Syrian Arab Republic

Damascus University

Faculty of Mechanical and Electrical Engineering

Biomedical Engineering Department

ENGLISH TRANSLATION OF THE SYLLABUS OF THE BIOMEDICAL ENGINEERING DEPARTMENT

The syllabus of Physics (1)course, first year, Biomedical Engineering, first term (4 theoretical weekly hours):

Course Content:

1. **Light:** **Principal concepts:** light nature, Fermat's principle, Huygens principle, principles of light measurement and the units of measurement. **Geometrical light:** mirrors, spherical refractors, parallel plates, prisms, thin lenses. **Physical light: Polarization**: semi-wave andquarter-wave plates. **Interference**: young's double-slits,interference in multi-point source equally distant.**Diffraction**: diffraction in rectangular slit or tiny wires, diffraction grids.**Fiber optics:** Working method, types, properties, applications.
2. **Temperature and its properties: Introduction to temperature:**equation of status, kinetic theory of gases.States of matter and parameters of status.Zero law of thermodynamics. The first principle of thermodynamics. Heat transfer. Thermal characteristics. The effect of temperature change in recruitment of electronic items.
3. **Vibrations and Waves:**Seismic movements, simple harmonic motion, the installation of two harmonic movements. **Accidental waves:** wave equation, the energy carried by the wave, waves overlay, stable waves and responding. **Sound:** The sound intensity, gradient, the spread speed of sound in the material, Doppler phenomenon.

The syllabus of Physics (2) course, first year, Biomedical Engineering, second term (2 theoretical weekly hours):

Course Content:

1. **Modern physics: Special relativity theory:** Einstein's two postulates, time-expansion and distance-contraction, relative propagation and relative energy.
   Quantization: black body radiation, photo-electric reaction, Compton's reaction, Bohr's model, uncertainty principle. **Nuclear physics:**nuclear reaction, decay laws and methods, fission and fusion.
2. **Static Electricity:** Electric field, Coulomb's law, Gauss law and field evaluations,conductors and insulators.
3. **SemiconductorsPhysics:**types of semiconductors, holes, active mass. **Conducting methods:** direct conducting, diffusion, charge carriers generating and reunifying, PN junction in semiconductors.

4. **Laser:Interaction of light with matter:**placement distribution of atoms, Einstein equations, principles of laser devices, Laser application in medical field.

The Syllabus of Mathematics (1) course, first year, Biomedical Engineering, first term (4 Theoretical + 2 practical= 6 hours weekly):

Course Content:

1. **Linear algebra:** algebraic polynomials, vector space, matrices, determinants, linear equation system, eigenvalues and eigenvectors, advanced quadratic equations.
2. **Mathematic analysis: introduction to mathematic analysis:** numerical sets and real numbers, Cartesian and polar coordinates in plane, numerical sequences, real functions of one variable, limit and continuity of function, elementary functions.**Complex number field.Differential evaluation of real function of one variable:** derivation and differentiation, essential theorems in differentiation, indefinite cases and removal methods, L'Hopital's rule, functions behavior analysis and plotting, Cartesian, polar and parametric function plotting. **Transcendental Curves. Numerical series:** positive bound series convergence tests,qualitative series,alternating series and Leibnitz test, absolute convergence and conditional convergence.**Functionalseriesand sequences:** point convergence and normal convergence, power series, Taylor and McLaurin power series.

The Syllabus of Mathematics (2) course, first year, Biomedical Engineering, second term (4 Theoretical + 2 practical = 6 hours weekly):

Course Content:

1. **Calculus: Indefinite integral:** primitive function, principles of integration, integration methods.**Definite integral and its application:** definite integral as a function of the greaterbound, derivative of definite integral, relationship between definite integral and indefinite integral.Improper integralsof the first and second types.**Engineering and physical applications of definite integrals, numerical methods of definite integral evaluation.**

2. **Real functions of more than one variable:**Limits and derivatives, partial derivatives, exact differential, Taylor's expansion, Minima and Maxima valuesand Lagrange method.
3. **Differential equations:Ordinary differential equations of 1st rank and 1st degree:** variable-separable equation, homogenous equations, linear equations, exact equation and integration coefficients, initial value problem, Cauchy's problem solution using power series.**Ordinary linear differential equations of higher ranks and constant coefficients:** differential operators, Lagrange method, inverse differential operator and particular solution evaluation.**Linear differential equation system of constant coefficients**. **Approximation methods to solve ordinary differential equations**: Euler method and Runge Kota method, sequential derivation method and sequential approximation method for solving (n) rankfor derivative differential equation.

The Syllabus of Mathematics (3) course, secondyear, Biomedical Engineering, first term (4 Theoretical + 2 practical = 6 hours weekly):

Course Content:

1. **Analytic geometry in space:** vector algebra, vector functionsof one variable or more, coordinate systems in space, curvilinear coordinates. Surface and curves in space: plane, straight line, second degree surfaces in space, geometric properties of space curve, geometric properties of space surface.
2. **Multivariable integrals:** double integral and its application, triple integral and its applications, surface integral and its applications, line integral and its applications, improper multivariable integrals.
3. **Vector analysis:** scalar field and vector field, vector derivatives of first and second order, the DEL operator, gradient, divergence, curl, potential vector field, **vector integrals:** ordinary vector integrals, linear vector integrals, work and circulation, vector integral on closed surface, vector function flux, volume integral of vector functions, gauss's theorem, stokes theorem, green theorem.
4. **Numerical analysis:** mathematical modeling and using computer in solving scientific issues, error analysis. Solving nonlinear equation. Methods of solving algebraic equations. Interpolation and functions' approximation. Numerical disciples to solve differential equations. Numerical methods for calculating integrative. Linear programming.

The Syllabus of Mathematics (4) course, secondyear, Biomedical Engineering, second term (4 Theoretical + 2 practical = 6 hours weekly):

Course Content:

1. **Complex analysis:complex variables and complex functions**: complex point sets and complex number representation, limit, derivative and continuity of a complex function, analytic functions, singular points, elementary complex functions, complex integrals, Cauchy's integral theorem and formulas. **Complex series:** Taylor's expansion, Laurent expansion, classification of singularities. **Residues theorem:** evaluation of complex integral using residues theorem, evaluation of real-definite integrals using residues theorem. **Mappings and its representation:** complex mapping and function, analytic function representation, conformal mapping, general conformal mappings.
2. **Fourier series and integral:**trigonometric series, complex form of Fourier series,harmonic analysis, Fourier integral, generalized Fourier series.**Special functions:** Gamma function, Beta function, errorfunction, Fresnel function, sine and cosine integrals, Bessel functions of first and second sort, Legendre's polynomials**.**
3. **Laplace transform and its applications:**Laplace transform, inversion of Laplace transform, Laplace transform of some special functions, Laplace transform applications, relationship between Fourier integral and Laplace transform, Z transform.
4. **Partial differential equations:** partial differential equations with direct integral ability, partial differential equation of the first order, partial differential equations of high orders with two independent variables and constant coefficients, vibrating string wave equation, two-dimensional heat transfer equation, circular membrane and Bessel equation.

Syllabus ofthe subjects supervised by department of Computers and Automation in the Biomedical Engineering Department:

Introduction to computer and programing: "in all departments of the college":

Computer usage. Components of computer system. Data representation using computer. Computer architecture. Computer peripheral units. Computer networks. Computer software. Ethics of computer science. Internet, windows OS and application implementation. Introduction to Algorithms.

Programming (1): "in all departments of the college":

C++ program structure. Variables and constant. Programming expressions and statements. Arithmetic andlogicalexpressions. Comments. Control techniques. Function declaration and calling. Introduction to classes. Arrays. Character arrays and strings.

Programming (2): "in all departments of the college":

Pointers. Classes and data abstraction. Overloading. Inheritance. Input/output operations, dealing with files.

Microprocessors and its systems in Electronics and Communications Engineering departments and Computer and Automation Engineering, Microprocessors and its applications in the Biomedical Engineering department:

Basic concepts in microprocessors. Historical overview of microprocessors development and technologies, Architecture and programming of 8-bit microprocessors. Architecture and programming of 16-bit microprocessors. Peripheral circuit function and interfacing techniques with microprocessors. Architecture and programming of 32-bit microprocessors, development perspectives of microprocessors.

Communications engineering principals in Computers and Automation Engineering department:

spectral analysis of signals, random signals and noise, the analog amendment and detection, sampling and adjustment pulsed analog, Delta Digital amendment ASK, PSK, FSK, multi-level M-ary digital amendment, filters, transmission lines, optical communications .

Syrian Arab Republic

Damascus University

Faculty of Mechanical and Electrical Engineering

Biomedical Engineering Department

Subjects of first year- Mechanical Design
Engineering Department

First: Geometric Drawing /1/ (1 theoretical +4 practical hours)

Engineering constructions necessary in the drawing and engineering materials, Watershed objects engineering by the way the global projection, parts of engineering objects and training to draw projections after cutting, screw stems, perspective, general exercises.

Second: Specialized workshops: (4 practical hours)

Turnery settlement and plumbing workshop, models workshop, electrical workshop, electrical wiring, auto electrical workshop, plates and welding workshop.

Third: Materials science and properties (2 theoretical +2 practical hours)

Material structure, crystallization, metal alloys, structure of matter testing, test expose the flaws of the material, mechanic tests of materials, materials corrode, iron and steel, non-ironic minerals, composed materials, ceramics materials on numeric and structural usage, best choice in selecting materials for manufacturing engineering parts.

Damascus University

Faculty of Mechanical and Electrical Engineering

Biomedical Engineering Department

Course name	**Biochemistry**			
Year	First			
Department	**Biomedical Engineering**			
Academic term	First			
Hours	Theoretical	3	Practical	3

Course Subjects

Chapter	Subjects
1	Life logic: general overview on biochemistry
2	Thermodynamic in biochemistry
3	Protein basic units: amino acids, Peptide and Polypeptides
4	Proteins three dimension structure
5	Proteins multifunction in bio systems
6	Vitamins and coenzyme and catalysts
7	Bio mediation and Enzymatic Reaction Mechanisms
8	Immunoglobulin
9	Antibiotics basic structures
10	Glycoproteins and Carbohydrates and their role in the cell wall
11	Lipids and membranes of cell
12	Genetic code: nuclear basis and Nucleotides
13	Introduction to genetic code: DNA and nuclear protein
14	Protein biosynthesis and few applied operations
Tutor	**Dr. Abdulmunem Razok**

Damascus University
Faculty of Mechanical and Electrical Engineering
Electrical power Engineering

Syllabus of Principles of Electrical Engineering-second year-Biomedical Engineering second term

(4+2 hours).

First section:static electricity:

- Static electric field and its forms.
- Coulomb electrical relation.
- The principle of accumulation in the electric field.
- The electric Static incitement.
- The flow of static electric field.
- Resident electrical potential.
- Static electric polarization.
- Electrical capacities theories and types of electrical capacitors.
- Charging and discharging electric capacitor.
- The capacity stored in Static electrical field and the density of stored capacity.

Second section: Moving Electricity (direct current):

- Its definition, density calculation, and density.
- Electrical resistance and conductors.
- Ohm's Law and its applications.
- Serial connection and its applications.
- Parallel connection and its applications.
- Star and delta connection.
- Kirchhoff's laws.
- Capacity rings method.
- Voltage potential difference.
- The principle of accumulation.
- Equivalent tension generation method.
- Equivalent current generation method.

Third section: magnetism and electromagnetism:

- Magnetic field and its forms.
- BioSavar-Laplace relation.
- The calculation of magnetic fields according to BioSavar-Laplace relation.
- Magnetic polarization.
- The magnetic circuits' law and calculation of magnetic fields.
- Theories and principles used in magnetic circuits.

- The similarity between the magnetic circuits and electric circuits.
- Electromagnetic incitement.
- The principle of generating AC capacity.
- Electromagnetic self-incitement.
- Electromagnetic mutual-incitement.
- Theories of equivalent coils in the electromagnetic circuit.
- The unstable situation in incitement circuit.
- Capacity stored in the incitement circuit.
- Electromagnetic force effective in Electromagnetic field.

Syrian Arab Republic

Damascus University

Faculty of Mechanical and Electrical Engineering

Biomedical Engineering Department

Thermodynamics /1/

Concepts and background information, the operating body and basic properties, the first law of thermodynamics, the physical processes

of the changing state of gas (when gas is confined within the physical boundaries), the second law of thermodynamics, Gas forces cycles.

Syrian Arab Republic

Damascus University

Faculty of Mechanical and Electrical Engineering

The subjects supervised by the General Mechanical Department in the Department of Electrical Power Engineering

Mechanical engineering (Balance)

Introduction to Mechanical Engineering. The basics of the balance of solid body in the plane, friction, diagrammatic static and methods of calculating space frames, a group of space forces, the center of parallel forces, center of masses.

Syrian Arab Republic

Damascus University

Faculty of Mechanical and Electrical Engineering

Automatic control , fourthyear, Biomedical Engineering, first term :

Concept of block diagram, functions characteristics of feature models, mathematical response according to experimental functions of input signal, functions of transformation of linear control systems and methods of analyzing its transient and stable systems, polar diagram and logarithmic representation of frequency response (bode), stability indications of linear control system.

Syrian Arab Republic

Damascus University

Faculty of Mechanical and Electrical Engineering

Biomedical Engineering Department

The Syllabus of Electronic (1), second year in Biomedical Engineering Department:

1- Introduction to Semiconductors.
2- P-N junction diode – Zener junction diode.
3- Field Effect Transistors FET, BJT-DC, AC.
4- Field Effect Transistors FET, BJT as Switch.
5- Negative resistance devices.
6- Optoelectronics LED-PH.D-SOLAR.CELL-OCI.

