King Abdulaziz University
Faculty of Science
Department of Physics

COURSE TITLE	ENGLISH CODE /No.	ARABIC CODE/NO.	CREDITS			
			Th.	Pr.	Tr.	CH
General Physics I	PHYS 110	ف ١١٠	3			3
PRE-REQUISITES		-				

Objectives:

1) **To achieve the necessary background to understand the principles of mechanics.**
2) **To build a concise d**emonstrative knowledge of the most important scientific and physical methods to contrast them with other ways of understanding the surrounding world.
3) To demonstrate an informative knowledge of the tools and methods that are used by scientists and physicists to investigate the world of nature.
4) To explain the most important and major parameters in mechanics such as velocity, acceleration, Newton laws and forces, work-energy, and laws of conservation of energy.
5) To enable the students to solve physics problems in a very structured process.
6) To enable non-physics students to creatively think and use of the physical sciences.

Contents:

Physical quantities, dimensional analysis, vectors, motion in one dimension, motion in a plane, Newton's laws, friction, work and energy, linear momentum, impulse, center of mass and collisions, and rotational motion.

Course Outcomes:

A- Knowledge:

1) Explaining the categories of measurements, Length, Mass and Time, Dimensional analysis, and Conservation of units.
2) Explaining the principles of scalar and vector quantities, Vector analysis, and various operations of vectors such as addition, subtraction, and multiplications.
3) Explaining the fundamental aspects of motion in One, two, and three dimensions such as position, displacement, speed, velocity, instantaneous and average velocity, acceleration, instantaneous and average acceleration.

Motion with constant acceleration, free falling, and projectile. Uniform circular motion.

4) Identifying the Laws of motion, the concept of force, Newton's First Law and inertial frames, mass, Newton's second law, gravitational force and weight, Newton's Third Law, and applications of Newton's Laws such as friction.
5) Explaining work and energy, work done by a constant force, kinetic energy and the work-kinetic energy theorem, and power.
6) Illustrating the concept of potential energy, total mechanical energy, and the law of conservation of energy.
7) Explaining the concept of linear momentum and the conservation law of linear momentum, the relation between force and momentum, the linkage between kinetic energy and momentum, impulse and momentum, elastic and inelastic collisions.
8) Explaining the principle of rotational motion, angular position, angular velocity, angular acceleration, rotational kinematics, the angular quantities and their images in the linear motion, torque, rotational kinetic energy, work, power and energy, and angular momentum in rotational motion.

B- Cognitive Skills

1) Solving various problems in different mechanical applications in the class.
2) Giving homework assignments to increase the ability of students of problem-solving techniques.
3) Enhancing the quick response of students by asking conceptual questions during the class.
4) Encouraging the students in the strategies of solving the examples in the class.

C- Interpersonal skills and responsibilities

1) Students are supposed to work as individuals and/or in small groups to share their knowledge and experiences.
2) Students should organize group meetings and schedule of their plans.
3) Students should elect a leader to manage their duties, responsibilities, and meeting.
4) Students should identify the available resources of the course with the help of the course director/instructor.

D- Analysis and communication:

1) Students are strongly advised to make use of the internet to follow the updates of the course materials and exams schedule on the personal webpage of the course coordinator.
2) Students are recommended to use internet to find relevant materials on the web and to test their understanding by answering the available QUIZZES on the websites that are designated for this purpose.
3) Students are suggested to make use of the programs (such as Mathematica, Fortran, C++) to solve some numerical problems in mechanics to increase their mathematical understanding of physical problems.

Assessment methods for the above elements

First Exam	30%
Second Exam	30%
Final Exam	40%

Text book:

Fundamentals of Physics by Halliday, Resnick & Walker 2001 John Wiley & Sons.

Supplementary references

Subsidiary books:

1- Physics for scientist and engineers with modern physics by Serway (1997), Saunders college publisher.

