

Brief course descriptions for BME website

Course ID/Code	BIOEN 312					
Course Name	Foundation of Biomechanics					
Course Description	This course provides a background in musculoskeletal anatomy and principles of biomechanics. The course builds on the concepts gained in Statics and Dynamics for human activities from inside , and biology and biochemistry from the other side. Topics include: Introduction about biomechanics and solving biomechanical problems. Modeling human performance (static, quasi-static, and dynamic approaches). The overall loading of the musculoskeletal system during functional activities. Methods of estimation of forces in the joints and muscles and evaluation of the endurance of human tissues under traumatic loading conditions. The course includes basic experiments of biomechanics (testing the mechanical properties of biological tissues)					
Credit Hours	Theory	Practical/Laboratory	Lecture	Studio	Contact Hours	Pre-requisite
2	-	-	2	-	2	BIOEN 341: Biology for Engineers

Course ID/Code	BIOEN 432					
Course Name	Biomedical Instrumentation Design					
Course Description	This course introduces the students to the basic design concept required to acquire, process and interpret biological and medically relevant signals. Emphasis is placed on recognizing and accommodating limitations inherent in sensor and their associated electronics. Topics include: design of biomedical instrumentation including different sensor types and their associated electronics. Mathematical models of sensor ranging including resistive sensors and biosensors. The design of the signal conditioning electronics. Practical application on specific cases where students will be able to demonstrate their skills on evaluating a biomedical instruments using MATLAB/LabVIEW/Multisim software.					
Credit Hours	Theory	Practical/Laboratory	Lecture	Studio	Contact Hours	Pre-requisite
3	-	2	2	-	4	BIOEN 431: Signals and Systems in BME

Course ID/Code	BIOEN 452					
Course Name	Safety and Maintenance in Healthcare					
Course Description	A study of codes, standards, and management principles. Emphasis is on the proper use and application of safety test equipment, preventive maintenance procedures, hospital safety. Course topics include: Definition of safety. Electrical, gas, and fire safety. Safe environment for patients, medical personnel and attendants. Medical Equipment life cycle (Planning, Acquisition, Test, Maintenance, Decommissioning). Generation of a computer database for equipment, suppliers, dealers and manufacturers (Medical Equipment Record MER). Using Medical Equipment service manual. Preventive maintenance procedures. Corrective maintenance, repair and amendment of existing equipment. Basic troubleshooting principles.					
Credit Hours	Theory	Practical/Laboratory	Lecture	Studio	Contact Hours	Pre-requisite
2	-	-	2	-	2	-

Course ID/Code	BIOEN 462					
Course Name	Biomedical Equipment					
Course Description	The course focuses on studying the structure, operation, clinical needs, associated abnormal physiology, biocompatibility, and mathematical modelling of several biomedical equipments including; electrocardiograph, pacemakers, external defibrillators, cardioverters, heart valves, ventilators, and pulse oximetry. Also, the course covers equipment's key features from engineering standards.					
Credit Hours	Theory	Practical/Laboratory	Lecture	Studio	Contact Hours	Pre-requisite
4	-	2	3	-	5	BIOEN 431: Biomedical Electronics & Measurement

Course ID/Code	BIOEN 511					
Course Name	Project Management					
Course Description	Explanation of the Project Management principles and main tools through the example of a simple four phases Project Life Cycle. The course is compliant with Project Management Institute standard.					
Credit Hours	Theory	Practical/Laboratory	Lecture	Studio	Contact Hours	Pre-requisite
1	-	-	1	-	1	-

Course ID/Code	BIOEN 521					
Course Name	Design of Medical Devices					
Course Description	This multidisciplinary problem based learning module is design to bridge the technical knowledge with the broader practical design and commercial challenges and aims to advance the students' knowledge and skills in the area of medical device design through case studies. It will enable students to develop a critical understanding and awareness of effective implementation strategies for new and emerging technologies utilizing the appropriate design routes.					
Credit Hours	Theory	Practical/Laboratory	Lecture	Studio	Contact Hours	Pre-requisite
2	-	2	1	-	3	BIOEN 432: Biomedical Instrumentation Design