Syrian Arab Republic

Damascus University

Faculty of Mechanical and Electrical Engineering

Biomedical Engineering Department

Course	**Biomechanics Fluids**			
Year	Second			
Department	**Biomedical Engineering**			
Academic term	Second			
Hours	Theoretical	4	Practical	2
Course purpose	To study the mechanical and physical properties of fluidsand the movement and mechanics of bio-fluids.			
Course curriculum	None - a notebook for biomechanics Fluids is dispensed to students of medical engineering,			
References that students mayrefer to:	- John_K_J_Li. Dynamics of the vascular system. - Nielsen, J, bio reaction engineering principles. - Fung.y.c. circulation 1.system association for heart diseases and surgery. - Lee, weand fine, j applied the massage connection.			

Course Subjects

Chapter	**Main titles**	**Subtitles**	**Lectures per chapter**
1	Fluidscharacteristics	1. Fluids classification. 2. Dimensions and units used in Fluids mechanics. 3. Physical and chemical values peculiar to Fluids. 4. Gases general equation. 5. Solved and unsolved practical problems.	**3**
2	Fluids balance	1. Pressure-Pascal's law. 2. Hydrostatic equation for gases and Fluids balance. 3. Pressure forces affecting vessel walls. 4. Solved and unsolved practical problems.	**3**
3	Flow basics	1. Current line current pipe. 2. Classification of flow. 3. Reynolds number. 4. Flow of Compressible and Incompressible prefect Solved and unsolved practical problems.	**3**

		5. Fluids circulation and hurricanes formation. 6. Solved and unsolved practical problems.	
4	One dimension flow-mechanism of conserving flowproperties	1. Continue Equation. 2. Bernoulli's equation. 3, Boazhoyl's law. 4. Conservation of momentum. 5. Solved and unsolved practical problems.	**4**
5	Blood dynamics	1. Mechanics of bio-fluids, physical concept (mass-length-time-variables reorientation). 2. Mechanism of heart and blood vessels (artery and veins). 3. Heart physiology and blood vessels (blood). 4. Types of vessel. 5. Artery system and veins system.	**4**
6	Flow in the heartand blood vessels	1. Flow in the solid and flexible vessels. 2. Pulsate flow. 3. Cardiac output.	**2**
7	Heart valves	1. Mechanisms of valves. 2. Types of valves. 3. Pressure changes through heart valve opening. 4. Wastes in valve. 5. Properties of perfect valve**.**	**2**
8	Respiratorysystem andmechanisms oflungs	1. Lung and breathing mechanism. 2. Lungs cycle. 3. Air flow. 4. Applications of pressure measurement in lungs-Respiratorysystem. 5. Measurement of air flow in lungs.	**3**
Tutors	**Dr. En. Michele Yousef - Dr. En. Safaa Sarakbi**		

Syrian Arab Republic

Damascus University

Faculty of Mechanical and Electrical Engineering

Biomedical Engineering Department

Course	**Principles of Medical Engineering**

Year	Second			
Department	**Biomedical Engineering**			
Academic term	First			
Hours	Theoretical	2	Practical	2
Course purpose	This course is an introduction to biomedical engineering, the studentsare taught to utilize the basic principles of engineering skills to solve medical and biomedical problems, It introduces students with forms of power and biomedical signals that are generated by the human body and affect it. It also introduces different branches of traditional biomedical engineering in a simple way such as: medical equipment and its design safety issues in medical engineering and hospitals engineering in addition to information systems in medicine. This course aims at facilitating the student's understanding in all fields of biomedical engineering so that he/she is able to comprehend and estimate the nature of biomedical engineering in all its different and intertwining fields.			
Course curriculum	None - a notebook for Principles of Medical Engineering is dispensed to students of medical engineering.			
References thatstudents may refer to:	• J. D. Bronzino, (2000) the biomedical engineering handbook. 2nd edition, CRC Press LLC, USA. • CRC Press-biomedical technology and equipment handbook. • John D. Enderle et al, introduction to biomedical engineering. • Cromwell, L, (2007) biomedical instrumentation and measurements. • Role of modem application trends in managing hospitals, Cairo. Egypt 2004. (Arabic book). • Electrical medical equipments: simplified entrance and headlines for medical professionals, Dar Tlas, Damascus, Syria 1994 (Arabic book).			

Course Subjects

Chapter	main titles	subtitles	Lecturesperchapter
1	Definition of medical engineering	**A-** What is medical engineering. **B-** Definition of medical engineering. **C-** Medical engineering specialization. **D-** Medical engineering field of	

		work. **E-** Medical engineering in the field of diagnosis and therapy. **F-** Party related to medical engineering.	
2	Human as an electricpower generator	A- Definition of electric power from engineering point of view. B- Mechanism of generating bioelectric signal (electric power from medical view). C- Bioelectric signal detection mechanism. D- Utilizing electric power in field of diagnosis and therapy. E- Diagnosis and therapy equipment (detecting and explaining bio-signals, definition of Electroencephalograph, field of use).	
3	Human as a thermalenergy generator	**A-** Definition of thermal power from engineering point of view. **B-** Thermal power from medical view and points of measuring temperature. **C-** Diagnosis therapy equipment. **D-** Types of body thermometers. **E-** Thermal transmission methods. **F-** Breathing average measurement. **G-** Mutual influence between thermal power and biomaterials.	
4	Pressuremeasurementmethods	**A-** Body blood pressure management. **B-** Types of pressure measurement equipment. **C-** Necessary conditions to measure blood pressure.	
5	Human as a sonicpower generator	**A-** Theoretical study of sonic waves: (classification types of waves, frequency). **B-** Medical study of sound: (human ear, aural system). **C-** Diagnosis equipment using	

		sonic waves (mechanism of exposing heart sounds, pulse and hearing measurement). **D-** Therapy equipment using sonic waves (hearing aid equipment). **E-** Theoretical study of ultrasonic waves. **F-** Doppler Effect and extracting Doppler frequency. **G-** Expose and generate ultrasonic waves and types of transmission waves. **H-** Ultrasonic imaging equipment. **I-** Fields of using ultrasonic waves in medicine.	
6	Electromagnetic radiations	A- Key concepts of electromagnetic radiations (engineering theoretical study). B- Electromagnetic flow. C- Atom energy radiation. D- Magnetic power and nuclear magnetic moment. E- Flow measurement using electromagnetic waves. F- Using electromagnetic radiation in diagnosis (radiation generation mechanism, the mechanisms of X-ray and CT scan.... etc.). G- Using electromagnetic radiation in therapy (Cobalt therapy). H- Nuclear medicine. I- Mechanism of imaging blood circulation. J- Magnetic resonance imaging (MRI). K- Mutual influence between magnetic power and biomaterials.	

		L- Ultraviolet ray: (method of generating ultraviolet ray and its applications in medicine.	
7	Human as mechanic power generator	**A-** Engineering study of mechanical power: (properties and key specifications). **B-** Medical study of mechanical power: (inhaling and exhaling, muscles movement for a certain effort). **C-** Types of mechanical power (kinetic energy, latent energy and effecting factors). **D-** Friction power. **E-** Factors affecting latent power. **F-** Mutual influence between mechanical power and biomaterials. **G-** Using mechanic power in diagnosis and therapy. **H-** Applied problems on mechanic power.	
8	Luminous power	**A-** Engineering study of luminous power: (its definition, luminous alternators). **B-** Infrared ray: (its properties, ray source, infrared ray recorders). **C-** Using infrared ray. **D-** Mutual infrared between infrared waves and biomaterials. **E-** Equipment using luminous	

		principle (SP02. Spectrogram, etc....)	
9	Safety in medicalenvironment	A- General definitions. B- Types of risks. C- Physiological effects of electricity. D- Grounding. E- Major and minor shock. F- Basic principles for protection from shock and ensuring patient safety. G- Bio effects of X-ray. H- Safety and security when using radiation equipment.	
10	Hospitals engineering	**A-** Concept of medical engineer. **B-** Tasks of medical engineer inside the hospital. **C-** Key function of the medical engineering department in hospital. **D-** Hospital departments. **E-** Disposal of the wastes of the hospital and medical centers.	
11	Maintenance in hospital	**A-** Concept of maintenance. **B-** The importance of maintenance in medical establishments (hospitals). **C-** Targets of maintenance in hospitals. **D-** Standards and basics that should be considered when preparing programs in hospitals. **E-** Reasons for equipment malfunctions. **F-** Ways of executing	

		maintenance tasks in hospitals.	
12	Informatics in medicine	**A-** Information systems in hospitals. **B-** Patient's computerized files. **C-** Decision support center. **D-** Computer networks in the field of medical care. **E-** Patient's integrated databases. **F-** Network account. **G-** Medical terms.	
Tutors	**Dr.En. Rasha Masoud - Dr.En. Safaa Sarakbi**		

Syrian Arab Republic

Damascus University

Faculty of Mechanical and Electrical Engineering

Biomedical Engineering Department

Course	**Anatomy & Physiology**
Year	Second
Department	**Biomedical Engineering**
Academic term	Second

Hours	Theoretical	4	Practical	4
Course purpose				
Course curriculum	Anatomy & Physiology			
References that students mayrefer to:				
Courses related to this course				
Course Subjects				

Chapter	**subject**	**Subtitles**	**Lectures per chapter**
1	Introduction to human body		
2	Human body anatomy	- Head. - Neck. - Trunk. - Limbs.	
3	Muscles		
4	Bones		
5	Circulatory system physiology		
6	Respiratory system physiology		
7	Digestive system physiology		
8	Urinary and Genital system physiology		
9	Nervous and Endocrine system		
10	Motion physiology		

Tutor	

Syllabus of Anatomy & Physiology -second year- Biomedical Engineering second term (4+2 hours).

Introduction to human body**:**

Human body anatomy.

- Head.
- Neck.

- Trunk.
- Limbs.

Muscles.
Bones.
Circulatory system physiology.
Respiratory system physiology.
Digestive system physiology.
Urinary and Genital system physiology.
Nervous and Endocrine system.
Motion physiology.

Damascus University

Faculty of Mechanical and Electrical Engineering

Syllabus of Electrical Machines -Third year-Biomedical Engineering.

<u>First chapter:</u>Introduction to Electrical Machines:

- Classes of Electrical Machines.
- Nominal Data of Electrical Machines.
- Required Characteristics of Electrical Machines.
- Ampere Law in Electrical Machines.

- Magnet Principles of Electrical Machines.

<u>Second chapter:</u>DC Electrical Machines:

- The principle of DC Machine.
- Operation DC Machine as Generator or Motor.
- DC Generators.
- DC Motors.

<u>Third chapter:</u>AC Electrical Machines:

1. Electrical Transformers:
   Working principle, characteristics and types.
2. AC Electrical Motors:
   - Rotational Magnet Field in AC Machine.
   - Characteristics & Drive Methods of Synchronous Motors.
   - Three Phase Induction Motors

<u>Fourth chapter:</u>Special Electrical Machines:

- Permanent Magnet DC Motors.
- Brushless DC Motor.
- Reluctance Motors.
- Hysteresis Motors.
- Stepper Motors.

<u>Fifth chapter:</u>Servo Motors & Drives:

- Basic Servo Drive Circuit.
- Voltage & current circuit in servo systems.
- Bipolar Drive of Voltage &Current Controls.
- PWM Servo Drive.
- Speed Control Using Tachogenertor-Optical Encoder.

<u>Sixth chapter:</u>Technical-Economical Selection of Electrical Motors:

- Optimal Utilization of Electrical Motors.
- The eight criteria's of Electrical Motors operations.
- Calculation Inertia & Torques Equivalent at Axle.
- Three-Criteria'. Optimal Selection according to electromechanical conversion of Electrical Motors.
- Optimal Selection of Electrical Motors according to Mechanical Loads Nature.

Tutor: Dr. Mohammad Omar Ward.

Damascus University
Faculty of Mechanical and Electrical Engineering
Electrical Power Engineering

Syllabus of Electrical Circuits-Third Year-Biomedical Engineering

First term (4+2 Hours**)**

<u>First chapter:</u>introduction and reminder of Moving Electricity(direct current) circuits:

Basic definitions, basic relations of voltage and current, Ohm's Law Kirchhoff's Laws, voltage splitter, current splitter, star transform-delta transform.

<u>Second chapter:</u> single phase alternating current AC:

Definition of alternating current, generating alternating current, the average value of the
alternating current, the effective value of the alternating current.

<u>Third chapter:</u>circuits of single phase alternating current AC:

Sinusoidal representation in circuits of single phase alternating current AC, circuits with pure
ohm resistance, circuit with inductive, circuit with capacitance capacitor, serial circuit: circuit
with inductor and resistance, circuit with resistance and capacitor, circuit with inductor and
capacitor, parallel circuits: circuit with inductor and resistance, circuit with resistance and
capacitor, circuit with inductor and capacitor.

Solved and unsolved problems.

Vector representation in circuits of single phase alternating current AC:

Circuit with serial resistance, inductor and capacitor, circuit with parallel resistance. Inductor
and capacitor, Solved and unsolved problems.

Complex representation in circuits of single phase alternating current AC, complex
representation of the sinusoidal functions, calculating complex numbers, using complexrepresentation of the circuits of alternating current, circuits with serial resistance, inductor and capacitor, circuits with parallel resistance, inductor and capacitor, Solved and unsolved problems.

Converting circuits of alternating current to different forms:

Converting serial circuit to parallel and vice versa, using approximation in converting from
serial circuits to parallel and vice versa, converting from serial circuits to parallel and vice
versa graphically. Solved and unsolved problems.

The concept of power in signal phase alternating current, complex representation of electrical
power, compensating reactance power and improving power factor, full

elimination, partial
elimination. Solved and unsolved problems.

Methods of solving circuits of single phase alternating current laws and basic rules, mesh
current method (Maxwell's currents). Complex potential difference method (complex voltage).Solved and unsolved problems.

Electrical resonant at single-phase AC circuits:

Resonance in serial circuits, geometric solution to resistance of serial resonant circuit,
resonance in parallel circuits, geometric solution to permittivity of resonant parallel circuit,
comparison between serial and parallel circuits, resonance in mixed circuits. Solved and
unsolved problems.

Methods of solving single-phase AC circuits by using computer:

Operation on matrices (solution, multiplication, division inversion) Cartesian and polar
complex values, using applications in solving problems in alternating current.

