Course Descriptions (Catalogue)

General Education

Eng 133–English Composition I 2(2-0-0): This is an intermediate level writing class. Students are guided through the stages of the writing process to write paragraphs that are both meaningful and organized and include a topic sentence with a controlling idea and conclusion. Students write multi-draft compositions from a variety of practical and academic purposes. They improve their writing by studying model sentences and paragraphs, basic sentence patterns, mechanics, coordinating conjunctions, transitions and vocabulary. Two 1-hour lectures per week. Pre-requisite: None.

Eng 134–English Composition II 2(2,0,0): This English course is designed to take learners from the paragraph level of writing in English to the Essay level. It concentrates of the essential form and function of the essay and prepares the ground for the academic essay. Particular importance is given to tasks of description and argumentation, including work on comparison, definition, cause-effect and expression of opinion in essay writing. Thus, students are taken through the major stages of the essay composition process. Two 1-hour lectures per week. Pre-requisite: Eng 133.

Eng 137–Technical Writing 2(2-0-0): This course introduces students to the fundamentals of writing, designing and conveying technical information to different audiences. Students will learn about technical writing conventions, such as organization, style and tone and illustration and layout as they work through the writing process to produce a variety of common technical documents that they will encounter in their academic work. Two 1-hour lectures per week. Pre-requisite: Eng 134.

Eng 138–Fundamentals of Speech Communication 2(2-0-0): A study of communication theories as applied to speech: practical communicative experiences ranging from interpersonal communication and small-group process through problem identification and solution in discussion, to informative and persuasive speaking in standard speaker-audience situations. One 2-hours lectures per week. Co-requisite: Eng 134.

Mgt 292–Management Fundamentals & Skill 3(3-0-0): The course covers Management fundamentals & Skill, such as, Global Management - Change and Innovation - Appendix: Managing Entrepreneurial Ventures - Decision Making - Strategic Management - Module Planning Tools and Techniques - In class discussion: Ethics Dilemma - Operations Management - Marketing Management - E Business - Marketing Plan - Human Resource Management - Team Building - Foundations of Individual Behaviour - Communication. Three 1-hour lectures per week. Pre-requisite(s): None.

SSC 101-Islamic Creed and Contemporary Doctrines 2(2-0-0): Creed: definition, importance, sources, characteristics, study methodology, pillars of faith, influence of creed on individuals and society, belief nullifiers, thought constraints, study of some contemporary doctrines: secularism, Satan worshipers, Baha'ism, Zionism, Misoneism, Christian fundamentalism. Student is required to memorize part of the holy Quran. One 2-hours lectures per week. Pre-requisite(s): None.

Deic 317-Islamic Morals and Ethics 2(2-0-0): Morals (Ethics: definition and foundations, characteristics, study of model samples of the Prophets' morals and ethics, tools of moral/ethical education in Islam. Concept of profession and its importance in human life, constituents of professional morals/ethics and its constraints, model samples of professional morals/ethics in Islam. Student is required to memorize part of the holy Quran. One 2-hours lectures per week. Pre-requisite(s): None.

Deic 318-Economic System in Islam 2(2-0-0): Islamic Economy: (its nature and principles, development, and characteristics), the economic problem and how to face it, contemporary economic systems (capitalism, socialism), economic globalism, World Bank and its goals, World Trade Organization and its goals, ownership in Islam: definition, types, constraints. Islam and economic freedom, Production, distribution, expenditure, economic policies in contracts and transactions. Student is required to memorize part of the holy Quran. One 2-hours lectures per week. Pre-requisite(s): None.

Deic 401- Islamic Social System 2(2-0-0): Society: definition, building blocks of society in Islam, Islamic society attributes, Family in Islam: definition, status, importance, building blocks, marriage and its purposes, spouses' rights, parents, siblings, and relatives' rights, women's status and rights in Islam, Family controversial issues about family system in Islam and responding to those issues (polygamy, inheritance, veil, divorce, etc.), Family problems and remedies (women's work, alimony, stewardship, etc.). Student is required to memorize part of the holy Quran. One 2-hours lectures per week. Pre-requisite(s): None.