Course ID/Code	BIOEN 531					
Course Name	Senior Design Projects I					
Course Description	Official Description inside the Program: Individual research in a field of special interest under the supervision of a faculty member as a requirement for the B.Sc. degree, culminating in a written report/thesis. The central goal of which is a substantive paper or written report containing significant analysis and interpretation of a previously approved topic. The Graduation Project is divided between two semesters. Methodology is developed and pre-data are collected in the first semester. Experiment is run, data is analyzed, and conclusions are sought in the second semester.					
Credit Hours	Theory	Practical/Laboratory	Lecture	Studio	Contact Hours	Pre-requisite
2	-	-	-	-	4	HUMN 402

Course ID/Code	BIOEN 532					
Course Name	Senior Design Project II					
Course Description	Official Description inside the Program: Individual research in a field of special interest under the supervision of a faculty member as a requirement for the B.Sc. degree, culminating in a written report/thesis. The central goal of which is a substantive paper or written report containing significant analysis and interpretation of a previously approved topic. The Graduation Project is divided between two semesters. Methodology is developed and pre-data are collected in the first semester. Experiment is run, data is analyzed, and conclusions are sought in the second semester.					

Credit Hours	Theory	Practical/Laboratory	Lecture	Studio	Contact Hours	Pre-requisite
4	-	-	-	-	8	BIOEN 531

Course ID/Code	BIOEN 563					
Course Name	Medical Image Processing & Communication					
Course Description	This course provides students with an overview of computational and mathematical aspects of medical image processing and communication. Students will learn the fundamentals behind image processing and analysis methods and algorithms with an emphasis on biomedical applications. It covers principles and algorithms for processing both deterministic and random signals presented in images. Topics include filtering, coding, feature extraction and modeling. The focus of the course is a series of labs and home works that provide practical experience in processing of real medical images using MATLAB.					
Credit Hours	Theory	Practical/Laboratory	Lecture	Studio	Contact Hours	Pre-requisite
3	-	2	2	-	4	Department consent

Course ID/Code	BIOEN 573					
Course Name	Magnetic Resonance Imaging					
Course Description	Introduces physics of magnetic resonance. Principles and technological implementation of MRI. Image formation, acquisition and processing - Hardware/Instrumentation - Functional MRI - Included are special applications in some contemporary issues like RF safety aspects.					
Credit Hours	Theory	Practical/Laboratory	Lecture	Studio	Contact Hours	Pre-requisite
3	-	2	2	-	4	Instrumentation course

Course ID/Code	BIOEN 421					
Course Name	Biomaterials					
Course Description	In this course, the students learn the fundamental instruction on the methods and rationales used in characterization of materials used in the biomedical engineering field with emphasis on biomedical implant fabrication. Topics include an overview of biomaterials: metals (e.g. Stainless steel, Co-based alloys), ceramics (e.g. Glass ceramics), and polymers (e.g. silicon rubbers). Selection, processing, Testing (in vitro and in vivo) and properties relations of biomaterials.					

	Biomaterials used in medical applications (e.g. tissue replacement, absorbable and non-absorbable sutures). Tissue, body, and blood response to implants (biocompatibility). The interactions between the implant material and the physiological environment. Overview of specific use of biomaterials in dental, orthopedic and ophthalmic applications.					
Credit Hours	Theory	Practical/Laboratory	Lecture	Studio	Contact Hours	Pre-requisite
2	-	-	2	-	2	BIOL 341: Biology for Engineers

Course ID/Code	BIOEN 461					
Course Name	Signals and Systems in BME					
Course Description	This course serves to introduce the students to fundamentals of signal and systems analysis and manipulation and their application in the medical field. This course also reinforces mathematical knowledge in differential calculus and adding universal quantitative analysis tools such as Fourier analysis. The course topics include: Laplace transforms, Fourier (series & integral) transforms, convolution and the response of linear systems, frequency response, Bode diagrams and Polar Plots. Sampling, Discrete-time signals; 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. Includes laboratory and computational experiences with biomedical applications.					
Credit Hours	Theory	Practical/Laboratory	Lecture	Studio	Contact Hours	Pre-requisite
3	-	2	2	-	4	ENG 322: Electronic Devices and Circuits

Course ID/Code	BIOEN 513					
Course Name	Biomedical Digital Signal Processing					
Course Description	The aim of this course is to provide students with a background and understanding of the biomedical digital signal processing. Moreover, a broad overview of state-of-the-art topics and cutting-edge research in the area of digital signal processing in medicine and biology will be presented.					
Credit Hours	Theory	Practical/Laboratory	Lecture	Studio	Contact Hours	Pre-requisite