<u>Fourth chapter:</u> quadric polarity:

Definition of quadric polarity, basic equations of quadric polarity, resistance equations,
permittivity equations, transmission equations, hybrid equations, symmetrical quadric
polarity, resistance peculiar to quadric polarity, primary resistance, subsidiary resistance,
positive resistance, specifying values of quadric polarity experimentally, diffusion functions
of symmetrical and nonsymmetrical quadric polarity, equivalent circuits to quadric polarity,
equivalent circuit T shaped, equivalent circuit TT shaped, accumulating quadric polarity:
serial, parallel, serial parallel, parallel serial, filters: definition of filters, its types and
calculation methods, active quadric polarity: its definition, types, equivalent circuits,
distinguished equations, its applications. Solved and unsolved problems.

<u>Fifth chapter:</u> three-phase linear electrical circuits:

Introduction

Star connection for three-phase sets, delta connection connecting for three-phase sets,
capacity in three-phase sets, multi-phase sets, two-phase sets, measuring capacity in three-
phase sets, by using three watts measure, tow watts measure, one watts measure, three-phase
unbalanced sets, symmetrical compounds of unbalanced sets, symmetrical compounds filters,
zero compounds filters, direct and reversed voltage compounds filters, capacity in unbalancedthree-phase sets, solved and unsolved problems.

Damascus University
Faculty of Mechanical and Electrical Engineering
Electrical Power Engineering

Syllabus of Electrical Circuits-Third Year-Biomedical Engineering

First chapter:introduction and reminder of direct current circuits:

1.1 Basic definitions.
1.2 Basic relations of voltage and current.
- 1.2.1 Ohm's Law.
- 1.2.2 Kirchhoff's Laws.
- 1.2.3 Voltage splitter.
- 1.2.4 Current splitter.
- 1.2.5 Star transform - delta transform.

Second chapter: single phase alternating current AC:

2.1 Definition of alternating current.

2.2Generating alternating current.
2.3The average value of the alternating current.
2.4The effective value of the alternating current.

<u>Third chapter:</u>circuits of single phase alternating current AC:

3.1 Sinusoidal representation in circuits of single phase alternating current AC.

3.1.1 Circuits with pure ohm resistance.
3.1.2 Circuit with inductive.
3.1.3 Circuit with capacitance capacitor.

3.1.4 Serial circuit:
- Circuit with inductor and resistance.
- Circuit with resistance and capacitor.
- Circuit with inductor and capacitor.

3.1.5 Parallel circuits:
- Circuit with inductor and resistance.
- Circuit with resistance and capacitor
- Circuit with inductor and capacitor.

3.1.6 Problems
- Solved problems.
- Unsolved problems.

3.2 Vector representation in circuits of single phase alternating current AC:

3.2.1 Circuit with serial resistance, inductor and capacitor.
3.2.2 Circuit with parallel resistance, inductor and capacitor.

3.2.3 Problems:
- Solved problems.
- Unsolved problems.

3.3 Complex representation in circuits of single phase alternating current AC

3.3.1 Complex representation of the sinusoidal functions.
3.3.2 Calculating complex numbers.

3.3.3 Using complexrepresentation of the circuits of alternating current.
3.3.3.1 Circuits with serial resistance, inductor and capacitor.
3.3.3.2 Circuits with parallel resistance, inductor and capacitor,

3.3.4 Problems:
- Solved problems.
- Unsolved problems.

3.4 Converting circuits of alternating current to different forms:

3.4.1 Converting serial circuit to parallel and vice versa.
3.4.2 Using approximation in converting from serial circuits to parallel and vice versa.
3.4.3 Converting from serial circuits to parallel and vice versa graphically.

3.4.4 Problems:
- Solved problems.
- Unsolved problems.

3.5 Power in signal phase alternating current:

3.5.1 The concept of power in signal phase alternating current.
3.5.2 Complex representation of electrical power
3.5.3 Compensating reactance power and improving power factor
3.5.3.1 Full elimination.
3.5.3.2 Partial elimination.

3.5.4 Problems:
- Solved problems.
- Unsolved problems.

3.6 Methods of solving circuits of single phase alternating:

3.6.1 Current laws and basic rules.
3.6.2 Mesh current method (Maxwell's currents).
3.6.3 Complex potential difference method (complex voltage).
3.6.4 Problems:
- Solved problems.
- Unsolved problems.

3.7 Electrical resonant at single-phase AC circuits:

3.7.1 Resonance in serial circuits.
3.7.2 Geometric solution to resistance of serial resonant circuit.
3.7.3 Resonance in parallel circuits.
3.7.4 Geometric solution to permittivity of resonant parallel circuit.
3.7.5 Comparison between serial and parallel circuits
3.7.6 Resonance in mixed circuits.
3.7.7 Problems:
- Solved problems.
- Unsolved problems.

3.8 Methods of solving single-phase AC circuits by using computer:

- 3.8.1 Operation on matrices (solution, multiplication, division inversion).
- 3.8.2 Cartesian and polar complex values.
- 3.8.3 Using applications in solving problems in alternating current.

Fourth chapter: Quadric polarity:

4.1 Definition of quadric polarity.

4.2 Basic equations of quadric polarity.

- 4.2.1 Resistance equations.
- 4.2.2 Permittivity equations.
- 4.2.3 Transmission equations.
- 4.2.4 Hybrid equations.

4.3 Symmetrical quadric polarity.

4.4 Resistance peculiar to quadric polarity.

- 4.4.1 Primary resistance.
- 4.4.2 Subsidiary resistance.
- 4.4.3 Positive resistance.

4.5 Specifying values of quadric polarity experimentally.

4.6 Diffusion functions of symmetrical and nonsymmetrical quadric polarity.

4.7 Equivalent circuits to quadric polarity.

- 4.7.1 Equivalent circuit T shaped.
- 4.7.2 Equivalent circuit TT shaped.

4.8 Accumulating quadric polarity:

- 4.8.1 Consecutively.
- 4.8.2 Serial.
- 4.8.3 Parallel.
- 4.8.4 Serial parallel.
- 4.8.5 Parallel serial.

4.9 Filters:

- 4.9.1 Definition of filters.
- 4.9.2 Its types and calculation methods.

4.10 Active quadric polarity:

4.10.1 Its definition.
4.10.2 Types.
4.10.3 Equivalent circuits.
4.10.4 Distinguished equations
4.10.5 Its applications.

4.11 Problems:
- Solved problems.
- Unsolved problems.

<u>Fifth chapter:</u> three-phase linear electrical circuits:

5.1 Introduction**.**
5.2 Star connection for three-phase sets.
5.3 Delta connection connecting for three-phase sets.
5.4 Capacity in three-phase sets.
5.5 Multi-phase sets.
5.6 Two-phase sets.

5.7 Measuring capacity in three-phase sets:
5.7.1 By using three watts measure.
5.7.2 Tow watts measure**.**
5.7.3 One watts measure.

5.8 Three-phase unbalanced sets.
5.8.1 Symmetrical compounds of unbalanced sets.
5.8.2 Symmetrical compounds filters**.**
5.8.2.1 Zero compounds filters**.**
5.8.2.2 Direct and reversed voltage compounds filters**.**
5.9 Capacity in unbalancedthree-phase sets.

5.10 Problems:
- Solved problems.
- Unsolved problems.

Damascus University
Faculty of Mechanical and Electrical Engineering
Electrical Power Engineering

Electromagnetic fields theory-third year- second term (2+4 Hours)

First chapter: vector analysis: introduction, numerical and vector values, coordination axis, gradient numerical value by difference of vector value and fragmentation theory, vector values circulation and Stokes' theory. Classifying vector fields, problems and reference questions.

Second chapter: electrostatic fields: introduction, Coulomb law and electrical field density, electric fields generating from continuous and spatially scattered charges, electric flow density, Gauss law, Maxwell equation, electric potential, equi-potential surfaces, potential and fields density of a system of point charges and superposition principle, electric field of gradient potential, transmitter and incitement charges, relation between power lines and equi-potential surfaces, field mapping, electric dipole, electric polarization and permeability coefficient, power and power density in static field, Gauss law applications, infinite linear charge and a pivot transmission line and a line of two parallel wires, problems, reference questions.

Third chapter: methods of solving problems of static field: introduction, properties of linear materials and homogenous and isotropic, boundary conditions, Poisson and Laplace equations, the only solution theory, general procedures for solving the equations of Poisson and Laplace, examples on solving the equations of Poisson and Laplace, photos method, mapping method, variables separation method, numerical methods, computer aided solution, problems, reference questions.

Fourth chapter static electric field if direct current DC: introduction, conductor and insulator, electric current, current density fragmentation and current continuity law, current and field at the cutting edge between conductor and insulator, current relaxation time, current mapping and resistance of simple geometrical forms, insulator cells, materials classification, Laplace equation in insulator milieu, photo method, experimental methods, problems, reference questions.

Fifth chapter: static magnetic field: introduction, BioSavar law, circular ampere law, Maxwell equation, Ampere law applications, magnetic flow density, Maxwell's magnetic incitement equation, negative magnetic potential and magnetic potential vector and its applications, magnetic power affecting the moving charge, powers between conductors with differential current length, magnetic and magnetic permeability coefficient, magnetic power, nature of magnetic materials, super insulator and magnetic field, boundary conditions of the magnetic field, deriving magnetic field laws for direct current DC modeling magnetic field, photo method, problems, reference questions.

Sixth chapter: variable fields in time and Maxwell's equations, introduction, Faraday's Law.
Displacement current, Maxwell equations in point formula (or differential), complex formula for Maxwell equations, variable potential in time, late potential

(Delamare equations), wave equations, solving wave equations, UO Ying vector and capacity consideration, UO Ying vector applications, problems, reference questions.

Seventh chapter: electromagnetic wave scattering: introduction, regular flat wave, wave scattering in free space and perfect insulator, wave scattering in insulator with loss, flat wave scattering in good conductor, skin effect, wave polarization, reflection of flat wave projected vertically, reflection of flat wave projected with deviation, standing wave ratio, Dipole Hertz, problems, reference questions.

Syrian Arab Republic

Damascus University

Faculty of Mechanical and Electrical Engineering

Biomedical Engineering Department

Course	**Measurements and Measuring Devices**			
Year	Third			
Department	**Biomedical engineering**			
Academic term	Second			
Hours	Theoretical	4	Practical	2
Course purpose	To present the practical and scientific knowledge on measurements and measuring devices and that to measure, supervise and control medical quantities. The applications of the same in maintaining and adjusting the medical devices and systems.			
References that students may refer to	- Tatsuo Togawa, Biomedical Transducers and Instruments, 1997, CRC. - R.K. Rajput, Electronic and Electrical Measurements & Instrumentation, 2008 , S.CHAND - Georges Asch, Transducers of Measurement Systems, 1992, MIR. - Ernest O. Doebelin, Measurement Systems, 1990, McGraw-Hill. - T.M. Aliev, Measurement Technique, 1991, H.S.			
Course Description	The course of measurements and measuring devices presents the following: "Measurement content and basic			

	properties, measurements results analysis, principles and methods of measurement, sensors and digital measuring system and devices in medical engineering and their metrological properties, adjustment of measurement devices".
Tutor	**Dr. Mowafak Al-Hulaibi**

Syrian Arab Republic

Damascus University

Faculty of Mechanical and Electrical Engineering

Biomedical Engineering Department

Course	**Biomedical Materials**			
Year	Third			
Department	**Biomedical engineering**			
Academic term	Second			
Hours	Theoretical	2	Practical	2
Course purpose	To provide the student with basic concepts of materials used in manufacturing and designing bio alternatives and the best choice of material and its formation to closest to natural like a medical equipment or tissue planted inside a living body, this course also aims at educating the student about the most recent developments in the field of bio materials through search engines and preparing research papers			

	for every two students and experimenting on some biomedical materials.
Course curriculum	None-a notebook
References that students may refer to	- J.D. Bronzino, The Biomedical Engineering, CRC Press; Inc, 1995 - M. Krutz, handbook of biomedical engineering, Kluwer Academic/Plenum Publishers, N.Y, 2001 - Biomaterial Journal; vol. 21-23, ELSEVIER, 2000-2003 - R.A. Goldsby, T.J. Kindt, B.A. Osborne, KUBY-Immunology; 4th Ed, W.H. Freeman & Company,2000
Courses related to this course	Materials Science

Course Subjects

Chapter	**Main titles**	**Subtitles**	**Lectures per chapter**
1	General overview of bio alternatives.		1
2	Immune system-its components and general mechanism		2
3	Natural and industrial Polymers		3
4	Stages of forming alternative material and methods of superficial and sterilization therapy.		1
5	Properties of biomedical materials**.**		1
6	Mineral and ceramic biomedical materials.		1
7	Stainless steel.		1
8	CoCr-Alloys.		1
9	Titanium alloys.		1
10	Minerals in prosthodontics		1
11	Rust of the metals planted in the		2

	body		
Tutors	**Dr. Abdul Minaam Razouk, Dr. En Moustafa Mawalidi**		

Syrian Arab Republic

Damascus University

Faculty of Mechanical and Electrical Engineering

Biomedical Engineering Department

Course	**Machines Components**			
Year	Third			
Department	**Biomedical engineering**			
Academic term	First			
Hours	Theoretical	4	Practical	2
Course purpose	This course aims at enabling student from calculating mechanic designs to mechanic medical machines components necessary for medical equipment.			
Course curriculum	Mechanical measurements (Dr. Abdulmoeen Khador)			
References that students may refer to	Machines theory(Dr. Simon Obaid + Dr. IskanderAmjah). Machines design 1 (Dr. MotazzJawish). Machines design 2 (Dr. Ghazi MisbahDroubi)			
Courses related to this course	This course is considered a continuation of the course engineering drawing, materials science, and the measurements that are needed in medical equipment and the biomechanics, and artificial Limbs when studied.			