2- University Physics by Sears, Zemansky, and Young (1995).
3- Physics by Halliday, Resnick & Krane (1992) John Wiley & Sons.
Other Information Resources

Time table for distributing Theoretical course contents		
Week	**Theoretical course contents**	**Remarks**
1	General Introduction , General review	
2	Fundamentals quantités, Dimensionnas analysais Units Introduction to Physical quantities, Vectors and Scalars	**Chapters 1,3**
3	Adding Vectors Geometrically, Components of Vectors	
4	Units Vectors, Adding Vectors by Components, Multiplying Vectors	
5	1-D Motion, position, displacement, speed, velocity, acceleration, average and instantaneous velocity, average and instantaneous acceleration	**Chapter 2**
6	Motion with a constant acceleration, and free falling	
7	2-D and 3-D Motions, Projectile Motion, and uniform circular motion.	**Chapter 4**
8	Newton's first laws, Newton's second laws	**Chapter 5**
9	Newton's third laws, Applications of Newton's laws, Friction	
10	Properties of Friction and applications of Neton's laws	**Chapter 6**
11	Work done by a constant force , Work done by a Gravitational force, and Work done by a spring force	**Chapter 7**
12	Work done by a general variable force, Potential energy, Power Conservation of Mechanical energy	**Chapter 8**
13	Work done on a system by an external force Newton's second laws for a system of particles	**Chapter 9**
14	Linear momentum and its conservation, Momentum and kinetic energy in collisions	
15	Rotational motion, angular position, velocity, acceleration, torque and angular momentum.	**Chapter 10**
	Final exam	

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COURSE TITLE	ENGLISH CODE /No.	ARABIC CODE/NO.	CREDITS			
			Th.	Pr.	Tr.	CH
General Physics II	PHYS 202	ف ٢٠٢	3	3		4
PRE-REQUISITES		PHYS 110, MATH 110				

Objectives:

To achieve the necessary background in understanding of the principles of electricity and magnetism. To build a concise demonstrative knowledge of the most important electrical and magnetic concepts for simple electric circuits such as simple and multi loop circuits and RC circuit. **To understand the relation between electricity and magnetism.**

Contents:

The course reveals the electric and magnetic concepts, including the charge and electric force, electric field, Gauss' law, electric potential, capacitance, electric current and resistance, DC circuits, magnetic force, magnetic field, induction and inductance, magnetism of matter and Maxwell's equations.

Course Outcomes:

A- Knowledge

Student successfully completing the course are expected to learn and understand the concepts of electric force between charged particles, electric field and potential of charged particles. Capacitors, resistors and electric circuits, magnetic fields and magnetic forces. Induction and inductance.

B-Cognitive Skills

1) Solving various in-class problems in different applications of electricity and magnetism.
2) Giving homework assignments to increase the ability of students of problem-solving techniques.
3) Enhancing the quick response of students by asking conceptual questions during the class.
4) Encouraging the students in the strategies of solving the examples in the class.
5) Giving short multiple-questions quizzes in the class.
6) Writing the experimental reports after performing the experiment with the lab instructor.

C- Interpersonal skills and responsibilities

1) Students are supposed to work as individuals and/or in small groups to share their knowledge and experiences.
2) Students should organize group meetings and schedule of their plans.
3) Students should elect a leader to manage their duties, responsibilities, and meeting.
4) Students should identify the available resources of the course with the help of the course director/instructor.
5) Small groups of students will work together in the lab to test and analyze the results of the experiment.
6) Student must write their experimental reports individually.

D- Analysis and communication:

1) Students are strongly advised to make use of the internet to follow the updates of the course materials and exams schedule on the personal webpage of the course coordinator.
2) Students are recommended to use internet to find relevant materials on the web and to test their understanding by answering the available QUIZZES ion websites that are designated for this purpose.
3) Students are suggested to make use of the programs (such as Mathematica, Fortran, C++) to solve some relevant numerical questions to increase their mathematical understanding of physical problems.
4) It is of great important for the students to use the available plot software to represent graphs of their experimental results and compare them with their manual plots.

Assessment methods for the above elements

Midterm Exam	20%
Coursework and quizzes	15%
Lab Reports	10%
Lab Exam	15%
Final Exam	40%

Text book:
Fundamentals of Physics by Halliday, Resnick, and Walker, (2007).
Supplementary references
1- Physics by Kane and Sternheim, (1998).
2- Physics for Scientist and Engineers with Modern Physics, by Serway and Jewett, (2009).
3- University Physics with Modern Physics, by Young and Freedman, (2003).