SSC 102-Contemporary Cultural Issues 2(2-0-0): Moderation, Islam globalism and human ties, discrimination and nationalism, Arabic as the medium of education and culture, science and religion, interfaith dialogue, Orientalism and Christianization, Colonialism, Westernization, modernity in literature, Globalization, Terrorism, Development of Moslem nations. One 2-hour lectures per week. Pre-requisite(s): None.

Math and Basic Sciences

Math 144–Calculus I 4(4-0-0): This is an introductory course of mathematics for college of engineering students. The course covers the basic concepts and methods of calculus. At the beginning of the course the instructor will provide students the knowledge of the number systems, algebraic operations and functions of single variable with domain and range so that students can learn differentiation of the functions. The main topics to be covered in this course include: Limits, Continuity, Differentiation of functions of a single variable, Exponential, Logarithmic, Trigonometric, Inverse trigonometric functions, Applications of derivatives, Differentials, Curve Sketching, L'Hospital Rule, Mean value theorems, Area and estimating with finite sums, Introduction to integrals and definite integrals. Four 1-hour lectures per week. Pre-requisite: None.

Math 145–Calculus II 4(4-0-0): This is an intermediate level calculus course designed for undergraduate Engineering students. This course covers mainly the integration and basic principles of Vectors and their applications. At the beginning of this course, the instructor will give the review of differentiation and integration. In depth, the students will learn the methods of integration and vectors. The topic covered include, Techniques of Integration, Improper Integration, Applications of Integration, Infinite Sequences and Series, (Power series and Taylor series), Polar coordinates, Transcendental Functions, Vectors, Vector Valued Functions. Four 1-hour lectures per week. Pre-requisite: Math 144.

Math 240–Differential Equations 3(3-0-0): This course is an introductory course of differential equations for college of engineering students. The course covers different methods and concepts to solve first and second order differential equations. At the beginning of the course we discuss some definitions and terminology about differential equations. Then we move to solving first and second order differential equations. The topics in this course include, linear differential equations, solving first order differential equations, solving second order differential equations, series solutions of second order linear differential equations, solving systems of linear differential equations, Laplace transform and its applications in solving differential equations. Three 1-hour lectures per week. Pre-requisite: Math 145.

Math 244–Multivariate Calculus 3(3-0-0): This course is an advanced course in calculus, designed for undergraduate students of engineering. The course covers the basic principles and methods of differentiation and integration of two or more variables. At the beginning of the course, the Instructor will give a review of functions of one variable and its differentiation and integration. Then, the functions of two or more variables with domain and range will be discussed. Throughout the course, the following main topics will be covered: solid analytic geometry; vector calculus; partial derivative; and multiple integrals. The coverage will also include relevant and important applications in the sciences and engineering. Three 1-hour lectures per week. Pre-requisite: Math 145.

Phys 140–General Physics I 3(3-0-0): The course is an introduction to units, measurements, motion in one and two dimensions, kinematics and dynamics, Newton's laws, work and energy, rotational dynamics, linear and angular momentum, torque, and collisions. Basic calculus and multi-variable algebra will be used. Three 1-hour lectures per week. Co-requisite: Math 144 & Phys 144.

Phys 144–General Physics I Lab. 1(0-0-3): Measure basic constants such as length, weight and time, value of acceleration due to gravity. Design and conduct experiments in mechanics. Analyze and interpret experiment data. Write a scientific report. Draw and interpret a graph. Apply experimental principles and error calculations to mechanics. Three hours Lab. per week. Co-requisite: Phys 140

Phys 141–General Physics II 3(3-0-0): This course introduces students to the physics of electricity and magnetism and the connections between them. The concepts of electric charge, electric field, electric potential, Kirchhoff Law, Gauss Law, electric and magnetic fluxes, capacitance, resistivity and resistance, connections in series and in parallel, RC-circuit, magnetic field, magnetic force, magnetic and electric torques, Ampere Law, electromagnetic induction, and Faraday Law and Lenz Law will be taught. Three 1-hour lectures per week. Pre-requisite: Phys 140. Co-requisite: Phys 145.