Course Subjects

Chapter	Main titles	Subtitles	Lecturesper chapter
1	Metrology.		1
2	Measurement principles.		2
3	Fist.		2
4	Welding		2
5	Clinch.		2
6	Designing wedges and pillars.		3
7	Motion and moving solid body.		4
8	Mechanism.		3
9	Gears.		1
10	Camshaft.		3
11	Bearings.		1

Tutors	**Section /1/ Dr. Abdulmoeen Khador – Section /2/ Dr. Monzer Khador**

Syrian Arab Republic

Damascus University

Faculty of Mechanical and Electrical Engineering

Biomedical Engineering Department

Course	**Logics Circuits**			
Year	Third			
Department	**Biomedical engineering**			
Academic term	Second			
Hours	Theoretical	4	Practical	4
Course purpose	The course aims to introduce students to the basic components of digital systems and training to design some practical applications using a simple digital circuits And learning to analyze and understand the work of some ready- made plans and at the same time teaching students to design logical circuits using computer.			
Course curriculum	Dr. En. Ahmad A1khaddor, logical circuits2007/2008			
References that students may refer to	M. Morris Mano, Digital Design, Third Edition, Published by Prentice Hall Inc, 2002			
Courses related to this course	-			

Course Subjects

Chapter	**Main titles**	**Subtitles**	**Lecturesperchapter**
1	Number Systems.		
2	Data representation.		
3	Codes.		
4	Boolean algebra and logic function.		
5	Logical function representation.		
6	Physical implementation of the logical elements.		

7	Integrated circuits.		
8	Combinational logic circuits.		
9	Basic components of Combinational logic circuits.		
10	Sequential Circuits		
11	Analysis of sequential circuits synchronous and asynchronous and design it.		
12	Registers.		
13	Counters.		
14	Memories and Programmable logic.		
Tutor	**Dr. En. Ahmad khaddor**		

Syrian Arab Republic

Damascus University

Faculty of Mechanical and Electrical Engineering

Biomedical Engineering Department

Course	**Biostatistics**			
Year	Third			
Department	**Biomedical engineering**			
Academic term	First			
Hours	Theoretical	4	Practical	2
Course purpose	The course aims to enrich the student with the knowledge of biostatistics due to the necessity of this decision be examined as a medical engineer.			
Course curriculum	**-**			

Course Subjects

Chapter	**Main titles**	**Subtitles**	**Lectures per chapter**
1	Random variables.		2
2	Statistical distribution.		2
3	Baez's statistical theory.		2
4	Likelihood estimation.		3
5	Clustering and Data mining.		3
6	Discrimination Functions.		3
Tutor	**Dr.En. Wael Imam**		

Syrian Arab Republic

Damascus University

Faculty of Mechanical and Electrical Engineering

Biomedical Engineering Department

Course	**Radiation physics**			
Year	Third			
Department	**Biomedical engineering**			
Academic term	Second			
Hours	Theoretical	2	Practical	2
Course purpose	To provide students with basics of physics and engineering to understand the different types of radiological equipment, such as diagnosis and therapy using Rontgen ray or radionuclide.			
Course curriculum	Radiation physics and its applications, Dr. Nicola Abo Issa, Section /1/			
References that students may refer to:	- X-ray in atom and nuclear physics-Norman Dyson 1973. - Wstep do fizykiatomowej-weher Richards 1983. - Nuclear medicine physics. Dr. MHD Safwat A1sioufi- 2010.(Arabic Book)			
Courses related to this course	This course is a continuation of the physics course and introduction in explaining Rontgen ray physics and the radionuclide physics and thus it is basic for radiological equipment used in diagnosis and therapy.			

Course Subjects

Chapter	Main titles	Subtitles	Lectures per chapter
1	Atoms structure and atomic nucleus and their properties.		2
2	Atomic structure.		2
3	Atomic nucleus structure.		2
4	Radioactive decay.		2
5	Mutual nuclear effect.		2
6	Neutrons physics.		2
7	Generating X-ray and loading designs in Rontgen lamb and its parameters.		2
8	Methods of medical imaging and		2

	radiographic image parameters.		
9	Methods of measuring X-ray and its use.		2
10	Basics of ionizing ray.		1
11	Power transmission to material.		3
12	Cell sensitivity to radiation.		2
13	Radiation bio effects.		1
Tutors	**Section /1/ Dr. Nicola Abo Issa-Section /2/ Dr. Monzer Khador**		

Syrian Arab Republic

Damascus University

Faculty of Mechanical and Electrical Engineering

Biomedical Engineering Department

Course	**Medical Electronics and Bio Measurements (1)**			
Year	Third			
Department	**Biomedical engineering**			
Academic term	Second			
Hours	Theoretical	2	Practical	4
Course purpose	The course aims to give the student the knowledge of electronic components used in bio fields and the bio signals with electrical nature and its collectible circuits			
Course curriculum	-			
References that students may refer to:	1-Medical instrumentation, J G Webster. 2-Hand book of Biomedical Instrumentation. R.S. Khandpur 3-Medical Equipment and Technology, J Carr			
Courses related to this course	Medical Electronics and Bio Measurements (2)			

Course Subjects

Chapter	**Main titles**	**Subtitles**	**Lectures per chapter**
1	Sources and properties of the bioelectrical signals	1. Forms of bio-signals **2.** Detection methods of bio-signals	2
2	Operational Amplifiers, Biometrics amplifier and its bio applications.	1. Income and gain impedance. 2. Isolate the initial amplification stage. 3. Window comparative and its applications in the field of	2

		bioengineering. 4. Slowdown comparative and its applications in the field of bioengineering. 5. Signal level adjust, dislodge and calibration zero circuits 6. Bio-signal adjust amplifiers 7. Sensors with nonlinear output: Wheatstone bridge, optical thermal sensors and logarithmic amplifier (non-linearity correction)	
3	Jamming and interference onbiosignals and methods of disposal.	1. Unwanted signals captured from the surrounding and from the body. 2. Jamming caused by the not good preparation for the detection. 3. Get rid of the common mode signals. 4. Veiling detection wires. 5. Reference electrode (the right leg electrode). **6.** Degradation of the Bio-signal through the detection and the deterioration detect circuits of the contact electrode and reparation for it, detect circuits of the electrode fall during the detection process**.**	2
4	Bio-signals detection electrodes.	1. Chemical equations to convert to bio-voltageto a measurable voltageby the electronic circuits. 2. Equivalent circuits ofthe electrodes. 3. Polarized and non-polarized electrodes 4. The frequency behavior of the electrodes. 5. Areapreparation before applying the electrodes and its impact. 6. Surface electrodes. 7. ECG, EEG, EMG, EOG, ERG electrodes. 8. Needle electrodes, specifications and types. 9. Micro electrodes and electrodes matrices. 10. Electrical stimulation and electrical shock electrodes. 11. Electrodes used in electric Surgery.	2
5	Electromagnetic stimulation.	1. The concept of electrical stimulation and magnetic stimulation. 2. Stimulate the muscles and signals'forms and	2

		generatecircuitsand the used electrodes. 3. Stimulate nerves and signals' forms and generate circuits and the used electrodes. **4.** Forms of brain stimulation and signals' forms and generate circuits and the used electrodes.	
6	Effective filters and amplifiers and its applications in biomedical engineering.	1. Types of effective amplifiers. 2. Effective filter as an impedance transducer. 3. Effective filter that is able to synthesize. 4. Usingthe measuring of digital voltage to control the synthesis of low-pass filter 5. Effective filter applications and selection of design elements of effective filters according to their bio-using.	2
7	Bio-isolation amplifiers.	1. Optical isolation and the principle of work and the most famous applications and circuits. 2. Pulsed insulation and the principle of work and the most famous applications and circuits. 3. Transformers Isolation and the principle of work the most famous applications and circuits.	2
8	Design bio-amplifiers with minimal rates of noise.	1. Random noise sources in electronic bio systems. 2. Resistors noise and active elements noise (JFET, BJT) 3. Parameters and forms of noise in bio-sequence amplifiers. 4. Ratio of signal to noise in sequential amplifiers. 5. Noise in the differential amplifiers. 6. The effect of feedback circuit on the noise.	2
9	Applications of digital connectivity systems in medical engineering systems.	1. Cutting signals. 2. Bandwidth deformation and theory of digital cutting. 3. Digital signal transducers to an analog and its design. 4. Static and dynamic characteristics of the transducers signal D / A. 5. Constipation circuits and transducers analog signals to digital A / D. 6. Path transducer, approximate sequential, integrative andflash transducer.	2
10	Transmitting bio-	1. Detection of multiple bio-signals.	2

	signals remotely.	2. Determine the sampling frequency of each bio-signal. 3. Sampling bio-signals different by time division. 4. Sampling bio-signals different by frequency division. 5. Amendment lifting the amendment of bio-signals. 6. Analog amendment, types and some of its circuits. 7. Digital amendment, types and some of its circuits. 8. Transmission by digital methods wirelessly, and Bluetooth technology. 9. Messaging with mobile devices and messaging via the Internet.	
11	Examples of specific bio-applications.	1. Electrocardiography (ECG). - Signal parameters, originating, proliferation, amplitude and detection. - I, II, II, aVR, aVL, aVF, V1...V6. - Healthy formats of ECG and frequency spectrum. - Some pathological forms of ECG and frequency spectrum. - Protection circuits of ECG measurements amplifier from electric shock devices and electrical Surgery Devices. 2. Electroencephalography (EEG). - Signal parameters, originating, spread and types of EEG signals. - Alpha signals (α), beta (β), theta (θ) and delta (δ) and their implications, conditions and optimum positions for detection. - EEG amplifiers and the requirements of the gain, impedance, frequency and filtering. - Electrodes matrix and its unipolar and bipolar formations. - The optimum environment for (EEG) signal detection. - Head preparation: The detection room, psychological factors, and weather and physical factors. - Healthy formats for the EEG and its frequency spectrum. - Some pathological forms of the EEG and its frequency spectrum, such as Epilepsy signals, Alzheimer's	6

		signals, and the general stress signals. 3. Electromyography (EMG). - Signal parameters, originating, spread and types of signals. - EEG amplifiers and the requirements of the gain, impedance and filtering. - Muscle signal complementary. - Healthy forms and some pathological forms of EMG. 4. Electroretinography (ERG). - Signal originating, spread and detection methods. - Healthy form and some pathological forms of ERG and its frequency spectrum. - ERG amplifiers its requirements. 5. Electrooculography (EOG).	
12	Methods of bio-signals separation.	1. Determine the detection positions of each signal. 2. Moderation, filtration, subtraction, and the opposing and self-bonding.	2
Tutors	**Dr. Hani Amasha + Dr. Issa Ibrahim**		

Damascus University

Faculty of Mechanical and Electrical Engineering

Biomedical Engineering Department

<table>
<tr><td>Course</td><td colspan="4">Biomechanics</td></tr>
<tr><td>Year</td><td colspan="4">Third</td></tr>
<tr><td>Department</td><td colspan="4">Biomedical engineering</td></tr>
<tr><td>Academic term</td><td colspan="4">Second</td></tr>
<tr><td>Hours</td><td>Theoretical</td><td>4</td><td>Practical</td><td>2</td></tr>
<tr><td>Course purpose</td><td colspan="4">The course aims at providing student with clear and sufficient idea about the human motion in general and the movement of all body parts, in addition to connecting this motion with the forces causing it, this entails the measurement of reaction force between feet and ground, and measuring affecting joints of lower Limbs. The student practice calculating forces and momentum (3D) and pressure center (CP) and force exerted during walking through solving special related problems.</td></tr>
<tr><td>Course curriculum</td><td colspan="4">Notebook.</td></tr>
<tr><td>References that students may refer to:</td><td colspan="4">
<table>
<tr><th>No.</th><th>Title</th><th>Author</th><th>Publisher</th><th>Year</th></tr>
<tr><td>1</td><td>Gait analysis: normal and pathological function</td><td>Jacquelinperry</td><td>Slack</td><td>1992</td></tr>
<tr><td>2</td><td>Gait analysis: an introduction</td><td>Michael Whittle</td><td>Butterworth-heinemann</td><td>2007</td></tr>
<tr><td>3</td><td>Clinical gait analysis: theory and practice</td><td>Christopher Kirtley</td><td>Chureilllivingstone</td><td>2006</td></tr>
<tr><td>4</td><td>Gait analysis: theory and application</td><td>Rebecca Craik</td><td>Mosby</td><td>2006</td></tr>
</table>
</td></tr>
<tr><td>Courses related to this course</td><td colspan="4">Biomechanics Fluids + machines components + anatomy and physiology</td></tr>
<tr><td colspan="5">Course Subjects</td></tr>
<tr><td>Chapter</td><td colspan="2">Main titles</td><td>Subtitles</td><td>Lectures Perchapter</td></tr>
<tr><td>1</td><td colspan="2">Human motion</td><td>1-1 introduction.
1-2 Human walking cycle.
1-3 Distance and time parameters and its calculation.</td><td>2</td></tr>
</table>

		1-4 Modeling human body. 1-5 Mass.	
2	Methods and equipment for measuring parameters of human walking	2-1 Introduction. 2-2 methods and equipmentfor measuring parameters of distance and time. 2-2-1 Sensors inside the shoes. 2-2-2 Electronic carpet. 2-3 Methods and equipment for measuring the force of reaction between ground and feet. 2-3-1 Pressure converters. 2-3-2 Force plate. 2-3-2-1 Its description and quality. 2-3-2-2 Calculate coordinates of pressure center. 2-3-3 Baylon. 2-4 Methods and equipment of measure human motion. 2-4-1 Direct methods. 2-4-1-1 Angular measurement. 2-4-1-2 Accelerometer. 2-4-2 Indirect methods. 2-4-2-1 Cameras. 2-4-2-2 Brands system. 2-4-2-3 Biomechanics laboratory	4
3	Human motion parameters	3-1 Introduction. 3-2 Human body center of gravity. 3-3 Lower Limbs joints movement. 3-3-1 Ankle joint movement. 3-3-2 knee joint movement. 3-3-3 Hip joint movement. 3-3-4 Numerical differential equation. 3-4 Human trunk movement. 3-4-1 Trunk movement in the sagittal plane. 3-4-2 Trunk movement in the frontal plane. 3-4-3 Chest movement in relation with hip. 3-5 Pelvis movement.	5

