project management, product
development and translational research. This second course focuses on
project management and quality control. A case-study approach is used
to illustrate best practices and common mistakes in management and
evaluation of engineering projects.
Credits: 2.00
College: Sch.of Biomed Engr,Sci & Hlth
Department: Sch of Biomedical Engineering
Restrictions:
Must be enrolled in one of the following Program Level(s):
Graduate Quarter
Undergraduate Quarter
May not have the following Classification(s):
Freshman
Pre-Junior
Sophomore
Pre-Requisites: BMES 381 Minimum Grade: D

BMES 391 - Biomedical Instrumentation I
This course introduces the student to the medical instrumentation and
provides background on the physical, chemical, electronic and
computational fundamentals by which medical instrumentation
operates. It is an analytical course exploring the design, operation,
safety aspects and calibration of primary electronic instruments.
Credits: 3.00
College: Sch.of Biomed Engr,Sci & Hlth
Department: Sch of Biomedical Engineering
Restrictions:
Must be enrolled in one of the following Program Level(s):
Undergraduate Quarter
May not have the following Classification(s):
Freshman
Sophomore
Pre-Requisites: ECE 201 Minimum Grade: C and TDEC 202 Minimum
Grade: C and TDEC 221 Minimum Grade: C

BMES 392 - Biomedical Instrumentation II
Continues BMES 391. Explores the operation, safety aspects, and
calibration of primarily optical and acoustical instruments, as well as
those involving ionizing radiation. Also examines instrumentation
primarily intended for particular departments and areas, such as
anesthesia and infusion.
Credits: 3.00
College: Sch.of Biomed Engr,Sci & Hlth
Department: Sch of Biomedical Engineering
Restrictions:
Must be enrolled in one of the following Program Level(s):

Undergraduate Quarter
May not have the following Classification(s):
Freshman
Sophomore

BMES 401 - Biosensors I
Introduces the general topic of microsensors, discusses basic sensing
mechanisms for microsensors, and presents various types of
conductometric, acoustic, silicon, and optical microsensors. Uses two
case studies that include an acoustic immunosensor and silicon glucose
sensor to provide students with in-depth knowledge and hands-on
experience. Provides additional experience through three laboratory
sessions that support the lectures and familiarize students with
practical aspects of microsensors. Also discusses applications of
microsensors in the medical, chemical, pharmaceutical, environmental,
aeronautical, and automotive industries.
Credits: 4.00
College: Sch.of Biomed Engr,Sci & Hlth
Department: Sch of Biomedical Engineering
Restrictions:
Must be enrolled in one of the following Program Level(s):
Undergraduate Quarter
May not have the following Classification(s):
Junior
Senior
Pre-Requisites: BMES 222 Minimum Grade: C and TDEC 202 Minimum
Grade: C and TDEC 221 Minimum Grade: C and ECE 201 Minimum
Grade: C

BMES 402 - Biosensors II
Investigates modern biosensor design methods and addresses the
challenges associated with fabrication technologies and
instrumentation techniques. Topics include theory and modeling of
biosensors, biosensor fabrication steps, and electronic and clinical
testing methods. Discusses local and distant sensor data acquisition
techniques. Students will design, fabricate and test a biosensor.
Essential stages of biosensor manufacturing processes will be outlined.
Credits: 4.00
College: Sch.of Biomed Engr,Sci & Hlth
Department: Sch of Biomedical Engineering
Restrictions:
Must be enrolled in one of the following Program Level(s):
Undergraduate Quarter
May not have the following Classification(s):
Junior
Senior
Pre-Requisites: BMES 401 Minimum Grade: C

BMES 403 - Biosensors III
Covers recent advances in biosensor technology and applications,
business aspects, and technology transfer issues. Topics include new
sensing mechanisms, new technologies, new biomedical applications,
the starting of small sensor companies, and the introduction of new
sensor technologies into industrial settings. Requires students to
develop a technical proposal in the area of biosensors and to review
proposals written by their peers. Presentations by regular faculty and
industrial and government researchers form an integral part of the
course.
BMES 409 - Entrepreneurship for BMES
This course serves as the foundation course in entrepreneurship and is designed to provide students with a complete working knowledge of the modern entrepreneurial and business planning process.
Credits: 3.00
College: Sch.of Biomed Engr,Sci & Hlth
Department: Sch of Biomedical Engineering
Restrictions: Must be enrolled in one of the following Program Level(s): Undergraduate Quarter
Must have the following Classification(s): Senior
Pre-Requisites: BMES 402