Phys 145–General Physics II Lab. 1(0-0-3): This course introduces students to the basic electrical measurements' techniques and to the physics of electricity and magnetism. The concepts of basic measurements, Resistors in series and in parallel, Verifying Ohm's law, Wheatstone Bridge, Verifying Kirchhoff's Laws, Resistivity, Capacitors in series and in parallel, RC circuit, Introduction to Oscilloscope, the Mechanical Equivalent of Heat, the Negative Temperature Coefficient of Resistance (Thermistor), Galvanometer, and the Magnetic Moment will be taught. Three hours Lab. per week. Co-requisite: Phys 141.

Chem 140-General Chemistry I 3(3-0-0): Matter properties and measurement, Atoms and the Atomic Theory, Chemical Compounds, Chemical Reactions, Reactions in Aqueous Solutions, Liquids Solids and Intermolecular Forces, Electrons in Atoms, Periodic Table and Atomic Properties, Chemical Bonding, Valence-Bond, Hybridization of Atomic Orbital, Multiple Covalent Bonds, Molecular Orbital Theory, Liquids and Solids. Three 1-hour lectures per week. Pre-requisite: None.

Chem 142-General Chemistry II 3(3-0-0): Properties of Gases: Kinetic-molecular theory of gases, Ideal gas law, Mixtures of gases, Thermo- chemistry, Principles of Chemical Equilibrium, Acids and Bases, Buffer

Solutions, Neutralization Reactions and Titration Curves, Solubility and Complex-Ion Equilibria, Spontaneous Change: Entropy and Free Energy, Thermodynamic, Solutions and Their Physical Properties, Chemical Kinetics and Electrochemistry. Three 1-hour lectures per week. Pre-requisite: Chem 140. Co-requisite: Chem 143.

Chem 143–General Chemistry Lab. 1(0-0-3): Laboratory safety rules and Evaluation of analytical data, Definition and determination of density, explanation and determination of specific heat, concept of Acids, bases and Heat of Neutralization Reaction and its determination, reversible reactions, concept of equilibrium constant and its determination, LeChatelier principle and its verification, principle involved in Acid base titrations, indicators, Ionization of electrolytes, determination of dissociation constant of weak acid(Ka), principle involved in complex metric titrations, hardness of water and its determination. Three hours Lab. per week. Co-requisite: Chem 142.

Common Engineering Courses

Engr 100-Introduction to Engineering 1(1-0-0): This course introduces engineering to students, particularly those who are interested in an engineering profession. It covers engineering ethics, teamwork, communication skills, engineering topics, and engineering problem solving skills and design methodology. One 1-lecture per week. Pre-requisite: None.

Engr 105-Engineering Computing & Skills 2(2-0-0): Problem solving skills and computing using MATLAB. Two 1-hour lectures per week. Pre-requisite: Engr 100. Co-requisite: Math 145.

Engr 106–Engineering Graphics 2(1-0-3): An introductory course in engineering graphics focuses on graphical communication. Topics include descriptive geometry elements, visualization, engineering drawing techniques, orthographic projection, pictorial representation, section views, and basic dimensioning. The course incorporates computer aided drafting (CAD) with engineering applications using 2-D drawing. This course is divided in to two sections: sketching and AutoCAD. The course begins by teaching the basics of engineering graphics using sketching. Freehand sketching using only a pencil and paper is an important skill for any engineer. It is a means of quickly conveying technical information to others. Through sketching the concepts of pictorial projections, section views, auxiliary views and dimensioning are taught. Once the foundation of engineering graphics is known, these concepts can be applied using computer aided design (CAD) software. AutoCAD is taught first. AutoCAD is a drawing software package used to create two-dimensional engineering drawings. One 2-hours lecture per week. Pre-requisite: None.