		3-5-1 Pelvis movement in the sagittal plane. 3-5-2 Pelvis movement in the frontal plane. 3-5-3 Pelvis movement in horizontal plane.	
4	Balance lower Limbs joints	4-1 Introduction 4-2 Force effect on the balance of lower limbs. 4-3 Muscles effect on the balance of lower limbs.	2
5	Forces of reaction between feet and ground	5-1 Introduction, 5-2 Force of horizontal reaction in the sagittal plane Fx. 5-3 Force of vertical reaction Fy. 5-4 Force of horizontal reaction in the frontal plane Fz. 5-5 Butterfly model.	2
6	Applied moment on the lower limbs joints	6-1 Introduction. 6-2 Moment applied on ankle joint. 6-2-1 Moment in the sagittal plane (around leg axis Z). 6-2-2 Moment in the frontal plane (around leg axis X). 6-2-3 Twisting moment around leg axis Y. 6-3 Moment applied on knee joint. 6-3-1 Moment in the sagittal plane (around leg axis Z). 6-3-2 Moment in the frontal plane (around leg axis X). 6-3-3 Twisting moment around leg axis Y. 6-4 Moment applied on hip joint. 6-4-1 Moment in the sagittal plane (around leg axis Z). 6-4-2 Moment in the frontal plane (around leg axis X). 6-4-3 Twisting moment around leg axis Y.	4

7	Force exerted in walking	7-1 Introduction. 7-2 Methods of measuring exerted force. 7-3 Exerted force by healthy human while walking. 7-4 Exerted force by unhealthy human while walking.	2
8	Examination of muscles	8-1 Introduction. 8-2 Origin of muscles signal. 8-3 Processing muscles signal. 8-4 Analyzing muscles signal. 8-5 Equipment used in detecting muscles signal.	2
Tutors	**Dr. MustafaMawalidi - Dr. Zuhair Marmar**		

Syrian Arab Republic

Damascus University

Faculty of Mechanical and Electrical Engineering

Biomedical Engineering Department

Syllabus of Electronics (2)-Third Year-Biomedical Engineering

1. BJT amplifier - alternating equivalentcircuits - alternating formations and transactions (Av, Ai, Rin, Ro) -The frequency response curve - medical applications.

2. JFET amplifier - alternating circuits - alternating formations and transactions (Av, Ai, Rin, Ro) -The frequency response curve - medical applications.

3. MOS transistors and CMOS transistors as an electronicinterrupter.

4. Amplifiers interconnection - RC, TRANS, DIRECT– Composited circuits (Darlington - Kascud - differential) - differential amplifier applications in the medical field.

5. Operational amplifier (OP-AMP) -background feedback - Applications in Biomedical Engineering field.

6. Sinusoidal vibrators and non-sinusoidal wave generators - applications in the engineering field.

7. Filters, itstypes and medical applications.

8. Noise and its impact on the electronic circuits.

Syrian Arab Republic

Damascus University

Faculty of Mechanical and Electrical Engineering

Biomedical Engineering Department

Course	**Medical Equipment /1/**			
Year	Forth			
Department	**Biomedical engineering**			
Academic term	First			
Hours	Theoretical	2	Practical	2
Evaluation	Student effort (20) marks: - Preparatory exam and assignments 8 marks**.** **-**Laboratory: 12 marks.			Final exam:80 marks
Course purpose	This course aims at introducing students of medical engineering with different medical equipment whether: diagnostic, therapeutic, or supporting. And introducing the student with the latest updates in this field in order to prepare him/her for practical life in case he/she chooses to work in the field of designing and investing medical equipment.			
Course description	This course is a part of three courses that target examining parts and structure of medical equipment where the students examine anatomy and disease cases that entail the existence of this device and then the engineering concept use in the advanced technology; it explains block diagrams for these devices. And it connects theoretical lectures with practical section through visiting labs in the faculty to examine parts of mentioned devices, or visiting hospitals to observe its operations and parts, as well as inviting companies' representatives to discuss their information.			

Course curriculum	A collection of printed lectures that are annually updated in conformity with the development medical technology.

References

No.	Title	Author	Publisher	Year
1	Encyclopedia of medical devices and instrumentation.	J.G. Webster	John Wiley & Sons Inc	1989
2	Design and development of medical electronic instrumentation: a practical perspective of the design, construction and test of medical devices.	David Prutchi	John Wiley & Sons	2004
3	Medical instrumentation accessibility and usability considerations.	J.H Dshalalow	CRC pess Inc	2006

Course Subjects

Chapter	Subtitles	Lecturesperchapter
1	Photometer.	Half a lecture
2	Flame-Photometer.	Half a lecture
3	Coulter counter for measuring blood component (blood cell counter).	Half a lecture
4	Electrosurgical unit.	1
5	Sine and Galvanic Muscle Stimulations.	Half a lecture
6	Diathermy and Microwave Therapy Machine.	1

7	Sterilizers.	1
8	Dentistry unit.	1
9	Breathing types and breathing machines.	1
10	Anesthesia Machines + breathing machines + pressure regulators, measuring pressure and gases concentration in respiratory system.	1
11	Heart and lungs system.	Half a lecture
12	Intra-AorticBalloon system.	Half a lecture
13	Incubators.	Half a lecture
14	Secretions absorbents.	Half a lecture
Tutors	**Dr. Mohammed Firas Alhinawi - Dr. Ayman Saboni**	

Syrian Arab Republic

Damascus University

Faculty of Mechanical and Electrical Engineering

Biomedical Engineering Department

Course	**Safety in Medical engineering**			
Year	Forth			
Department	**Biomedical engineering**			
Academic term	Second			
Hours	Theoretical	2	Practical	2
Evaluation	Student effort (20) marks: - Preparatory exam and assignments 8 marks**.** **-**Laboratory: 12 marks.			Final exam:80 marks
Course purpose	This course aims at teaching medical engineering the basics of safety and protection from risks and methods of prevention in order not to experience these risks.			
Course description	The medical engineer practices his/her work in a milieu that is usually polluted either microbial or radiation or full ofrisks such as electricity due to dealing with medical equipment or patients wired with these differentequipment, therefore, the course introduces the medical engineering with the risks that might face him/her.			

Course curriculum	A collection of printed lectures that are annually updated in conformity with the development medical technology.

Course Subjects

Chapter	Subjects	Lecturesper chapter
1	Shielding against radiation.	3
2	Electricity safety.	3
3	Industrial safety and health.	1
4	Protection equipmentand machines security equipment.	1
5	Safety and security of medical equipment.	2
6	Safety and health in hospitals and health care centers.	1
7	Health risks in hospitals.	1

Tutor	Dr. Mohammed Firas Alhinawi - Dr. Ayman Saboni

Syrian Arab Republic

Damascus University

Faculty of Mechanical and Electrical Engineering

Biomedical Engineering Department

Course	**Bio Signal processing**			
Year	Forth			
Department	**Biomedical engineering**			
Academic term	First			
Hours	Theoretical	4	Practical	1
Course purpose	This course aims at introduction signals and stating their behavior and distinguishing properties, in addition to recognizing its mutual effect after amendment in conformity with new changing inputs that must be considered. The importance of signal processing is not only about examining signals resulting or introducing used system by also signal processing is important un the stage of system design. This means that stating the properties of signals related to a proposed system with specific mathematical indication and using modem specifications that are possible through electronic processors in representing proposed system.			
Course curriculum	Signal processing-Dr. Hassan Abo Alnour.			
References that students may refer to:	Arabic reference: probability, statistics and random operation -Dr. Bassam Lala. Foreign reference:			

	1-Digital signatory processing principal, algorithms and applications, John G.ProakisDimitris G. Manolakis, Prentice Hall, 1996. 2-Signal and system, Alan V. Oppenheim Alan S,Willsky, Prentice - Hall, 1998.
Courses related to this course	Mathematics/3/-mathematics/4/-second year. Biostatistics-third year.

Course Subjects

Chapter	**Main titles**	**subtitles**	**Lectures per chapter**
1	Systems, signals, classification.	Continuous time, discrete time	4
2	Sequences.	Some simple sequences, shifting and some special sequences.	4
3	Linear systems unrelated to time		4
4	Fourier series	Representing Fourier series for continuous periodical signals... Fourier properties	4
5	Fast Fourier transform and its properties.		3
6	Z transforms and its properties.	Reversed analyzing System unchanged by time in z level.	4
7	Discrete Fourier transform and its properties.		3
8	Random signals analysis.		4
Tutor	**Dr. E. Bassam Lala**		

Syrian Arab Republic

Damascus University

Faculty of Mechanical and Electrical Engineering

Biomedical Engineering Department

Course	**Microprocessors**			
Year	Forth			
Department	**Biomedical engineering**			
Academic term	Second			
Hours	Theoretical	4	Practical	2
Course purpose	This course aims at primarily at training students on designing integrated systems for specified application through building different designs with multiple components. It also aims at teaching students programming using low level languages which is specialty of engineers and specialists through many practical examples.			

Course curriculum	- Barry B. Brey, intel Microprocessors 8086/8088, 80186/80188,80286,80386,80486, Pentium, Published by Prentice Hall, 2005 - William C. Runnion, Structured Programming in Assembly language for IBM PC and PS/2, Published 1995.

Course Subjects

Chapter	**Main titles**	**Subtitles**	**Lecturesper chapter**
1	Digital computer and the concept of each of its basic components	- Standard structure of electronic computer. - General concept of central processing unit, Arithmetic and Logic Unit, memory unit, control unit, input and output unit, buses.	
2	Memories	- Designing memory block (increasing word length, and memory size). - Samples of memories: RAM, ROM, as an integrated circulates it be used in examples of actual designs.	
3	Microprocessors	- Generations of microprocessors at Intel company and their development. - Classifications of microprocessors and the concept of each of them. Monolithic Microprocessors, Slice Processor & Interfacing Microprocessors, One chip Microcomputers.	
4	8 bits Microprocessors	General description of microprocessor I8080 as an example of 8 bits microprocessors.	

5	Support circuits for microprocessor I8080 (MCS 80 structure)	- Un-programming circuits: I8224, 8228/8238,8216/8226,8282/83,8212, 8214,8205 with concise explanation of each of them (its function, structure, conduction…) - Programming circuits: I8255/8256, 8251, 8253, 8257, 8259 with concise explanation of each of them (its function, structure. conduction…) - Some of TTL circuits compatible with microprocessor I8080 of SSI, MSI.	
6	Other microprocessors of Intel company 8 bits	- Processors (microcomputers) 8045/8053/8748 - Interfacing processors 8041/8741 - Set-Bit-slice processor.	
7	Other microprocessors 8 bit of companies other than Intel	- Processor MC 6800 of Motorola Company (general specifications, support circuits). - Processor Z-80 of Zilog Company (general specifications, support circuits). - Comparison between the most famous processors of 8 bits in the most famous manufacturing companies.	
8	Introduction to 16 bit microprocessors	- Introduction on the general specifications of 16 bit microprocessors. - Concept of multiprocessors systems. - Processor family I8086 (I8086,8087, 8088,8089 - Processors I80186/88,80286,80386, 80486, Pentium	

9	16 bit processor I8086	- General description of processor I8086/88 (generation, packing, technology, structure). - General map of the inner structure of processor I8086 and the concept of its basic components. - Execution unit EU and BIU and their joint work mechanism. - Forming the memory physical address of 20 bits length.	
10	Work mechanism of 16 bit processor I8086/88	- Processor synchronization. - Processor registers and their interconnection. - Memory organization. Organizing input and outputs. - An integrated example on designing a microprocessor computer system based on processor I8086 using micro pattern.	
11	32 bits processors		
12	Address encoding language Assembly	- Introduction on programming languages. - High level languages and the concept of compiler, low 1evel languages and the concept of interpreter, some instructions of address encoding language. - Simple instructions of assembly language for processors of I8086 family. - Some ambiguity forms and make tracing.	
13	Addresses and instructions affecting memories	- Jumps, swapping. - Concepts of main sections for the program in assembly language for processors of I8086 family.	
14	Some functions of operating system DOS	- Interrupt 21 H and functions 1,2,5,9,4C - Miscellaneous programming examples.	

15	Pointers and arithmetic	- Instructions of: addition, subtraction, multiplication, division. - Transformation instructions, negation and comparison.	
16	Complementary and miscellaneous subjects on programming is assembly language for the processors of I8086 family.	- Loops. - Subroutine and call ret. - Stack and PUSH & POP instructions. - Miscellaneous examples on programs covering all previous concepts.	
Tutors	**Dr. En. Ahmad khaddor**		

Syrian Arab Republic

Damascus University

Faculty of Mechanical and Electrical Engineering

Biomedical Engineering Department

Course name	**Medical Imaging System and Image Processing(1)**			
Year	Fourth			
Department	**Biomedical Engineering**			
Academic term	Second			
Hours	Theoretical	4	Practical	2
Course purpose	Providing students with the necessary theoretical basics and the main techniques for image processing. Display and use in fields of medical imaging and diagnosis system.			
Course curriculum	Medical Imaging System and Image Processing(1)			
References thatstudents may refer to:	**1.** Maan Ammar, medical image processing, Damascus University, 1992. **2.** R.C. Gonzales and R.E. Wood, digital image processing prentice Hall, 2008.			
Related courses	Medical Imaging System and Image Processing(2)			

Course Subjects

	Main titles	**subtitles**	**Lectures per chapter**

The below mentioned content is distributed on 13 chapter and the actual number of lectures depends on the tools used for giving the lectures and students comprehension which varies from one year to another taking into consideration to cover the below subjects during the whole semester.

Introduction to medical image processing.
Digital image and medical images.
Examples for fields of using digital images processing.
Basics stages for digital images processing.
Basics of digital image.
Sensing and obtaining images.
Representing digital images.

Medical images processing.
Improving medical images.
Improving medical images in the spatial domain
Histogram.
Negative images.
Logarithmic transform.
Force conversion law.
Contrast expand.
Histogram settlement.
Using histogram statistics in improving image.
Improvement using mathematical and logical operations.