3	-	2	2	-	4	Department consent
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Course ID/Code	BIOEN 504					
Course Name	Introduction to Biomedical Optics					
Course Description	The aim of this course is to provide students with a background and understanding of the fundamentals of optical engineering and to expose them to some exciting current research in this field. The propagation of light in tissue, optical components, fluorescence, Raman, two-photon, spectral microscopy, and confocal microscopy, polarization in tissue, and spectroscopy will be studied. Moreover, a broad overview of state-of-the-art topics and cutting-edge research in the area of optics and lasers in medicine and biology will be presented.					
Credit Hours	Theory	Practical/Laboratory	Lecture	Studio	Contact Hours	Pre-requisite
3	-	-	3	-	3	Department consent

Course ID/Code	BIOEN 585					
Course Name	Medical Laser					
Course Description	Basics: Fundamentals of light, laser terminology, specular and diffuse reflections, laser output and types. Laser in healthcare: Medical laser delivery devices, laser bio-effects on the eye and skin, medical surveillance, anesthesia practices and controls, surgical smoke, medical laser standards and regulations. Laser Safety: Medical safety control measures and practices, laser hazard classification, Maximum Permissible Exposure (MPE) and Nominal Hazard Zone (NHZ), laser accidents.					
Credit Hours	Theory	Practical/Laboratory	Lecture	Studio	Contact Hours	Pre-requisite
3	-	2	2	-	4	Department consent

Course ID/Code	BIOEN 553					
Course Name	Biomedical Imaging Systems					
Course Description	The course introduces students to the basic physics and instrumentation concepts of main biomedical imaging modalities such as X- Ray, Radiography, Computed Tomography, Ultrasound and Magnetic Resonance Imaging (MRI). Student will learn the fundamental concept of radiation and image formation processes along with the safety issues of different imaging modalities. The focus of the course is a					

	series of labs using PHYWE training units and Gate 4 simulation software and home works that will enable students to perform useful biomedical imaging experiments that in turns not only will help them to understand the principle of imaging systems but also will familiarize them with basic parameters that matter most for clinical applications.					
Credit Hours	Theory	Practical/Laboratory	Lecture	Studio	Contact Hours	Pre-requisite
3	-	2	2	-	4	Department consent

Course ID/Code	ENG 322					
Course Name	Electronic Device & Circuits					
Course Description	Electronic Device & Circuits cover a wide range of topics including, Introduction to Semiconductors, Diode Circuits, Bipolar junction Transistor, Transistor Bias Circuits, Bipolar Junction Transistor Amplifier, Field Effect Transistor, Multistage Amplifier, Differential Amplifier and Frequency response .					
Credit Hours	Theory	Practical/Laboratory	Lecture	Studio	Contact Hours	Pre-requisite
3	-	2	2	-	4	ENG 331: Electrical Circuits

Course ID/Code	BIOEN 541					
Course Name	Control Systems in BME					
Course Description	Introduction to analysis and design of feedback control systems, Classical control theory in the time and frequency domain, Modeling of physical and biological information systems using linear and nonlinear differential equations, Stability and performance of interconnected systems, Use of block diagrams, Bode plots, Nyquist criterion, and Design of feedback controllers.					
Credit Hours	Theory	Practical/Laboratory	Lecture	Studio	Contact Hours	Pre-requisite
3	-	2	2	-	4	ENG 331: Electrical Circuits

Course ID/Code	BIOEN 432					
Course Name	Biomedical Electronics & Measurement					
Course	Understanding measurement error and uncertainty, Understanding the static and					

Description	dynamic characteristics of measurement system, General Design Criteria and Process of Medical Instrument, Showing an appreciation for the basic electronic techniques for reducing noise and enhancing measurement fidelity, Introduces the principles that allow engineers to make precise measurements of physiological signals, How to determine the filtering properties of a circuit, The course topics also include: Physiological signals, origin of biopotentials (ECG, EMG, EEG, EOG, ERG...), Biomedical electrodes. Biomedical signal detection, amplifications, and filtering, Electrical safety in medical environment.					
Credit Hours	Theory	Practical/Laboratory	Lecture	Studio	Contact Hours	Pre-requisite
3	-	2	2	-	4	ENG 322: Electronic Devices and Circuit Theory