Engr 206-Electric Circuits 3(3-0-0): Resistors, capacitors, inductors, currents; voltages; power and energy; circuit analysis techniques; DC and AC analysis; magnetic circuits and transformers; Introduction to DC and AC machines. Three 1-hour lectures per week. Pre-requisite: Phys 141.

EE 247 Electric Circuit Lab 1(0-0-3): Lab experiments using resistors, inductors, capacitors, function generators, DC supplies Multimeters, and Oscilloscopes. Focus will be on DC inputs. Software circuit simulations will be used. Three hours Lab. per week. Co-requisite: Engr 206.

Engr 223-Engineering Mechanics 3(3-0-0): Engineering Mechanics, covering both statics and dynamics. Topics include vector algebra, force systems, free-body diagrams, equilibrium of particles and rigid bodies, kinematics of particles and rigid bodies, Newton's laws applied to particles and rigid bodies, friction. Three 1-hour lectures per week. Pre-requisite(s): Math 145 & Phys 140.

Engr 303–Thermofluids 3(3-0-0): Basic concepts of thermodynamics, properties of pure substances, energy transfer by heat, work, and mass, first and second laws of thermodynamics, basic principles and concepts of fluid mechanics including fluid statics, momentum analysis of flow structures, Bernoulli and energy equations, flow in pipes, basic principles of heat transfer including modes of heat transfer, steady heat transfer. Three 1-hour lectures per week. Pre-requisite(s): Phys 140 & Chem 142.

Engr 307–Engineering Economics 3(3-0-0): The course covers the following topics: Engineering Economic Decisions; Understanding Financial Statements; Cost Concepts and Behaviors; Time is Money; Understanding Money and Its Management; Principles of Investing; Present Worth Analysis; Annual Equivalent Worth Analysis; Rate of Return Analysis; Depreciation; Taxes; Break-Even Analysis, Cost Estimation; Developing Project Cash Flows; Inflation; Replacement Decisions. Three 1-hour lectures per week. Pre-requisite(s): Engr 100.

Engr 310-Numerical Methods 3(3-0-0): Introduction to Numerical Methods, Solution of Nonlinear Equations, Solution of Simultaneous Linear Algebraic Equations, Solution of Matrix Eigenvalue Problem, Curve Fitting and Interpolation, Numerical Differentiation, Numerical Integration, Ordinary Differential Equations: Initial-Value Problems, Ordinary Differential Equations: Boundary-Value Problems. Three 1-hour lectures per week. Prerequisite: Math 240, CS 204.

Engr 340-Probability and Statistics for Engineers 3(3-0-0): This course provides a comprehensive introduction to those models and methods most likely to be encountered and used by students in their careers in engineering and the natural sciences. Some homework requires use of computers. The course will cover: Introduction to Statistics and Data Analysis, Probability, Random Variables and Probability

Distributions, Mathematical Expectations, Some Discrete Probability Distributions, Functions of Random Variables, Fundamental Distributions and Data Description, Simple Linear Regression, Multiple Linear Regression, and Bayesian Statistics. The students can use Microsoft Excel or any other statistical software in their projects. Three 1-hour lectures per week. Prerequisite: Math 145.

CS 204–Engineering Programming 3(3-0-0): Introduction to computer systems; problem solving methodology; testing and debugging of programs; variables, declarations, and assignments; input and output; data types; control flow and looping; functions and overloading; streams and input/output; one-dimensional arrays; two-dimensional arrays; pointers and dynamic arrays; structures; abstract data types and classes; inheritance; friends, overloaded operators, and arrays in classes; recursive functions.. Projects that will require lab work will be assigned weekly. Three 1-hour lectures per week. Prerequisite: Math 144.

Engr 399-Engineering Training 0(0-0-0): All engineering students are required to undergo a comprehensive "Engineering Training Program" with a reputable and specialized industrial firm. The firm can be in or outside Saudi Arabia relevant to his major area of interest in engineering analysis, design, or construction. The main purpose of this summer training is to enhance the students' practical experience and career abilities. Also, it deepens their engineering knowledge acquired during their academic years in the field of practical experience in real-life engineering projects. Additionally, such a program improves the relationship between the College of Engineering and the governmental and private industrial firms. Also, it can provide the industry with well-trained professionals in the near future. The qualifying student should spend at least eight weeks in a governmental organization, a reputable industrial firm, or a research center that is involved with engineering activities. Two months of full-time training. Pre-requisite: Eng 137 & (Level 7 or above).