Digital subtraction. Centering. Spatial filtering filters. Sharpness filter. Using second derivative a (Laplacian) in the improvement**.** Merging spatial improvement methods.
Improving medical image in the frequency field. Introduction. Fourier transform. Filtering in the frequency fields. Basic filters and their properties. Frequency smoothing filters. Perfect law pass filter. Gaussian filter. Frequency sharpness filter.
Color processing of medical images. Color basics. Color patterns. Processing colored images compounds. Pseudo colorsprocessing Color conversions. Color histogramprocessing Color splitting. Color edge detecting. Noise in colored images.
Computer diagnosis of content of medical images. **Medical images analysis.** Morphological images processing. Images splitting. Computerized definition of medical images components. Identifying medical images components.
Interpreting and diagnosing content of medical images. Smart processing of medical images. Aiding techniques in processing medical images. Recording medical images. Encoding medical images. Compressing medical images.
Tutor | **Dr. Maan Ammar**

Syrian Arab Republic

Damascus University

Faculty of Mechanical and Electrical Engineering

Biomedical Engineering Department

Course name	**Medical Equipment /2/**			
Year	Fourth			
Department	**Biomedical Engineering**			
Academic term	Second			
Hours	Theoretical	2	Practical	2
Evaluation	Student effort (20) marks: - Preparatory exam and assignments 8 marks. - Laboratory 12 marks.			Final exam: 80 marks.
Course purpose	This course aims at introducing students of medical engineering with different medical equipment whether:			

	diagnostic, therapeutic, or supporting. And introducing the student with the latest updates in this field in order toprepare him/her for practical life in case he/she chooses to work in the field of designing and investing medical equipment.
Course description	This course is a part of three courses that target examining parts and structure of medical equipment where the students examine anatomy and disease cases that entail the existence of this device and then the engineering concept use in the advanced technology; it explains block diagrams for thesedevices. And it connects theoretical lectures with practical section through visiting labs in the faculty to examine parts of mentioned devices, or visiting hospitals to observe its operations and parts, as well as inviting companies' representatives to discuss their information.
Course curriculum	Collection of printed lectures that are annually updated in conformity with the development medical technology.

References thatstudents may refer to:

NO.	Title	Author	Publisher	Year
1	Encyclopedia of Medical Devices and Instrumentation	J.G. Webster	John Wiley & Sons Inc	1989
2	Design and Development of Medical Electronic Instrumentation: A Practical Perspective of the Design, Construction, and Test of Medical Devices	David Prutchi	John Wiley & Sons	2004
3	Medical Instrumentation Accessibility and Usability Considerations	J.H. Dshalalow	CRC Press Inc	2006

Course Subjects

Chapter	Subjects	Lecturesper chapter
1	X-ray imaging devices. Simple radial imaging device-Fluoroscopy. Imaging-mobile imaging-C-arm imaging.	5
2	Retinoscope	1
3	Airflow plate units for operation rooms.	1
4	Airflow plate units for labs	2
5	Cardiac Catheterization units and contrast imaging.	1
6	Defibrillator devices.	1
7	Injection devices.	1

Tutors	Dr. Mohammed Firas Alhinawi – Dr. Ayman Saboni

Syrian Arab Republic

Damascus University

Faculty of Mechanical and Electrical Engineering

Biomedical Engineering Department

Course name	**Prosthetics and Orthotics**			
Year	Fourth			
Department	**Biomedical Engineering**			
Academic term	second			
Hours	Theoretical	4	Practical	2
Course purpose	The course aims at providing the student with a clear and sufficient idea about the movement of amputee human and physically disabled in general and the movement of all parts of his/her body, in addition to connecting this motion with the forces causing it, this entails the measurement of reaction froes between feet and ground, and measuring affecting joints of lower Limbs. The student practice calculating forces and momentum (3D) and pressure center			

	(CP) and force exerted during walking this shows up the degree of disability of the disabled human, this enables as of prescribing the best device or prosthetic for each case.				
Course curriculum	Notebook.				
References thatstudents may refer to:	**NO.**	**Title**	**Author**	**Publisher**	**Year**
	1	Prosthetics and orthotics: Lower Limb and spinal	Ron Seymour	Lippincott Williams &Wilkins	2002
	2	Orthotics and ProstheticsinRehabilitation Caroline	Michelle M Lusardi, and Caroline Nielsen	Saunders BookCompany	2006
	3	Atlas of Limb Prosthetics: surgical, Prosthetic, and Rehabilitation Principles	John H Bowker	American Academy of orthopedic Surgeons	2002
	4	Orthotics: A Comprehensive Clinical Approach	Joan E Edelstein, MA, TP, Jan Bruckner	Slack	2002
	5	A Manual of Lower Educational Orthotics	Anderson Miles	Joint Extremities Advisory committee	2007
Related courses	Biomechanics				

Course Subjects

Chapter	**Main titles**	**Subtitles**	**Lecturesper chapter**
1	Orthotics	1.1Definition of Orthotics. 1.2Historic preview on Orthotics 1.3Reasons for using Orthotics. 1.4Classification of Orthotics. 1-4-1 Orthotics for lower limbs. 1-4-2 Orthotics for Upper limbs. 5-1 Basic principles for manufacturing Orthotics.	1

2	Analyzing unhealthy human Walk	1-2 Introductions. 2-2 Walking requirements. 2-2-1 Sources of movement. 2-2-2 Articulated hands. 2-2-3 Realizing types of required movement. 2-2-4 Source of control to create the required movement. 2-2-5 Force. 2-3 Reasons and forms of-walking deformation. 2-3-1 Structuraldeficiency. 2-3-2 Deficiency in movement unit. 2-3-3 Deficiency in both movement unit and peripheral nervous system. 2-3-4 Dysfunction in central control. 2-3-5 Force insufficiency.	4
3	Lower limbs Orthotics	3-1 Foot Orthotics. 3-2 Ankle and foot Orthotics. 3-3 Knee, ankle and foot Orthotics 3-4 Knee Orthotics. 3-5 Hip, knee, ankle and foot Orthotics. 3-6 Hip Orthotics.	4
4	Upper limbs Orthotics	4-1 Hand Orthotics. 4-2 Wrist and hand Orthotics. 4-3 Elbow Orthotics. 4-4 Shoulder and elbow Orthotics.	2
5	Vertebral column Orthotics	5-1 Neck Orthotics. 5-2 Lumbar vertebrae. 5-3 Sacral vertebrae.	1
6	Methods of manufacturing orthotics		1
7	Muscles functional electric inductance		1
8	Reasons and levels of amputation	1-1 Introduction. 1-2 Reasons for amputation. 1-3 Levels of amputation. 1-3-1 Levels of amputation for lower limbs. 1-3-2 Levels of amputation for upper limbs.	1
9	Prosthetics	2-I Historic preview on prosthetics. 2-2 Classification of prosthetics. 2-2-1 Upper limbs prosthetics. 2-2-2 Lower limbs prosthetics.	1

10	Prosthetic for	3-1 Parts of prosthetics for amputee above knee. 3-1-1 Prosthetic feet. 3-1-2 Prosthetic knee joints. 3-1-3 Prosthetic shirts. 3-1-4 Prostheticleg. 3-2 Methods of attaching prosthetic for amputee above Knee. 3-3 Methods of manufacturing prosthetic shirts for amputee above knee. 3-4 Colinearity of prosthetic for amputee above knee. 3-5 Force analysis between shirts and rhizome for amputee above knee. 3-6 Surgery for amputation above Knee	6
11	Prosthetic for amputee below knee	4-1 Parts of prosthetics for amputee below knee 4-1-1 Prosthetic feet prosthetics for amputee below Knee. 4-1-2 Prosthetic leg. 4-1-3 Prosthetic shirt for amputee below knee. 4-2 Methods of manufacturing for amputeebelow knee. 4-3 Methods of manufacturing prosthetic shirts for amputee below Knee. 4-4 Colinearity of prosthetic for amputee below knee. 4-5 Force analysis between shirts and rhizome for amputee below knee. 4-6 Surgery for amputation below knee.	2
12	Analyzing the walk of amputee above knee	5-1 Examining the movement of lower limbs joints. 5-2 Examining the movement of trunk. 5-3 Moment applied on the prosthetic joints. 5-4 Forces of reaction between ground and feet. 5-5 Butterflydiagram.	3
13	Upper prosthetics	6-1 Surgery for upper limb amputation. 6-2 Prosthetics for amputee below	1

		elbow. 6-3 Prosthetics for amputeeabove elbow.	
Tutors	**Dr. En Moustafa Mawalidi – Dr. Zuhair Marmar**		

Syrian Arab Republic

Damascus University

Faculty of Mechanical and Electrical Engineering

Biomedical Engineering Department

Course name	**Medical Electronics and Bio Measurements (2)**			
Year	Fourth			
Department	**Biomedical Engineering**			
Academic term	First			
Hours	Theoreti	4	Practical	2

	cal			
Course purpose	The course aims to give the student knowledge of detection methods of bio parameters, and types of sensors used in bio measurement operations			
Course curriculum	None			
References thatstudents may refer to:	1-Medical instrumentation, Webster. 2-Hand book of Biomedical Instrumentation.R.S. Khandpur 3-Intro to biomedical Equipment and Tech, J Carr			
Related courses	Medical Electronics and Bio Measurements (1)			
Course Subjects				
Chapter	**Main titles**	**Subtitles**		**Lectures per chapter**
1	Blood pressure measurement	1. Bio-fields of pressure and measured positions. 2. Blood Pressure Sensors. 3. Directmethods of measuring: - Pressure measuring catheters with membrane outside the body, and the dynamic response of the catheter. - Pressure measuring catheters with membrane deposited at the nozzle. - Pressure measurement by internal capsules wirelessly. - Pressure Measuring within different vessels. 4. Indirect methods of measuring: - Quantum specifications used in pressure measurement. - Measurement by Kortkov Voices. - Measurement using the Doppler principle. - Measurement using the reaction forces. - Methods of measuring the speed of the vascular pulse. - Contact and non-contact intraocular pressure measurements.		4
2	Measuring blood	1. Fields ofbiometricsof flow		2

	now in the blood vessels and tissue.	and its units. 2. Electromagnetic methods. 3. The effect of Hull. 4. Sources of jamming. 5. Methods based on the principle of labeling. 6. Labeling shady materials 7. Heat labeling. 8. Vick method. 9. Ultrasound measurement methods. 10. Migratory measure time 11. Methods Dobler. 12. Bio-impedance measurement method. 13. Flow measurements in tissue. 14. Filtering methods. 15. Volumetric planner methods. 16. Methods of radioactive isotopes. 17. Methods of thermal dissipation. 18. Laser Doppler methods. 19. Methods using magnetic resonance.	
3	Measuring the systolic volume of the heart.	1. Physiology of cardiac contraction. 2. Physical foundations of systolic force. 3. Frank-Starling law 4. Laplacian Law. 5. Measurement methods using reagents and Vekshy principle. 6. Measurement methods of thermal dissipation. 7. Method of measuring cardiac impedance	2
4	Functional and therapeutic measurements in intensive care units (requirements and specifications).	1. Measurements preparation in intensive care rooms for manifesting appropriate systems. 2. Distance measurements in the intensive care rooms. 3. Required measurements during anesthesia. 4. Measurements during ventilation	2

		5. Control measurements of volumetric and barotrauma breathing. 6. The intensity of the gas flow. 7. Measuring the parameters of high-frequency breathing. 8. Measurement of oxygen saturation. 9. Measurement of blood oxygen transfer rate. 10. Method of measuring the absorption of light waves.	
5	Biometrics in respiratory	1. Biometrics in respiratory device. 2. Measuring the volume of inspiratory and expiratory air breathing, and the functionally dead size of the lung. 3. Respiratory capacity and flexibility of the lung and the chest. 4. Airflow resistance in the airways. 5. Flow sensors used in breath measurements, measure the volumetric breathing parameters of breathing process. 6. Effective lung capacity and its physiology. 7. Pneumotachography	2
6	Noise measurements.	1. Measuring the electrical hearing plan. 2. Measuring audio impedance. 3. Measure the auditory incitement voltage. 4. Regressive signals measurements for audio influences. 5. Measurements should be available in the trade-offs hearing. 6. Measurements should be available in the trade-offsmiddle ear. 7. Measurements should be	2

		available in the trade-offs inner ear.	
7	Measuringvisualacuity	1. Optical measurements. 2. Measurement for vision correction. 3. Measuring vision acuity. 4. Eyes deviation measurements using axial camera. 5. Measuring linear nystagmus. 6. Measuring video nystagmus.	2
8	Measuring bio-impedance	1. Four poles measuring system. 2. Measuring impedance to show the activity of the heart. 3. Group and measurement methods these necessary for imaging by electrical impedance.	1
9	Measurements during Pregnancy	1. Fetal heart Planning. 2. Fetal breathe measurements. 3. Ultrasonic measurements. 4. Measurements in incubators.	1
10	spectral measurements	1. Optical measurements. 2. Spectroscopy measurements. 3. Forms of measurements of spectroscopy imaging and its systems. 4. The principle of measuring by the spectrophotometer. 5. The liquid crystal filter that able to synthesis. 6. Spectral measurements in the clinical diagnosis and in the laboratory analysis. 7. Fluorescent imaging measurements and its applications in the clinical diagnosis and in the laboratory analysis.	2
11	Bio thermal measurements	1. Fields ofbiometrics of flow and its units. 2. Temperature and humidity sensors used in biometrics. 3. Contact measurements methods.	2

		4. Non-contact measurements methods. 5. Evaporation measurements of the human body and its sensors. 6. Measurements of the transmission and the spread of heat in the body.	
12	Movement and forces measurements	1. Measurement fields and its positions of the human body. 2. Stress measurements in the bone. 3. Measurements of human weight and its distribution. 4. Measurements of muscle contraction. 5. Measurementsensors of the movement. 6. Motion, linear and rotational move,contactand non-contact measurements. 7. Measurements of sports movements.	2
Tutors	**Dr. Hani Amasha - Dr. Issa Ibrahim - Dr. Mamdouh Munif**		

