COURSE CATALOG

218 141 Biology **(3-2-0,4)**

Cell biology, cell membrane, mediated transport system, bulk transport, cytoplasm and nuclear cell biology, cell cycle and cell division, meiosis and gameto-genesis, primary tissues, connective tissues, muscle tissues, nerve tissues.

218 151 Introduction to Biomedical Engineering **(1: 0: 2, 1)**

History of biomedical engineering, disciplines of biomedical engineering, role of biomedical engineers in health care sector, challenges and future directions in biomedical engineering, moral and ethical issues in biomedical engineering, visits to hospitals, student seminars Pre-

218 229 Circuit Analysis **(3: 2: 2,4)**

Basic circuit variables, elements and Kirchoff's law, resistive circuit analysis and theorems, network theorems, time domain analysis, AC analysis, frequency characteristics of electric circuits, magnetic coupled circuits and two port elements. Pre-requisite: Engineering Physics II

104 110 Computer Application **(2: 2: 0,3)**

Introduction to information technology, operating systems, information systems, graphics and multimedia, networks and their uses, internet and information retrieval, electronic mail and news, computers and society, ethical issues, computer security issues.

213 235 Logic Design **(3: 2: 2,4)**

Basic theorems and properties of Boolean Algebra and boolean functions. Simplification of Boolean Functions: Karnaugh Map and Tabulation (Quine-McCluskey) Method. Product of Sums (POS) and Sum of Products (SOP) forms. Combinational logic circuits: design and analysis procedures. Decoders, encoders, multiplexers, demultiplexers, ROM, PLA and PAL. Sequential logic circuits: Flip Flops (RS, D, JK, T), design procedure for clocked sequential circuits, counters. Registers and shift registers. Pre-requisite: Computer Applications

218 221 Computer Programming **(3: 0: 2,3)**

Flow charts and problem solving, data types, input output statements, C++ basics, functions, arrays and strings, pointers structures and unions, C++ preprocessor, MATLAB programming. Pre-requisite: Computer Applications

218 242 Human Anatomy **(2: 2: 0,3)**

An Introduction to the human body, the skeletal system, the axial skeleton and ribs, the appendicular skeleton, joints, the muscular system, thorax, abdomen, upper limb, lower limb Pre-requisite: Biology

218 245 Human Physiology **(2: 2: 0,3)**

Cell physiology, nervous system, muscles, cardiovascular systems, respiratory system, digestive system, urinary system, endocrine system. Pre-requisite: Human Anatomy

218 346 Electrophysiology **(2: 2: 0,3)**

Basics of electro-physiology, membrane models, resting potential, action potential, bio electrodes, the electrophysiology of bio potential signals- ECG, EEG, EMG, EOG, ERG etc. Pre-requisite: Human Physiology I

218 233 Electronics Circuits **(3,2: 2,4)**

Semiconductors and PN Junction, bipolar junction transistor (BJT) DC analysis, bipolar Junction Transistor (BJT) AC analysis, junction field effect transistor (JFET), biasing and amplifiers circuits. Pre-requisite: Circuit Analysis

218 337 Microprocessors and Microcontrollers **(3: 2: 0,4)**

The 8086 architecture and programming modes, assembly programming, the 8086 microprocessor instruction set, memory interface and I/O interface, interrupt processing, microcontrollers and applications. Pre-requisite: Logic Design

218 361 Medical Electronics **(2: 2: 2,3)**

Amplifiers and filters, bio-potential amplifiers, design of power system in medical electronics, oscillator circuits, Analog to digital converter (ADC), digital to analog converter (DAC) and data acquisition circuits. Pre-requisite: Electronic Circuits, Human Physiology I

218 356 Biomechanics **(3: 0: 2,3)**

Basics of anatomy and mechanics, applications involving forces and moments, statics and dynamics, Applications to human joints, Properties of deformable bodies, kinematics and kinetics, applications from real-life problems, contemporary issues: Motion analysis. Pre-requisite: Engineering Physics I, Human Anatomy

218 118 Biochemistry **(2: 2: 0,3)**

Structural organization and function of the major components of living cells, metabolism and energy production, and biosynthesis of small molecular weight compounds and macromolecules. Pre-requisite: Chemistry for Engineers

218 375 Signals and Systems **(3: 0: 2,3)**

Continuous- and discrete-time signals and systems. Basic system properties. Linear Time-Invariant (LTI) systems. Properties of LTI systems. Convolution sum. Fourier series of periodic signals. Amplitude, phase, and power spectra. Fourier transform of non-periodic signals. Laplace transform, analysis of continuous-time LTI systems using Laplace transform. Z-Transform. Pre-requisite: Engineering Mathematics III

218 365 Biomedical Instrumentation I **(3: 0: 0,3)**

Introduction to biomedical instrumentation, biomedical sensors and transducers, basic concepts of measurements and instrumentation, bio potential electrodes, clinical laboratory instrumentation. Pre-requisite: Medical Electronics, Human Physiology II

218 355 Biomaterials **(3: 0: 2,3)**

Introduction to biomaterials, structure and properties of materials, crystalline and non-crystalline materials, properties of biologic materials, biocompatibility, Metallic implant materials, ceramic implant materials, polymeric implant materials, composite implant materials. Pre-requisite: Chemistry for Engineers, Human Anatomy