BME Courses

BME 202-Molecular Biology and Genetics 3(3-0-0): This is an introductory course in molecular biology and genetics. Students will learn the nomenclature and current knowledge about the cell and its structures. Topics include chemical bonds; macromolecules; protein structure and function; enzymes; cell structure and function; cellular respiration; cell signaling; cellular reproduction and life cycle; cellular communication; structure and nature of DNA and genetics. Three 1-hour lectures per week. Prerequisite: BME 304.

BME 204-Anatomy and Physiology I 3(3-0-0): The objective of this course is to present the concepts of human anatomy and physiology that are most pertinent to the field of biomedical engineering. Concepts from the following topics will be covered: homeostasis; cell membrane potentials and transport mechanisms; nerves; muscular, cardiovascular and circulatory systems. Modeling of living systems will be covered as well. Three 1-hour lectures per week. Prerequisite: CHEM 140.

BME 220-Biomaterials 3(3-0-0): This course introduces the science of materials with emphasis on materials used in biomedical applications such as surgical implants, medical devices, dental restoration, drug delivery systems, etc. Students shall learn the classes of biomaterials and their properties, characteristics, biological response, and clinical applications. Other topics include biocompatibility, biodegradation, and performance and design requirements of materials for medical applications. Three 1-hour lectures per week. Prerequisite: BME 204.

BME 304-Anatomy and Physiology II 3(3-0-0): The objective of this course is to present the concepts of human anatomy and physiology that are most pertinent to the field of biomedical engineering. It is a continuation of Anatomy and Physiology I course. Concepts from the following topics will be covered: autonomic nervous system; blood; lymphatic and immunity; respiratory, urinary, endocrine and digestive systems. Three 1-hour lectures per week. Prerequisite: BME 204.

BME 310-Biomedical Electronics I 3(3-0-0): Diodes characteristics, models and applications (rectification, clipping, regulation, etc); Bipolar Junction Transistors (BJT) and Field Effect Transistors (FET): states and modes of operation of these devices; BJT and FET amplifiers; multistage amplifiers; frequency response of amplifiers. Three 1-hour lectures per week. Prerequisite: ENGR 206.

BME 312-Biomedical Electronics II 3(3-0-0): Operational amplifiers, power amplifiers, differential & multistage amplifiers and their medical applications; passive and active filters; comparators; oscillator circuits and applications; functional integrated circuits (*V/f* converters, *A/D* converters… etc); frequency response; control systems; analysis and design of feedback control systems and applying these principles to solve biological feedback control problems. Three 1-hour lectures per week. Prerequisite: BME 310.

BME 313-Biomedical Electronics Lab 1(0-0-3): The goal of this laboratory is to study electronics through experimentation. Upon completion of this lab course, students should be able to use standard laboratory equipments to analyze the behavior of basic electronic devices and to design and construct simple circuits containing these devices. Three hours Lab. per week. Co-requisite(s): BME 312.

BME 314-Biomedical Signals and Systems 3(3-0-0): Biosignals and their Non-deterministic properties. Models for Biomedical systems. System response and Stability, Fundamentals of continuous-time signal processing as applied to biomedical instrumentation.

Random noise and signal processes. Time Domain and Frequency Domain Analysis of Signals and System, Sampling theory, Applications of Fourier transforms and Laplace transforms, Transfer functions. Analog filter design methods for biomedical instrumentations. Discrete-time signal processing and Digital filter design will be introduced in this course. Projects and software will be used. Three 1-hour lectures per week. Pre-requisite(s): Math 240 & Engr 206.