BMES 411 - Chronoengr I: Bio Rhythms
Introduces students to the concepts of biological, and especially circadian, rhythmicity. Advances students' knowledge of biological time-keeping and adaptive functions of biological clocks. Topics include biochemical and physiological models of biological clocks, adjustment to environmental cycles, rhythms in behavior and physiological functions, sleep-wake cyclicity, adaptability of circadian systems, and influences of rhythms on human physiology and behavior. Designed to give students a thorough understanding of the role rhythms play in animal and human behavior, physiology, and medicine.
Credits: 3.00
College: Sch.of Biomed Engr,Sci & Hlth
Department: Sch of Biomedical Engineering
Restrictions: May not be enrolled in one of the following Program Level(s): Continuing Education
May not have the following Classification(s): Freshman
Sophomore
Pre-Requisites: BIO 203 Minimum Grade: C and BMES 222 Minimum Grade: C

BMES 412 - Chronoengr II: Sleep Functions
Continues BMES 411. Enhances students' education in the concepts of biological, and especially circadian, rhythmicity. Focuses on sleep patterns, rhythms, evolution, neurology, psychology, and overall function.
Credits: 3.00
College: Sch.of Biomed Engr,Sci & Hlth
Department: Sch of Biomedical Engineering
Restrictions: May not be enrolled in one of the following Program Level(s): Continuing Education
May not have the following Classification(s): Freshman
Sophomore
Pre-Requisites: BMES 411 Minimum Grade: C

BMES 421 - Biomed Imaging Sys. I: Images
Provides an overview of the field of medical imaging. Covers aspects of light imaging; systems theory, convolutions, and transforms; photometry, lenses, and depth of field; image perception and recognition; three-dimensional imaging; image acquisition and display; and image processing operations, including scanning and segmentation.
Credits: 4.00
College: Sch.of Biomed Engr,Sci & Hlth
Department: Sch of Biomedical Engineering
Restrictions: Must be enrolled in one of the following Program Level(s): Undergraduate Quarter
Must have the following Classification(s): Senior
Pre-Requisites: TDEC 115 Minimum Grade: C and TDEC 122 Minimum Grade: C and TDEC 222 Minimum Grade: C and MATH 311 Minimum Grade: C and MATH 290 Minimum Grade: C and ECES 302 Minimum Grade: C

BMES 422 - Biomed Imaging Systems II
Intended for students who would like to gain an adequate understanding of diagnostic ultrasound imaging principles and become familiar with developments in this rapidly expanding field. Introduces medical visualization techniques based on ultrasound propagation in biological tissues. Topics include generation and reception of ultrasound, imaging techniques (A-mode, B-mode, M-mode, and Doppler), typical and emerging diagnostic applications, elements of ultrasound exposure, and safety aspects from the clinical point of view.
Credits: 4.00
College: Sch.of Biomed Engr,Sci & Hlth
Department: Sch of Biomedical Engineering
Restrictions: Must be enrolled in one of the following Program Level(s): Undergraduate Quarter
Must have the following Classification(s): Senior
Pre-Requisites: BMES 421

BMES 423 - Biomed Imaging Systems III
Covers volumetric and functional imaging systems. Discusses the principles and algorithms of projection tomography, XCAT, SPECT, PET; the principles of MRI: Bloch equation, slice selection, k-space scanning, volumetric MRI; biochemical imaging; chemical equilibrium equations and Scatchard plots, specific and nonspecific labeling; autoradiography; and flow and dynamical systems: Doppler, mass transport, and phase (MRI) measurement of flow.
Credits: 4.00
College: Sch.of Biomed Engr,Sci & Hlth
Department: Sch of Biomedical Engineering
Restrictions: Must be enrolled in one of the following Program Level(s): Undergraduate Quarter
Must have the following Classification(s): Senior
Pre-Requisites: BMES 422 Minimum Grade: C
BMES 432 - Biomed Systems and Signals
Introduces various aspects of biomedical signals, systems, and signal processing. Covers topics in the origin and acquisition of biomedical signals; discrete-time signals and linear systems; frequency analysis of discrete-time signals, spectral estimation, data records and digital filters; and compression of biomedical signals through time-domain and frequency-domain coding.
Credits: 3.00
College: Sch.of Biomed Engr,Sci & Hlth
Department: Sch of Biomedical Engineering
Restrictions:
May not be enrolled in one of the following Program Level(s):
Continuing Education
May not have the following Classification(s):
Freshman
Pre-Junior
Sophomore
Pre-Requisites: ECES 302 and ECES 304 and ECES 352