Syrian Arab Republic

Damascus University

Faculty of Mechanical and Electrical Engineering

Biomedical Engineering Department

Course name	**Modeling and simulation**			
Year	Fourth			
Department	**Biomedical Engineering**			
Academic term	Second			
Hours	Theoretical	2	Practical	2

Course purpose	This course introduces the fourth year students, medical engineering a new field of study which modeling and simulation bio physiological systems, the student is successively introduced with the basic concepts of modeling, its targets, types and methods of simulation and method of examining a physiological system in order to model and simulation it. The student in this course will get the knowledge of how to examine a biological system to transform it into an actual model and the process of analyzing and evaluation this model and the possibility of stimulating some healthy and unhealthy biological signals with a detailed and comprehensive study of many biological/bio models which internationally known and examined which enhances and deepens the students' scientific research side. In this Course purpose course the student is also introduced with modem modeling methods especially the digital modeling. The practical side includes introducing the student with the use of programming language MATLAB/SIMULINK and its application in the fields of modeling and simulation where the students are taught and trained to establish an integrated models through the use of this language which enable the students of obtaining the knowledge necessary to propose a system for examination and to execute it through an aiding programming environment which is specialized in this field (MATLAB/SIMULINK). And then full evaluation of this system which is transferable into a model. This facilitates the scientific research for the students of medical engineering in the field of modeling and simulating biological systems including bio signals.
Course curriculum	An integrated and full notebook that· is annually amended and developer.
References thatstudents may refer to:	- Modeling Biological Systems, Second Edition, James W. Haefner, Utah State University, Springer press, 2005. - 3D Modeling and Animation: Synthesis and Analysis Techniques for the Human Body· Nikos Sarris\Michael G. Strintzis, IRM press, 2005 - Simulation Modeling Handbook, Christopher A. Chung, CRC press; 2003. - Simulation, Modeling and Analysis. Averill M. Law, W. David Kelton. Third edition, 2000.
Related courses	
Course Subjects	

Chapter	main titles	Subtitles	Lectures per chapter
1	Principles and definitions	- The reason for making modeling and simulation for bio system. - Terms identification: System, description, modeling, model, simulation. - Models of biological systems. - Methods of using practical systems and models.	
2	Modeling and its classifications	- Hard modeling, soft modeling, hybrid modeling. - Black box. - Systems properties:Memory, causal, invertible, stable, timeinvariant, linear. - Conditions for forming a model: Realism, precision, generality. - Modeling functions. - Classifications of models: • Models types according to system work principle. • Models types according to formula or types. • Some notes o11 previous classification. Examples of some of previous models types.	
3	Computersimulation	- What is computer simulation? - When is simulation appropriate or inappropriate? - Advantages and disadvantages of simulation.	
4	Essential steps to developing a model	- Classification method: exact definition ofthe problem, hypotheses describing system work, stating relations that connect system components:	

		mathematical formulation, verification, calibration parameter, model analysis, model evaluation, model validation, parameters optimization. - Disadvantages of classical modeling method. - Modeling by multiple hypotheses method.	
5	Examples on physiological and biological models	- Compartment model for the treatment protocols for dialysis patients. - Blocky model used for examining the dynamics in bonecells. - Blocky model for examining the dynamics of insulin and glucose concentration in blood and it is applied and simulated by SIMULINK through using first class and second class differential equations. Simulation ECG by using Fourier series equations.	
6	Digital modeling	Digital modeling by using medial images. Structural modeling of the left ventricle.	
7	Qualitative and quantitative model formulation	- Qualitative model formulation. - Principles of qualitative formulation. - Model simplification. - Quantitative model formulation. - Shifting from qualitative to quantitative. - Finite difference and differential equations.	
8	Mathematical modeling method	- Quantitative mathematical representation of the basic biological operation. - Methods of mathematical modeling. Detailed example on representing bio system through a set of	

		mathematica1 equations (mathematical model of the left ventricle).	
9	Analog and its theories	- Definitions. - Quantities of analog. - Analog theories. - Examples in modeling and mathematical analog. • Mechanical modeling. • Electrical analog modeling. Similarity between mechanical and electrical models.	
Tutor	**Dr. En. Rana Haddad**		

Syrian Arab Republic

Damascus University

Faculty of Mechanical and Electrical Engineering

Biomedical Engineering Department

Course name	**Imaging systems and image processing (2)**			
Year	Fifth			
Department	**Biomedical Engineering**			
Academic term	First			
Hours	Theoretical	4	Practical	2
Course purpose	Medicalimagingis one of thecore disciplinesinbiomedical engineering, This course aimsto introducevarious medicalimagingtechniquesused inhospitalsby focusing onexplaining thevariousengineeringprinciples which usedin formattingthe diagnosticimage tothe internalanatomic tissues ofthe bodyin various types ofmedicalimaging systems. Brieflythis course buildsthe basicphysical andengineering skills of the studentto understand anddistinguishproperties, benefits and applications ofthe variousmedicalimagingsystems. Where it isexplaining method/methods of formatmedicalimage in: 1. MedicalimagingX-raysystems'techniques, from simpleimaging system thenmove on tospecializedsystems such asMammographyand Dental Panoramic imagingand other, passing through the digitalX-raydetectors, accesstoCTscanand its latesttechnicaldevelopments. 2. Medicalimaging systems'techniques usingradioactiveisotopesin theGammacameraand *single-photon emission computerized tomography (SPECT)* and positron emission tomography (PET). 3. Medicalultrasoundtechniquesthat includethe latestdifferentscanning methods, as well as the latesttypes ofscanningusingDopplersystems. 4. The mainphysical principlesinmagneticresonance imagingMRItechnology. Briefly, this coursecompletes theengineering informationobtained by thestudentinprevious coursesin theBiomedical Engineeringdepartment, such as the physics ofradiationin medicineandimage processingso thatestablishedthe studentwith thescientificbackgroundoftypes of medicalimages.			

Course curriculum	None.
References thatstudents may refer to:	1. Bushong S. (2008). Radiologic Science for technologist: Physics, Biology, and Protection 9th Edition, MOSBY Publisher, USA. 2. Bushberg J.T and Boone J. (2002), The Essentials Physics of Medical Imaging, 2nd edition, Williams and Wilkins Publisher, USA. 3. Curry T., Dowdy J. and Murry R. (1990), Christensen's Physics of Radiology, Lee &Febiger Publisher, USA.
Related Courses	1. Imaging systems and image processing (1) "Fourth year". 2. Radiation physics "Third year".

Course Subjects

Chapter	Main titles	subtitles	Lectures per chapter
1	Introduction about Medical Imaging systems		1
2	Conventional X-ray Imaging		6
3	Mammography		1
4	Digital X-ray Imaging		1
5	X-ray Fluoroscopy		2
6	X-ray Computerized Tomography		4
7	Medicalimaging systems byradioactiveisotopes	Gamma Camera	2
		Single-photon emission computerized tomography (SPECT)	2
		Positron emission tomography (PET).	1
8	Ultrasound Imaging		2
9	MagneticResonance Imaging "MRI"		1

Syrian Arab Republic

Damascus University

Faculty of Mechanical and Electrical Engineering

Biomedical Engineering Department

<table>
<tr><td>Course name</td><td colspan="5">Artificial Organs</td></tr>
<tr><td>Year</td><td colspan="5">Fifth</td></tr>
<tr><td>Department</td><td colspan="5">Biomedical Engineering</td></tr>
<tr><td>Academic term</td><td colspan="5">First</td></tr>
<tr><td>Hours</td><td>Theoretical</td><td>2</td><td>Practical</td><td>2</td><td></td></tr>
<tr><td>Course purpose</td><td colspan="5">The course aims to expand the awareness of students in the engineering design of artificial organs and knowledge of the functions of human organs and how they work (such as the heart, lung and pancreas ... etc.) and follow-up of modern scientific developments in the field of artificial organs. It also aims to strengthen the students on how to research and prepare the seminar, which motivates them to read and think and creativity.</td></tr>
<tr><td>Course curriculum</td><td colspan="5">None.</td></tr>
<tr><td rowspan="4">References thatstudents may refer to:</td><td>NO.</td><td>Title</td><td>Author</td><td>Publisher</td><td>Year</td></tr>
<tr><td>1</td><td>Artificial Organs</td><td>Gerald E. Miller</td><td>Morgan &Claypool l</td><td>2006</td></tr>
<tr><td>2</td><td>The Biomedical Engineering Handbook (Tissue engineering and artificial organs)</td><td>Joseph D. Bronzino</td><td>CRC Taylor & Francis</td><td>2006</td></tr>
<tr><td>3</td><td>Artificial organs</td><td>Judith JandaPresnall</td><td>San Diego, CA : Lucent Books</td><td>1996</td></tr>
<tr><td>Related courses</td><td colspan="5">Anatomy & Physiology & Medical devices /2/</td></tr>
<tr><td colspan="6">Course Subjects</td></tr>
</table>

Chapter	main titles	Subtitles	Lectures per chapter
1	The main stages in the design of Artificial organs	1- Introduction 2- Define theraised problem and clarify the basic tasks. 3- The initial design of artificial organ. 4- The detailed design of artificial organ. 5- Gain experience and generalization	**2**
2	The total artificial heart	1- Historical overview. 2- The total artificial heart parts.	**1**
3	planted supporting heart's pumps	1- One-axial rotary pump for supporting the work of the left ventricle. 2- Pulsed electromagnetic pump. 3- Centrifugal rotary pump.	**1**
4	Artificial valves of the heart	1- Introduction 2- Valve disease and replace 3- Optimized design of the valve 4- Mechanical valves 5- Valves histological vital 6- Hemodynamic and hydraulicparameters of prostheticvalves.	**2**
5	Artificial pancreas	1- Introduction 2- Artificial pancreas 3- Types of pumps used to inject insulin and which is implantable within the body.	**1**
6	Artificial lung	1- Introduction 2- The artificial lung "Novalung" 3- The artificial lung "MC3 (Michigan Critical Care Consultant)" 4- Membranous vascular	**1**

		built oxygenator. 5- Membrane vascular balloon oxygenator.	
7	Artificial liver	1- Physiological introduction. 2- Artificial liver. 2-1-Artificialnon vital liver 2-2-bio-artificial liver	**1**
8	Prosthetic vessels	1- Types of vascular grafts 2- The materials used in the manufacture of vascular grafts. 3- Uses hematic grafts. 4- Planting vascular grafts.	**1**
9	Airwaysprosthetic equipment	1-Introduction. 2-Designing the artificial trachea.	**1**
10	Artificial skin	1-Introduction. 2-Classification of skin substitutes 3. Natural skin substitutes 4- Artificial leather substitutes. 5-Ideal properties of skin substitutes.	**1**
11	Artificial blood	1-A brief History 2-pathological cases where blood transfusion 3-properties that must be available in the substituteblood. 4-Artificial blood patterns.	**1**
12	Pacemakers implanted inside the body	1- Introduction 2- Several types of Pacemakers	**1**
Tutor	**Dr. En Moustafa alMawalidi**		

Syrian Arab Republic

Damascus University

Faculty of Mechanical and Electrical Engineering

Biomedical Engineering Department

Course name	**Hospital Management**			
Year	Fifth			
Department	**Biomedical Engineering**			
Academic term	second			
Hours	Theoretical	2	Practical	2
Course purpose	Explain the concept of hospital management and the ideas and issues related to it in addition to showing other sciences associated with it such as the Economy, Sociology, Accounting, Aware of rights, Marketing, Math, Pathology... and other. Providing deep analysis of the structures of the administrative organization of a number of essential administrations in the hospital, such as medical corps, engineering, nursing, finance, human resources... and others. And certainly educate the medical engineer about his role in the management of hospitals.			
Course curriculum	None.			
References thatstudents may refer to:	Mukhaiber, Hanan (2010). "Hospital Management", The Arab Center for localization, translation, and authoring and publishing, Damascus, Syria (Arabic book).			
Related Courses	Hospital Engineering			

Course Subjects

Chapter	main titles	subtitles	Lecturesperchapter
1	Entrance to the Hospital Management	- Definitions. - The challenges facing hospitals and administrations. - Classification of hospital. - Hospital environment.	**1**
2	Functions of the administrative	- Planning in hospitals. - Organization in hospitals.	**1**

	process	- Supervision in hospitals. - Coordination in hospitals.	
3	The medical team at the hospital	- Medical Corps - Nursing Administration	**2**
4	Engineering administration	- Introduction - Medical Device management - Medical waste management	**1**
5	Major administrations in the hospital	- Human Resources Management - Medical Records Management - Nutrition Management	**1**
6	Quality management in the hospital	- Reliability. - Concepts and foundations of quality management. - The total quality management in the hospital.	**1**
7	Marketing Health Services	- Basic Concepts - Marketing services properties - Health Marketing - Analysis of consumer behavior - Public relations at the hospital	**1**
8	Patient Safety	- Basic Concepts. - Ethics of Health Professions. - Patient rights and duties. - Medical errors in practice.	**1**
9	Statistical analysis in the hospital	- Important definitions - Monthly Report for the movement of patients in the hospital - Health Statistics Service Output - Manpower in hospital statistics	**1**
10	The economics of health services	- Basic Concepts - Health services pricing - Health Insurance - Competition between hospitals	**1**
11	Finance Department	- Hospital funding - Measurement of the total operating cost of the hospital - Materials Management	**1**

Tutor	**Dr. Hanan Mukhaiber**

Syrian Arab Republic

Damascus University

Faculty of Mechanical and Electrical Engineering

Biomedical Engineering Department

Course name	**Medical Equipment /3/**			
Year	Fifth			
Department	**Biomedical Engineering**			
Academic term	First			
Hours	Theoretical	2	Practical	2
Evaluation	**Student effort (20) marks:** 5. Preparatory exam and assignments 8 marks. 6. Laboratory 12 marks.		**Final exam: 80 marks.**	
Course purpose	This course aims at introducing students of medical engineering with different medical equipment whether: diagnostic, therapeutic, or supporting. And introducing the student with the latest updates in this field in order toprepare him/her for practical life in case he/she chooses to work in the field of designing and investing medical equipment.			
Course description	This course aims at introducing students of medical engineering with different medical equipment whether: diagnostic, therapeutic, or supporting. Course purpose And introducing the student with the latest updates in this field in order to prepare him/her for practical life in case he/she chooses to work in the field of designing and			

	investing medical equipment. This course is a part of three courses that target examining parts and structure of medical equipment where the students examine anatomy and disease cases that entail the existence of this device and then the engineering concept use in the advanced technology; it explains block diagrams for thesedevices. And it connects theoretical lectures with practical section through visiting labs in the faculty to examine parts of mentioned devices, or visiting hospitals to observe its operations and parts, as well as inviting companies' representatives to discuss their information.
Course curriculum	Collection of printed lectures that are annually updated in conformity with the development medical technology.