BME 316-Logic Design and Microprocessors for BME 3(3-0-0): This is an introductory course in digital logic design and microprocessor systems. The course shall include introduction to digital systems; Boolean algebra; Combinational circuit analysis; Sequential circuit analysis and design that includes counters, registers and timers… etc. The fundamental principles of digital logic design shall be applied to understand Microprocessor organization and architecture; assembly language programming; CPU; Memory, I/O, and parallel processing. Biomedical Engineering applications shall be discussed wherever applicable. Three 1-hour lectures per week. Pre-requisite(s): CS 204.

BME 320-Biomechanics 3(3-0-0): This course applies the principles of solid mechanics to musculoskeletal system. Topics include kinematics, kinetics, and biomechanics of locomotion. Students will learn the microstructure and mechanical properties of biological tissues such as bones, joints, blood vessels, muscle, heart…etc. The learned concepts of biomechanics will be applied to those body tissues. Design and analysis projects will be assigned. Three 1-hour lectures per week. Pre-requisite(s): Engr 223 & BME 220.

BME 322-Biomedical Transport Phenomena 3(3-0-0): Topics include reaction-diffusion processes; transport across membranes; fluid flow in the circulatory system and other tissues; oxygen transport in lungs and tissues; pharmacokinetics; biomedical engineering applications and devices: extracorporeal devices (e.g. hemodialysis, blood oxygenators, etc) and artificial organs. Three 1-hour lectures per week. Pre-requisite(s): Engr 303 & Math 240.

BME 330-Biomedical Imaging Systems 3(3-0-0): This course covers the fundamentals of different types of medical imaging modalities. Topics include the physics, mathematics, instrumentation and clinical applications of different imaging modalities including X-rays, Computed Tomography (CT), Fluoroscopy, Ultrasound Imaging, Optical Imaging, Nuclear Imaging (SPECT, PET) and Magnetic Resonance Imaging (MRI). Three 1-hour lectures per week. Pre-requisite(s): Phys 141, Math 240 & BME 312.

BME 331-Biomedical Imaging Systems Lab 1(0-0-3): This laboratory focuses on the main medical imaging modalities in BME 330 and provides a hands-on experience for students to practically apply the knowledge they have learned in BME 330. Medical images will be acquired using different modalities, analyzed, reconstructed, and archived. Three hours Lab. per week. Co-requisite(s): BME 330.

BME 410-Biomedical Instrumentation I 3(3-0-0): This is the first course in bioinstrumentation covering clinical measurements. Topics include the origin of Biopotentials: cell, nerve, and muscle potentials; Biopotential electrodes; Biosensors and Transducers; Basic Theories of Measurements and concepts of Medical Instrumentation; Modular Block and System Integration; electrocardiogram (ECG); electroneurogram; electromyogram (EMG); electroretinogram; electroencephalogram (EEG); Cardiovascular system and associated measurements; Blood pressure and Blood flow Measurements; Measurements of the respiratory System; Pulmonary Function Analyzers; Audiometery; Introduction to Biomedical Virtual instrumentation. The Course shall explore the design, operation, safety aspects and calibration of the respective instrumentations. Three 1-hour lectures per week. Pre-requisite(s): Engr 105 & BME 312.

BME 411 Biomedical Instrumentation I Lab 1(0-0-3): This laboratory-based course is designed to develop hands-on experimental skills to the selection and application of various sensors and transducers, and develop practical experience to designing, using and testing analog instrumentation used to acquire and process biomedical signals. Students shall develop skills in writing Matlab programs and employing LabView to perform signal processing on biomedical signals such as ECG and testing electrical equipment against safety standards. It will inculcate the safety issues involved in bioelectrical measurement and medical instrumentation.

Team work and written communication skills are emphasized through laboratory report organization, documentation of results, error analysis and interpretation of findings. Three hours Lab. per week. Co-requisite(s): BME 410.