BMES 442 - Biomechanics II
Teaches students to think biomechanically. Reviews and categorizes the various functional components (tissues) of the musculoskeletal system. Considers constraints of the joints and action of the soft and hard tissues, along with corresponding models. Computes joint and muscle forces. Discusses some aspect of postural stability of the whole musculoskeletal structure and reviews various methods of task performance.
Credits: 4.00
College: Sch.of Biomed Engr,Sci & Hlth
Department: Sch of Biomedical Engineering
Restrictions:
Must be enrolled in one of the following Program Level(s):
Undergraduate Quarter
Must have the following Classification(s):
Senior
Pre-Requisites: BMES 441

BMES 440 - Introduction to Biodynamics
The objective of the course is to prepare students for biomechanical modeling, modeling methods, formulation of equations of motion and methods of determination of strength will be applied to human body dynamics. Particular emphasis is placed on the use of Rigid Body and Multi-Body Dynamics.
Credits: 3.00
College: Sch.of Biomed Engr,Sci & Hlth
Department: Sch of Biomedical Engineering
Restrictions:
Must be enrolled in one of the following Program Level(s):
Undergraduate Quarter
Pre-Requisites: MEM 202 Minimum Grade: C and MEM 230 Minimum Grade: C

BMES 443 - Biomechanics III
Provides more advanced knowledge of mechanics of materials and offers a general description of mechanical behavior of the variety of the soft and hard tissues of the human body. Considers some prosthetic replacements of tissues as well as entire bone, joint, soft tissue, and system prosthetics. Reviews some specific orthopedic appliances and covers limb prosthetics if time permits. Students plan design projects.
Credits: 4.00
College: Sch.of Biomed Engr,Sci & Hlth
Department: Sch of Biomedical Engineering
Restrictions:
Must be enrolled in one of the following Program Level(s):
Undergraduate Quarter
Must have the following Classification(s):
Senior
Pre-Requisites: BMES 442

BMES 444 - Biofluid Mechanics
This course introduces flow-related anatomy and pathophysiology, and biomedical flow devices and their design challenges. Analysis methods to solve biological fluid mechanics design problems will be introduced and several interdisciplinary team projects will be assigned to apply fluid mechanics to practical biological or medical problems.
Credits: 3.00
College: Sch.of Biomed Engr,Sci & Hlth
Department: Sch of Biomedical Engineering
Restrictions:
Must be enrolled in one of the following Program Level(s):
Undergraduate Quarter
Pre-Requisites: BMES 451 Minimum Grade: C

BMES 441 - Biomechanics I:
Teaches students to use mechanical tools to get an introductory appreciation for solving biomechanical problems. Models human performance by using static, quasi-static, and dynamic approaches. Assesses overall loading of the musculoskeletal system during functional activities. Demonstrates some introductory methods of estimation of forces in the joints and muscles and evaluates the endurance of the human tissues under traumatic loading conditions. Builds on existing knowledge in mechanics, such as the basic variables of mechanics, modeling methods, formulation of the equations of motion, and methods of determination of strength, then practices actual illustration of the application of the mechanical tools in the determination of human systems performance.
Credits: 4.00
College: Sch.of Biomed Engr,Sci & Hlth
Department: Sch of Biomedical Engineering
Restrictions:
Must be enrolled in one of the following Program Level(s):
Undergraduate Quarter
Must have the following Classification(s):
Senior
Pre-Requisites: MEM 202 Minimum Grade: C and MEM 230 Minimum Grade: C and MEM 238 Minimum Grade: C and BMES 222 Minimum Grade: C and BMES 440 Minimum Grade: C and BIO 203 Minimum Grade: C