References thatstudents may refer to:

NO.	Title	Author	Publisher	Year
1	Encyclopedia of Medical Devices and Instrumentation	J.G. Webster	John Wiley & SonsInc	1989
2	Design and Development of Medical Electronic Instrumentation: A Practical Perspective of the Design, Construction, and Test of Medical Devices	David Prutchi	John Wiley & Sons	2004
3	Medical Instrumentation Accessibility and Usability Considerations	J.H. Dshalalow	CRC Press Inc	2006

Course Subjects

Chapter	Main titles	Lectures per chapter
1	Magnetic resonance imaging devices	3
2	Mammography device	1
3	Ultrasound imaging device	2
4	Flexible endoscopes	1
5	Cruel endoscopes	1

6	Lithotripsy Devices	2
7	capsule endoscopy	1
Tutors	**Dr. Mohammed Firas Alhinawi – Dr. Ayman Saboni**	

Syrian Arab Republic

Damascus University

Faculty of Mechanical and Electrical Engineering

Biomedical Engineering Department

Course name	**Hospital Engineering**			
Year	Fifth			
Department	**Biomedical Engineering**			
Academic term	First			
Hours	Theoretical	2	Practical	2
Course purpose	Providing the knowledge to the student about the classification and structure of hospitals (therapeutic and services hospital departments, the relationship between the sections, the basic devices in each section).And teaching The student everything related to designing hospitals starting with the functional program, planning designs, preliminary and final designs and up to overseeing the construction and the finishing with a focus on the relationship between the architectural side with the device and how to investment and maintenance it and its needs.And also teaching students the necessary safety and protective procedures to protect against the transmission of infection in addition to the different requirements for ventilation and air-conditioning inside the hospital according to the serviced area, also teaching the students the designing foundations of the medical gases network and other.			
Course curriculum	None.			

References thatstudents may refer to:	1. Clear and sufficient summary provided by the teachers of the course. 2. Ali, Hisham Hassan (2004). "Lectures in the planning and coordinating hospitals." College of Nursing, University of Asyut, Egypt. (Arabic Book). 3. Khulusi, Mohammed Majid (1999). "Hospitals and social health centers." Dar Al Kabas for printing and publishing and distribution, Lebanon. **4.** Kunders, G. D. (2006). “Hospitals; Facilities Planning and Management”, Tala McGraw-Hill Publishing Company Limited, New Delhi.
Related Courses	Geometrical Drawing - fluid mechanics - medical equipment materials - Occupational Safety - maintenance of medical equipment.

Course Subjects

Chapter	**main titles**	**subtitles**	**Lecturesper chapter**
1	Introduction	1. The concept of Hospital Engineering science. 2. The relationship between Biomedical engineering and Hospital engineering. 3. Hospital classification. 4. The start point in Hospital designing.	**2**

2	Hospital designing Stages	1. Functional program setting stage. 2. Planning designs of the hospital setting stage. 3. The initial plan of the hospital setting stage. 4. The final plan of the hospital setting stage. 5. Hospital building and equipment delivering.	**4**
3	Nursing department	1. Patient rooms 2. Services	**2**
4	Intensive care and isolation department	1. Patient rooms 2. Services	**1**
5	Medical gases	The foundations of calculate and design the medical gases network.	**2**
6	Principles of design	1. Basic considerations in the design of hospitals. 2. The different directions in the design of hospitals' buildings. 3. Motion axes in the hospital	**1**
7	Operations department	1. Operations department site. 2. Design considerations of the department. 3. Operations department Sections 4. Movement analysis inside the department. 5. Wound infections. 6. Leaked anesthesia gases. 7. Thermal convection currents. 8. Environmental Control in the department.	**1**
8	Isolate rooms	1. Introduction 2. TB patients Isolate department 3. Bone marrow transplant center	

9	Ventilation in hospitals	1. Introduction 2. The effectiveness of the ventilation system. 3. The basic types of air movement within the room 4. Ventilation systems in hospitals	
10	Emergency department	1. Emergency department Features. 2. Patient flow Regulate 3. Design and general functional requirements.	
11	Radiology department	1. radiology department Site 2. Elements of the radiology department 3. Movement axes 4. An overview of the hardware and requirements	
Tutors	**Dr. Zuhair Marmar - Dr. Hanan Mukhaiber**		

This course is taught by both: d. Zuhair Marmar (Part I) and d. Hanan Mukhaiber (Part II). The following is a brief description of the Platform for decision, as Dr. Zuhair Marmar taught the first half of the course, which includes the first five chapters, and the Dr. Hanan Mukhaiber teaches second half of the course which consists of the last six seasons.

Syrian Arab Republic

Damascus University

Faculty of Mechanical and Electrical Engineering

Biomedical Engineering Department

Course name	**Biomedical control**			
Year	Fifth			
Department	**Biomedical Engineering**			
Academic term	First			
Hours	Theoretical	4	Practical	2
Course purpose	The course aims to recall the foundations of control theory, which's known by the students in the fourth year in the Control course, and empower students by applying these principles to vital systems.It also aims to develop the students' ability to design controlled systems generally, and Bio controlled particularly. Also there is a practical support for theoretical course,where the student becomes after finishing the study of this course is able to precise control of any dynamic system.			
Course curriculum	None.			
References thatstudents may refer to:	• Ogata, K. (2002). *Modern Control Engineering.* Prentice Hall. • Dorf R. C., Bishop R. H. (2005). *Modern control systems.* Pearson Prentice Hall. • Milhorn H. T. (1966). *The Application of Control Theory to Physiological Systems*, W. B. Saunders Company. • Li-xin Wang. (1997). *A course in Fuzzy systems and control.* Prentice Hall. • Linkens D. A. (1994). *Intelligent Control in Biomedicine*. Taylor & Francis.			

	• Mahfouf M., Abbod M.F., Linkens D. A. (2001). A Survey of Fuzzy Logic Monitoring and Control Utilization in Medicine, *Artificial intelligence in Medicine*,**21**, pp. 27-42. • Pedotti A., Ferrarin F., Quintern J., Riener R. (1996). *Neuroprosthetics from Basic Research to Clinical Application*. Springer-Verlag. • Dunn S. M., Constantinides A., Moghe P. V. (2006) Numerical Methods in Biomedical Engineering, Elsevier Academic Press, UK. • C.Cobelli, G.Sparacino, P.A. Caumo, M. P. Saccomani, G. M. Toffolo, Compartmental Models of Physiologic Systems. In: *The Biomedical Engineering HandBook*. Editor: J.D. Bronzino, (2000) Second Edition, CRC Press LLC, USA. • Makroglou,J. Li b, Y. Kuang, (2006) Mathematical models and software tools for the glucose-insulin regulatory system and diabetes: an overview. *Applied Numerical Mathematics*, vol(56),pp. 559-573.
Related Courses	Modeling and Simulation, Automatic Control Theory

Course Subjects

Chapter	**main titles**	**subtitles**	**Lectures per chapter**
1	The modern control systems	- Introduction to control - control system design - linear systems - find a mathematical model of a physical system - finding the final conversion function of box system	**2**
2	Designing the controlled system (Glucose regulation system in the blood)	- Glucose organization-introduction. - Chamber model. - Minimal models of the glucose movement. - System identification. - Physiological and medical explanation system to regulate glucose.	**5**
3	Proportional Integrative Differential Controller (PID)	Proportional Integrative Differential Controller (PID)	**1**
4	Fuzzy logic systems	- A historical overview of the emergence of the fuzzy systems - The fuzzy systems applications in medicine - The importance of the fuzzy	**2**

		systems	
5	Fuzzy Sets theory	- General definitions. - The fuzzy relations.	**2**
6	Fuzzy logic controller	- Linguistic variables - The fuzzy controller structure and how it works. - Processing rules in Mamdani and Sugeno ways. - Analytical method for the conclusion. - Designing steps of the fuzzy controller. - Designing of the fuzzy controller that is similar to the PID controller. - The fuzzy rules table	**5**
7	Studying the model of the skeletal muscles	- Anatomy and physiology of skeletal muscles. - Types of muscles' models. - Comparison of muscles' models.	**3**
8	Controlling system of skeletal muscles by the FES	Comparison between the Fuzzy system to control muscles and between the PID system	**1**
9	controllers adjust methods		**1**
Tutor	**Dr.En. Rasha Masoud**		

Syrian Arab Republic

Damascus University

Faculty of Mechanical and Electrical Engineering

Biomedical Engineering Department

Bioinformatics:

Or computational biology, Is the use of the latest techniques ofapplied mathematics, informatics, statistics, and computer science to solve biological vitality problems.

It is the latest science of computer that concerned with the biological information analysis using computer and statistical techniques.It is the science that trying to use and develop databases and computer algorithms to accelerate and strengthen the Biological Research.

It is a field of science in which Biology and Computer Science and IT (Information technology) merged together in one scientific field.

Bioinformatics has three main sections:

- The development of new algorithms and statistical techniques to help in collecting information from large collections of data.
- Analysis and explanation the different types of data (for example, the analysis of sequences of amino acids).
- Develop and implement tools to help in effective management of the different types of information.

Required Skills:

- Experience in working on one or more of custom software packages to dealing with the biology of molecules,learning how to analyze the biological data using this software.
- Learning operating systems (LINUX, UNIX) due to its strength and availability of software tools and custom software for this purpose.
- Good knowledge of programming languages such as: Java, HTML, C++
- Knowledge of database management systems and the best of them: Oracle and SQL most commonly used to store huge amounts of biological data to analyze and extract information from them.

Tutor of the course: Dr. Bassam Lala

Syrian Arab Republic

Damascus University

Faculty of Mechanical and Electrical Engineering

Biomedical Engineering Department

Course name	**Maintenance strategies of medical devices**			
Year	Fifth			
Department	**Biomedical Engineering**			
Academic term	second			
Hours	Theoretical	2	Practical	2
Course purpose	The course aims to clarify the mechanical and electronic maintenance methods and types of medical equipment maintenance in hospitals in order to increase the student's ability to deal with the maintenance and repair of medical devices and calibration,as well as increase the student's ability to detect the expected breakdowns to occur in the medical devices and increase the ability to adjust the parameters of medical devices and increased the interest by raising the levels of safety in medical devices			
Course curriculum	None.			
References thatstudents may refer to:	1. Handbook of electro medicine,Gearat G., 1983 2. Servicing medical bioelectronics equipment, Carr joseph, 1977. 3. X –ray Repair, PanichelloJosephj, 2000. 4. Lectures in the maintenance of medical devices (d. Ayman Saboni). 5. Components crashes in electronic circuits (d.			

	Mamounalhallak). 6. Maintenance and testing of anesthesia devices (d. Ahmed Hassan Jaber). 7. Different catalogs in the maintenance of medical devices.
Related Courses	This course is considered to be a complement to the course of the medical equipment that helps the student to deal with medical devices and calibrate it and detect breakdowns.

Course Subjects

Chapter	**main titles**	**subtitles**	**Lecturesper chapter**
1	Preventive maintenance and its requirements and procedures		**2**
2	Mechanical maintenance and its requirements		**1**
3	Maintenance of electronic medical equipment		**1**
4	Maintenance of radiation equipment		**1**
5	Maintenance of anesthesia devices		**1**
6	Maintenance of dental devices		**1**
7	Maintenance of autoclaves		**1**
8	Maintenance of artificial dialysis devices		**1**
9	Maintenance of respirators		**1**
10	Maintenance of cardiac devices		**1**
11	Maintenance of ultrasound waves devices		**1**
Tutors	**Dr. Mamdouh Munif – Dr. Munzer Khador**		

Syrian Arab Republic

Damascus University

Faculty of Mechanical and Electrical Engineering

Biomedical Engineering Department

Course name	**Nuclear Medicine**			
Year	Fifth			
Department	**Biomedical Engineering**			
Academic term	second			
Hours	Theoretical	4	Practical	4
Course purpose	The course aims to give students a good idea of the devices used in the field of nuclear medicine and how to use and methods of use as well as the course aims to introduce students to how to deal with equipment used in nuclear medicine and radioactive materials in order to avoid its risks.			
Course curriculum	None.			
References that students may refer to:	Physics in nuclear medicine – simon cherry 2003 Basic science principles of nuclear medicine - charlesboyd Zastosowaniaizotopòwpromieniotwòrczych (1+2) – bohdandziunikowski 1998 Dozymetriapromieniowaniajonizugącego w radioterapii –- włodzimierzŁobodziec- 1999			
Related Courses	The Nuclear Medicine Engineering course is a complement to the Radiation Physics course in the third year, as well as the radiological equipment that are taught in Medical equipment			

	course.

Chapter	main titles	subtitles	Lectures per chapter
1	Physics and the work of the mass spectrometer to analyze the elements		**2**
2	Nuclear reactions and its properties		**4**
3	Methods of radioactive isotopes preparation		**3**
4	Radioactive isotopes used in nuclear medicine		**2**
5	Linear accelerators and its types		**2**
6	Introduction to Nuclear Medicine		**1**
7	Radiological reagents and its parameters		**3**
8	Thyroid planning device and gamma camera		**4**
9	CT PET and SPECT		**2**
10	Radiation therapy in nuclear medicine		**1**
11	Radiation Protection in Nuclear Medicine		**1**
12	Radiation protection in nuclear medicine		

Tutors	**Section/1/ Dr. Nicola Abo Issa –Section/2/ Dr. Monzer khador**