BME 412-Biomedical instrumentation II 3(3-0-0): Students shall explore the design, operation, safety aspects and calibration of the respective instrumentation: Patient Monitoring Systems, Bedside Monitors and Central Monitors, Arrhythmia and Ambulatory Monitoring, Biomedical Wireless Telemetry, Introduction to networking concepts in Medical Devices. Clinical Laboratory Instrumentation (types and principle of operation): Electrophoresis, ELISA, Hematology, Chromatography, Spectroscopy and Spectrophotometry, Blood gas analyzers, Electrolytes analyzers. Therapeutic and Prosthetic Devices: pacemakers and defibrillators, Pacemaker analyzers cardiac assist devices, Hemodialysis, Lithotripsy, Ventilators, Anesthesia Machines, Infant Incubators, Drug Delivery Devices, Instruments for Surgery. Three 1-hour lectures per week. Pre-requisite(s): BME 410.

BME 413-Biomedical Instrumentation II Lab 1(0-0-3): This laboratory-based course is designed to develop

hands-on experimental skills relevant to the design and construction of biomedical instrumentation commonly used to acquire biomedical signals including aspects of signal processing, micro-computer interfacing, and simple software development. Teamwork and written communication skills are emphasized through laboratory report organization, documentation of results, error analysis and interpretation of findings. Three hours Lab. per week. Pre-requisite(s): BME 316. Co-requisite(s): BME 412.

BME 414-Biomedical Digital Signal Processing 3(3-0-0): This course is designed for senior level students. The objective of this course is to introduce the main techniques for the analysis of continuous and discrete signals including Laplace, Fourier and *Z* Transforms and apply them to analyze biological signals. Topics covered include signal acquisition and sampling; Nyquist rate; signal averaging; noise removal and signal compensation; discrete-time system analysis; *Z* transform; discrete and fast Fourier transform; transfer functions and digital filtering; Infinite Impulse Response (IIR) and Finite Impulse Response (FIR) systems. Computer programming software such as Matlab will be used for the course assignments to analyze biological systems and design different types of filters. Three 1-hour lectures per week. Pre-requisite(s): Engr 105 & BME 314.

BME 416-Introduction to BioMEMS and Bionanotechnology 3(3-0-0): The objective of the course is to expose students to biomedical MicroElectroMechanical Systems (MEMS) and Nanotechnology, and to teach them fundamental principles of MEMS applications in biology and medicine. Topics covered include MEMS and nanotechnology, its application to biotechnology/biomedicine. Introduction to scaling laws as applied toward living systems and artificial devices; micro- and nanofabrication; biosensors and actuator principles; drug delivery; implantable systems; micro-total- analysis systems and lab-on-a-chip devices; minimally invasive surgery; detection and measuring systems; DNA, and protein microarrays; emerging applications in medicine. Three 1-hour lectures per week. Pre-requisite(s): BME 202 & BME 220.

BME 420-Prosthetic Systems for Biomedical Engineering 3(3-0-0): Applying biomechanics of human movement to design and evaluate artificial devices intended to restore or improve movement loss due to disease or injury. Topics include motion analysis; gait analysis and electromyogram (EMG) and their measurement techniques. Artificial limbs; joint replacement & models of muscle and tension will be covered as well with the biomaterials used and their biocompatibility. Matlab projects will be assigned to demonstrate the concepts learned in this course. Three 1-hour lectures per week. Pre-requisite(s): Engr 105, BME 304 & BME 320.

BME 430-Biomedical Image Processing 2(2-0-0): Medical image processing and analysis techniques: image enhancement and filtering in spatial and frequency domains, image restoration, image compression and archiving, segmentation, and registration. Common image characteristics such as Signal-to-Noise Ratio (SNR), resolution, contrast and Contrast-to-Noise ratio (CNR) will be covered as well. Concepts learned in this course will be demonstrated throughout projects and assignments utilizing computer programs such as Matlab. Two 1-hour lectures per week. Pre-requisite(s): Engr 105, Math 240 & Math 244.