BMES 451 - Trans. Phenomena in Living Sys
Introduces students to applications of chemical engineering concepts in biological systems. Shows that chemical engineering approaches to problem solving are ideally suited to investigation of biology. Approaches include material and energy balances, transport phenomena, and kinetics.
Credits: 4.00
College: Sch.of Biomed Engr,Sci & Hlth
Department: Sch of Biomedical Engineering
Restrictions:
May not be enrolled in one of the following Program Level(s):
Continuing Education
May not have the following Classification(s):
Sophomore
Pre-Junior
Sophomore
Pre-Requisites: TDEC 122 Minimum Grade: C and TDEC 115 Minimum Grade: C and BMES 222 Minimum Grade: C and BIO 203 Minimum Grade: C

BMES 452 - Trans. Phen in Living Sys II
Continues BMES 451. Advances students’ understanding of the engineering principles of membrane transport and its consequences at the subcellular (mitochondria), cellular (neuron), and organ (kidney) level. Introduces concepts associated with pharmacokinetics. Provides students with a kinetic approach to analysis of receptors, including the kinetics of ligand-receptor binding, rate constants, and signal transduction.
Credits: 3.00
College: Sch.of Biomed Engr,Sci & Hlth
Department: Sch of Biomedical Engineering
Restrictions:
May not be enrolled in one of the following Program Level(s):
Continuing Education
May not have the following Classification(s):
Freshman
Pre-Junior
Sophomore
Pre-Requisites: BMES 451

BMES 460 - Biomaterials I
First course in a three-quarter sequence designed to acquaint students with the behavior of materials used in biomedical application under load (i.e., mechanical properties), their modes of failure and as a function of their environment. This course provides students with the fundamentals needed to proceed with Biomaterials II
Credits: 4.00
College: Sch.of Biomed Engr,Sci & Hlth
Department: Sch of Biomedical Engineering
Restrictions:
Must be enrolled in one of the following Program Level(s):
Undergraduate Quarter
Co-Requisites: BMES 471
Pre-Requisites: MEM 202 Minimum Grade: C and MEM 230 Minimum Grade: C and CHEM 241 Minimum Grade: C and CHEM 242 Minimum Grade: C

BMES 461 - Biomaterials II
Second course in a three-quarter sequence in biomaterials. The goal of this course is with an understanding of, and ability to select, appropriate materials for specific applications taking into account mechanical, thermal, and rheological properties taught in Biomaterials I and combining them with the biocompatibility issues covered in the present course.
Credits: 4.00
College: Sch.of Biomed Engr,Sci & Hlth
Department: Sch of Biomedical Engineering
Restrictions:
Must be enrolled in one of the following Program Level(s):
Undergraduate Quarter
Must have the following Classification(s):
Senior
Co-Requisites: BMES 472
Pre-Requisites: BMES 460 Minimum Grade: C

BMES 462 - Biomaterials II
Third course in a three-quarter sequence in biomaterials. The goal of this course is to provide students with sufficient knowledge to predict and resolve unfavorable/upcoming tissue responses to a particular material, both during implantation and under implant conditions
Credits: 4.00
College: Sch.of Biomed Engr,Sci & Hlth
Department: Sch of Biomedical Engineering
Restrictions:
Must be enrolled in one of the following Program Level(s):
Undergraduate Quarter
Must have the following Classification(s):
Senior
Co-Requisites: BMES 473
Pre-Requisites: BMES 461 Minimum Grade: C

BMES 466 - Robotics in Medicine III
This course covers topics in the design of medical robotic systems, including force and movement analysis for robotic arms, dynamics, computer vision and vision-based control. Thus use of haptics, vision systems and robot dynamics are examined in a cohesive framework.
Credits: 3.00
College: Sch.of Biomed Engr,Sci & Hlth
Department: Sch of Biomedical Engineering
Restrictions:
Must be enrolled in one of the following Program Level(s):
Undergraduate Quarter
Pre-Requisites: BMES 365 Minimum Grade: C

BMES 471 - Tissue Engineering I
Course is designed to familiarize students with the advanced concepts of cellular and molecular biology and physiology relevant to tissue engineering. The initial part of a two-quarter sequence combining material from cellular/molecular biology, evolutionary/developmental biology with engineering design and biomaterials to educate students in the principles, methods, and technology of tissue engineering.
Credits: 4.00
College: Sch.of Biomed Engr,Sci & Hlth
Department: Sch of Biomedical Engineering
Restrictions:
May not be enrolled in one of the following Program Level(s):
Continuing Education
Must have the following Classification(s):
Senior
Pre-Requisites: BIO 214 Minimum Grade: C and BIO 215 Minimum Grade: C and BIO 218 Minimum Grade: C and BIO 219 Minimum Grade: C and CHEM 242 Minimum Grade: C and BMES 375 Minimum Grade: C and MEM 230 Minimum Grade: C