Time table for distributing Theoretical course contents

Week	Theoretical course contents	Remarks
1	Introduction to the course, Review vectors	
2	Electric charge, electrostatic forces	**Chapter 21**
3	Electric field due to a single charge, dipole, and a uniform distribution of charges	**Chapter 22**
4	Electric flux, Gauss's law and its application, and electric field due to a line of charge.	**Chapter 23**
5	Electric field inside and outside a conductor and electric field inside and outside an insulator.	
6	Electric potential, potential energy, and the relation between the electric field and potential.	**Chapter 24**

7	Electric Capacitance and the equivalent capacitance, parallel and series connections of capacitors, energy stored in a charged capacitor and dielectrics	**Chapter 25**
8	Electric current, conductivity, and Ohm's law , resistance and temperature, electrical power and energy, electrical energy consumption cost.	**Chapter 26**
9	Direct current circuits and the equivalent resistance, parallel and series connections of resistors, and Kirchhoff 's Rules	**Chapter 27**
10	Magnetic field and magnetic forces.	**Chapter 28**
11	Magnetic fields due to currents, Biot-Savarat Law, Ampere's law, magnetic field due to solenoid.	**Chapter 29**
12	Faraday's and Lenz's laws of induction and motional electromotive force.	**Chapter 30**
	Inductance and self inductance and energy stored in the magnetic field.	**Chapter 30**
13		
14	Revision	
	Final exam	

Time table for distributing practical course contents		
Week	**Experiment**	**Remarks**
1	Announcing of the lab registration in the class	
2	Registration for the lab	
3	Introductory experiment	
4	Electric field and potential	
5	Determination of unknown resistance using Wheatstone Bridge	
6	RC Circuit	
7	The basic DC meter	
8	RLC Circuit	
9	Resonance in RLC Circuit	
10	The tangent method for determining the earth's magnetic field	
11	The electric and magnetic field deflections	
12	Revision	
13-15	Preparing the labs for examination	
	Final exam.	

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COURSE TITLE	ENGLISH CODE /No.	ARABIC CODE/NO.	CREDITS			
			Th.	Pr.	Tr.	CH
Introductory Biophysics	MPHY 205	ف ط ٢٠٥	3			3
PRE-REQUISITES		PHYS 110, BIO 222				

Objectives:
The course provides a general introduction to the physics of biological systems.

Contents:
The course introduces the fundamental concepts of living systems, cell structure and functions, concept of replication, DNA and protein structure, Brownian motion and diffusion, electrophoresis, descriptive models of liquids flow, electrophoresis and osmosis.

Course Outcomes:
At the end of the course the student will be able to deal with e&m components and problems such charge, field, volts, currents, etc. Students can read diagrams and connect circuits and get results. He can analyze the results and get the properties of the components …., Some thing like that , this is how to write the outcome of the course

A-Knowledge:
Lectures will provide a basic understanding of the key concepts of biophysics by applying physical principles, methods and techniques.

B-Cognitive Skills
It is desired to identify the physical laws and its rule on biological phenomena and life. Solved problems will cover the applications of physics in biological systems

C- Interpersonal skills and responsibilities
Students will be encouraged to attempt the problems independently and then collaborate and solve together.

D- Analysis and communication:
Real biological systems are extremely complex and rarely well defined. Making reasonable assumptions and identifying models is the key to progress.

Text book:
Biophysics: An Introduction, by Cotterill, John Wiley and Sons (2000).

Supplementary references
1- Biophysics, by R. Glasser, Springer Verlag (2001).

2- Biology in Physics: Is Life Matter, by K. Bogdanov, Academic Press (2000).
3- Biophysics: An Introduction, by C. Sybesma, Kluwer Academic (1989).
4- Introduction to Molecular Biophysics, by J. Tuszynski, CRC Press (2003).
Other Information Resources

Time table for distributing Theoretical course contents		
Week	**Theoretical course contents**	**Remarks**
1	Introduction to Biological Structures	
2	Structure and formation of biomolecules	
3	ar structure of membranesMolecul	
4	Fundamental concepts of Thermodynamics	
5	Cell structure and functions	
6	Electrostatic fields and cells	
7	Self assembly and stability	
8	DNA and its functions	
9	Proteins and protein folding	
10	Brownian motion	
11	Basic properties of fluids	
12	Viscoity of biological fluids	
13	Biomechanics of fluid behaviour	
14	Electrphoresis	
15	Osmosis and osmotic pressures	
	Final exam.	