BME 432-Biomedical Data Processing, Archiving, and Communication 3(3-0-0): Data acquisition, digitization, storage and recovery. Review of image digitization, compression, enhancement and storage (archiving). Introduction to Picture archiving and communication System; Components of PACS; PACS Infrastructure; Network terminology; types of workstations; the relationship of a Radiology Information System (RIS) and/or a Hospital Information System (HIS) to PACS; interfaces and languages such as DICOM and HL-7 will be addressed. Three 1-hour lectures per week. Pre-requisite(s): BME 430.

BME 440-Management of Healthcare Technology 3(3-0-0): Driven by ever-evolving technological advancements, healthcare institutions must continuously adapt them in order to provide optimal patient care. The proliferation of cutting-edge procedures in the Hospital call for the development of expertise in the management of Healthcare Technology. Management of Healthcare Technology ensures that the equipment and systems used in patient care are safe, operational, and properly configured to meet the mission of the healthcare; that the equipment is used in an effective way consistent with the highest standards of care.

***Description*:** Management concepts of Healthcare Technology; Introduction to the codes, standards, ethical issues and regulations governing Healthcare Technology practices; Implications of Safe Medical Device Act (SMDA); Impact of regulatory agencies' (SFDA, JC etc.) requirements on the operations of the Healthcare Technology Management (HTM) program; Development of related policies and procedures govern activities such as the selection, planning, and acquisition of medical devices for their safe use; Patient Safety and Safety programs; infection control; Types of Contracts and contract negotiation; Development and operation of a Healthcare Technology Management/Clinical Engineering Department in a Hospital. Three 1-hour lectures per week. Pre-requisite(s): Level 6 or above..

BME 442-Information Technology for Biomedical Engineer 3(3-0-0): Integration of Information technology and Biomedical Engineering. Introduction to networking, communications, and information infrastructures in medical environment. Exposure to basic concepts related to networking at several levels: low-level (TCP/IP, services), medium-level (network

topologies), and high-level (distributed computing, Web-based services) implementations. Commonly used medical communication protocols (HL7, DICOM) and current medical information systems (HIS, RIS, PACS). Advances in networking, such as wireless health systems, peer-to-peer topologies, grid/cloud computing. Introduction to security and encryption in networked environments. Three 1-hour lectures per week. Pre-requisite(s): Engr 105.

BME 444-Medical Device Innovation and Entrepreneurship 3(3-0-0): This course provides a foundation course for those interested in developing medical devices and associated technologies. Topics include: innovation models, risks, costs and rewards; product development and new product management; product failure; introduction to medical devices and their classification and nomenclature; healthcare needs assessment; new medical devices and healthcare delivery: industry, government, hospital and user perspectives; medical device innovation including funding and IP issues and design guidance for manufacturers; medical device regulations including harmonization; essential principles of safety and performance of medical devices; Council Directive 93/42/EC on Medical Devices; ISO13485 and ISO14971 standards; FDA's 510(k) review procedure for medical devices; product liability and non-conformance; reliability and the product development process; biotechnology innovation; engineering entrepreneurship. Three 1-hour lectures per week. Pre-requisite(s): Senior standing in BME.

BME 450-Senior Design I 2(2-0-0): This is the first course of a two-semester sequence of senior capstone design. It provides students with experience in the process and practice of biomedical component/system design from concept through final design. Project management techniques, SFDA requirements for medical device design, intellectual property, ethical and human research subject considerations will also be covered. Emphasis will be on teamwork, project management, testing through simulation or prototype, oral and written communications. Two 1-hour lectures per week. Pre-requisite(s): Senior Standing in BME.

BME 452-Senior Design II 2(2-0-0): Continuation of BME 450 – Senior Design I. Two 1-hour lectures per week. Pre-requisite(s): BME 450.

BME 460-Special Topics in Biomedical Engineering 3(3-0-0): Topics determined by the course instructor in consultation with the department chair. Three 1-hour lectures per week. Pre-requisite(s): Senior standing in BME.

BME 462-Undergraduate Research in Biomedical Engineering 3(3-0-0): Individual research projects for students with honors classification. It requires prior approval of, and arrangement with, a faculty research advisor. Three 1-hour lectures per week. Pre-requisite(s): Senior standing in BME