BMES 472 - Tissue Engineering II
Familiarizes students with advanced concepts of developmental and evolutionary biology relevant to tissue engineering. This second part of the two-quarter sequence combines material from cellular/molecular biology and evolutionary design and biomaterials to educate students in the principles, methods, and technology of tissue engineering.

Credits: 4.00
College: Sch.of Biomed Engr,Sci & Hlth
Department: Sch of Biomedical Engineering
Restrictions:
May not be enrolled in one of the following Program Level(s):
Continuing Education
Must have the following Classification(s):
Senior
Pre-Requisites: BMES 477 Minimum Grade: C

BMES 478 - Neuroengineering II
This course investigates cutting edge technologies in neuroengineering in a seminar-style format with faculty from the School of Biomedical Engineering and College of Medicine. Three modules cover topics, which vary from year to year. Students are expected to submit written and oral presentations covering each topic.

Credits: 4.00
College: Sch.of Biomed Engr,Sci & Hlth
Department: Sch of Biomedical Engineering
Restrictions:

May not be enrolled in one of the following Program Level(s):
Continuing Education
Must have the following Classification(s):
Senior
Pre-Requisites: BMES 477 Minimum Grade: C

BMES 480 - Spec Top Biomed Engr/Sci
Covers topics related to the field of health care, systems, and technology. Past topics include health care administration.

Credits: 12.00
College: Sch.of Biomed Engr,Sci & Hlth
Department: Sch of Biomedical Engineering
Restrictions:
May not be enrolled in one of the following Program Level(s):
Continuing Education
May not have the following Classification(s):

BMES 483 - Quantitative Systems Biology
This course uses a systems engineering approach to provide a foundation in systems biology and pathology informatics. Topics covered include the robust complex network of genes and proteins; cell as basic units of life; communication of cells with other cells and the environment; and gene circuits governing development.

Credits: 4.50
College: Sch.of Biomed Engr,Sci & Hlth
Department: Sch of Biomedical Engineering
Restrictions:
Must be enrolled in one of the following Program Level(s):
Undergraduate Quarter
Pre-Requisites: TDEC 222 Minimum Grade: C and BIO 203 Minimum Grade: C and BMES 375 Minimum Grade: C

BMES 484 - Genome Information Engineering
This course is designed to provide students with hands-on experience in the application of genomic, proteomic, and other large-scale information to biomedical engineering. The underlying goal is to develop an understanding of highthroughput underlying technologies, biological challenges, and key mathematical and computational methods relevant to biomedical engineering.

Credits: 4.50
College: Sch.of Biomed Engr,Sci & Hlth
Department: Sch of Biomedical Engineering
Restrictions:
Must be enrolled in one of the following Program Level(s):
Undergraduate Quarter
Pre-Requisites: BMES 483 Minimum Grade: C or BIO 331 Minimum Grade: C

BMES 491 - Senior Design Project I
This is a writing intensive course.

Credits: 2.00
College: Sch.of Biomed Engr,Sci & Hlth
Department: Sch of Biomedical Engineering
Restrictions:
May not be enrolled in one of the following Program Level(s):
Continuing Education
BMES 492 - Senior Design Project II
Credits: 2.00
College: Sch. of Biomed Eng, Sci & Hlth
Department: Sch of Biomedical Engineering
Restrictions:
May not be enrolled in one of the following Program Level(s):
Continuing Education

BMES 493 - Senior Design Project III
Credits: 4.00
College: Sch. of Biomed Eng, Sci & Hlth
Department: Sch of Biomedical Engineering
Restrictions:
May not be enrolled in one of the following Program Level(s):
Continuing Education

BMES 499 - Independent Study in BMES
Credits: .50 to 6.00
College: Sch. of Biomed Eng, Sci & Hlth
Department: Sch of Biomedical Engineering
Restrictions:
May not be enrolled in one of the following Program Level(s):
Continuing Education