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COURSE TITLE	ENGLISH CODE /No.	ARABIC CODE/NO.	CREDITS			
			Th.	Pr.	Tr.	CH
Modern Physics	MPHY 242	ف ط ٢٤٢	3			3
PRE-REQUISITES		PHYS 202, MATH202				

Objectives:
The course is intended to give the student a comprehensive introduction of theory of matter and charged particles.

Contents:
The course introduces the fundamental concepts like black body radiation, quantization of energy, photoelectric effect, the Compton Effect. It also introduces line spectra, X-ray spectrum and laser light. A brief introduction of Wave functions and Schrodinger equation.

Course Outcomes:

A-Knowledge:
It is desirable to understand and appreciate the key concepts of modern physics like black body radiation and the use of wave functions.

B-Cognitive Skills
Students will be able to differentiate between the classical and modern concepts of physics. In fact, students will appreciate the concepts of physics introduced in the beginning of last century, specially relativity and quantum physics.

C- Interpersonal skills and responsibilities
Students will be encouraged to attempt the problems independently and then collaborate and solve together.

D- Analysis and communication:
Course objectives will be accomplished through group discussions and lectures..
Assessment Methods for the above elements: Besides the final examination at the end of semester, there will be a mid term examination, two quizzes and two assignments. Students will be graded as the given scheme (40 + 20 + 20 + 20).
Text Book:
K. Krane, Modern Physics, John Wiley and Sons (1996)

Supplementary References:

1- A. Beiser, Cocepts of Modrn Physics, Mc-Graw Hill (2002)
2- J.Taylor, C. Zafiratos and M. Dubson, Modern Physics for scientists and engineers, McGraw Hill (2003)

Time table for distributing Theoretical course contents		
Week	**Theoretical course contents**	**Remarks**
1	Thermal and Black body radiation	
2	Planck radiation law and quantization of energy	
3	Heat capacity of solids	
4	The photoelectric effect and Einsten theory	
5	gThe compton effect and concept of scatterin	
6	Line spectra and Bohr theory	
7	Wave behaviour of particles and wave functions	
8	Uncertainty principle	
9	Schrodinger equation and applications	
10	Trapped particles and probability density	
11	Hydrogen atom	
12	x rays and x ray spectrum	
13	Laser and laser light	
14	Einsteinian concepts	
15	Functions of lasers	
	Final exam.	

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COURSE TITLE	ENGLISH CODE /No.	ARABIC CODE/NO.	CREDITS			
			Th.	Pr.	Tr.	CH
Mathematical Methods for Medical Physics	MPHY 255	ف ط ٢٥٥	3			3
PRE-REQUISITES		PHYS 202, MATH 202				

Objectives:
The course is designed to introduce the basic mathematical methods and applications to understand and appreciate the physics of biological systems.

Contents:
Vector analysis, concepts of gradient, divergence, and curl of a vector, integral theorems, elements of complex algebra, determinants and matrices, Fourier and Laplace transformations, ordinary differential equations, special functions such as Bessel, Legendre, Beta, Gamma, and Laguerre functions with their applications are discussed within this course.

Course Outcomes:

A- Knowledge:
It is desirable to understand the relationship between fundamental physical phenomena and the corresponding formulation in terms of mathematical principles.

B-Cognitive Skills
Elementary techniques of mathematics will enable the students to appreciate the relationship between biological phenomena and the basic physical principles.

C- Interpersonal skills and responsibilities
Elementary techniques of solving problems will enable students to appreciate and understand the behavior of biological systems.

D- Analysis and communication:
Students will learn how to identify the basic underlying physics of living systems and then to analyze these.

Text book:
Introduction to Mathematical Physics, by C. Harper, Prentice Hall (1976).

Supplementary references
1- Introduction to Mathematical Physics: Methods and Concepts, by C.W. Wong, McGraw Hill (1991).
2- Mathematical Methods in the Physical Sciences, by M. Boas, John Wiley & Sons (2005).
3- Introduction to Mathematical methods in Physics, by G. Fletcher, W. Brown Publishers (1994).