218 476 Bio-signal Processing **(3: 2: 2,4)**

Nature of biomedical signals, frequency response, DFT, FFT, DCT, design of digital filters, nonlinear models of biomedical signals, DSP applications of bio-signals. Pre-requisite: Signals and Systems, Human Physiology II

218 466 Medical Instrumentation II **(3: 2: 0,4)**

Design procedure of medical equipment, bio-potential recording systems, blood pressure, flow and volume instrumentation systems, blood gas analyzers, pace-makers and defibrillators, electro-surgical, physiotherapy instruments, respiratory systems instruments Pre-requisite: Medical Instrumentation I

218 392 Biomedical Design **(2: 2: 2,3)**

Amplifiers and filters, bio-potential amplifiers, design of power supplies, oscillator circuits, and biomedical data acquisition circuits, mini projects related to biomedical engineering applications. Pre-requisite: Medical Electronics

218 498 Biomedical Design Project I **(1: 4: 0,3)**

Teams of three to four students shall design, implement, test and demonstrate their graduation project in two semesters. Biomedical design Project I is to be completed in one semester and includes a literature survey, action plan, design of complete project taking into account realistic constraints, computer simulation (if applicable). Pre-requisite: Completion of 100 Credit Hours

218 499 Biomedical Design Project II **(1: 4: 0,3)**

It is continuation of biomedical design project I in the second semester. Students will complete the implementation and testing of remaining part of their design. They will integrate the complete project, test it, and prepare a PCB. Report writing, oral presentation, poster presentation, and project demonstration. Pre-requisite: Biomedical Design Project I

218 471 Biomedical Imaging System I **(3: 0: 2,3)**

Radioactivity, X -ray physics and imaging techniques, Computed tomography (CT imaging), introduction to SPECT and PET imaging techniques, biological effects of radiation and safe handling. Pre-requisite: Engineering Physics II, Human Anatomy

218 472 Biomedical Imaging System II **(3: 2: 0,4)**

Medical ultrasound imaging techniques, modes of operation, magnetic resonance imaging techniques (MRI), principles of operation, components of MRI machines, computer based reconstruction, biological effects of magnetic fields, static magnetic fields, radio frequency fields, gradient magnetic fields. Pre-requisite: Medical Imaging System I

218 458 Biomedical Safety **(2: 0: 2,2)**

Introduction to the types of hazards in hospitals and clinics, electrical hazards safety requirements of power distribution in hospitals, biological, safety codes and standards for biomedical equipments and facilities, test instruments for checking safety parameters of medical instruments. Pre-requisite: Medical Instrumentation II

210 400 Engineering Training: 4Cr. Hrs

Pre-requisite: Approval of Academic Advisor

218 512 Physiological Modeling and Control **(2: 2: 0,3)**

Physiological modeling, static analysis of physiological systems, time domain analysis, frequency domain analysis, stability analysis. Pre-requisite: Human Physiology II

218 518 Tissue Engineering **(3: 0: 0, 3)**

Tissue engineering principles, cell, Intracellular signaling, control of cell growth, scaffolds, cell traction and migration, tissue regeneration and replacement, artificial organs, orthopedic tissue engineering, bioreactors and bio expansion. Pre-requisite: Biomaterials

218 511 Artificial Organs **(3: 0: 0, 3)**

Major types of artificial organs, artificial blood. artificial skin and dermal equivalents. artificial pancreas. Prosthetics and orthotics; artificial limbs, major joint implants, dental implants. Pre-requisite: Human Physiology II

218 515 Bio-fluid Mechanics **(3: 0: 0, 3)**

Fundamentals of fluid mechanics. Flow properties of blood, applications describing flow of air in the airways and flow of blood in large arteries. Pre-requisite: Biomechanics

218 513 IT and Computer Networks in Health-care **(2: 2: 0,3)**

Types and classification of computer networks, networks topology and wiring type, OSI layering model, design process of computer network, hospital information system, and modern application of computer networks in health-care. Pre-requisite: Microprocessors and Computer Interfacing

218 514 Rehabilitation Engineering (3: 0: 0, 3)

Introduction to rehabilitation engineering, disability, rehabilitation engineering technology, assistive devices, physiological and biomedical measurement techniques, disability assessment, application of rehabilitation engineering, prosthetics and orthotics. Pre-requisite: Medical Instrumentation I

218 516 Artificial Neural Networks and Fuzzy Logic (3: 0: 0,3)

Fuzzy logic fundamentals, fuzzy sets, types of membership functions, linguistic variables, creation of fuzzy logic rule base, fuzzy logic operations, neural network fundamentals, neural type learning process, single layer perception, artificial neural networks architectures, training algorithms, genetic algorithms and evolution computing, neuro-fuzzy technology, fuzzy control systems and applications related to biomedical engineering. Pre-requisite: Engineering Mathematics I

218 517 Biomedical Image Processing (2: 2: 0,3)

Digital image fundamentals, image transforms image enhancement, image restoration, image segmentation, representation and description, recognition and interpretation, image compression. Pre-requisite: Signals and Systems