4- Mathematical Methods of Physics, by J. Mathews and R. Walker, Pearson Education, Ins. (1970).

Other Information Resources

Time table for distributing Theoretical course contents		
Week	**Theoretical course contents**	**Remarks**
1	Introduction to vectors	
2	Vector multiplications and applications	
3	Differentiation of vectors	
4	Graient Divergence and Curl of vectors	
5	gral theoremsLine intergal and inte	
6	Algebra of complex numbers	
7	Determinants and matrices	
8	Fourier series and applications	
9	Laplace transforation and applications	
10	Ordinary differential equations	
11	Linear equations with constant coefficeints	
12	ctions and applicationsBessel fun	
13	Beta and Gamma functions	
14	Legenre polynomials and functions	
15	Laguerre differential equation and functions	
	Final exam.	

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COURSE TITLE	ENGLISH CODE /No.	ARABIC CODE/NO.	CREDITS			
			Th.	Pr.	Tr.	CH
Health Physics	MPHY 261	ف ط ٢٦١	3			3
PRE-REQUISITES		PHYS 110, BIO 222				

Objectives:
This course presents the fundamental principles of health physics

Contents:
The physics of dose deposition, radiation dosimetry, elementary shielding and radiation protection devices, Description and proper use (calibration and maintenance) of health physics instrumentation, and the regulatory and administrative requirements of health physics programs. A systemic approach to the study of the human body from a medical imaging point of view: skeletal, respiratory, cardiovascular, digestive, and urinary systems, breast and women's issues, head and neck, and central nervous system.

Course Outcomes:

A- Knowledge:

Definitions of dose deposition, radiation dosimetry, elementary shielding and radiation protection devices and skeletal, respiratory, cardiovascular, digestive, and urinary systems, breast and women's issues, head and neck, and central nervous system.

B-Cognitive Skills

Calculations of dose deposition and radiation dosimetry, thinking how to make a calibration and maintenance

C- Interpersonal skills and responsibilities

Urged students to work groups, each group assigned a mini-job search that includes one of the topics to be that the students explaining the school hall and urged them to interact with their colleagues by asking questions and attempts to find a solution.

D- Analysis and communication:

Urged the students to understand the importance of analyzing the knowledge they have obtained and linked to reality and how to communicate what they received from the knowledge and practical touch with reality

Assessment methods for the above elements

Quizzes, periodical tests, assignments and researches

Text book: Only one

Introduction to Health Physics: Fourth Edition by Herman Cember and Thomas Johnson (2008), Oxford pub.

Supplementary references

1. Radiation Protection and Dosimetry: An Introduction to Health Physics by Michael G. Stabin (2007)
2. Basic Health Physics: Problems and Solutions by Joseph John Bevelacqua (1999).

Time table for distributing Theoretical course contents		
Week	**Theoretical course contents**	**Remarks**
1	introduction	
2	Definitions of doses	
3	The physics of dose deposition	
4	radiation dosimetry	
5	elementary shielding	
6	radiation protection devices	
7	Description and proper use of health physics instrumentation	
8	(calibration and maintenance)	
9	the regulatory and administrative requirements of health physics programs	
10	skeletal, respiratory	
11	cardiovascular	
12	digestive, and urinary systems	
13	breast and women's issues	
14	head and neck	
15	central nervous system	
	Final exam.	

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COURSE TITLE	ENGLISH CODE /No.	ARABIC CODE/NO.	CREDITS			
			Th.	Pr.	Tr.	CH
General Physics Lab.	PHYS 281	ف ٢٨١		3		1
PRE-REQUISITES		PHYS 110				

Objectives:
The course tends to give the student a feel of the physical experiments and their setup and then the analysis of the experimental data.

Contents:
The experiments and applications of this laboratory are described very closely in accordance to the topics of General Physics I (PHYS 110).

Course Outcomes:

A-Knowledge:

B-Cognitive Skills

C- Interpersonal skills and responsibilities

D- Analysis and communication:

Assessment methods for the above elements

Student Evaluation:

1- 5 Quizzes 20 Marks
2- Reports. 40 Marks
3- Final Exam. 40 Marks

Total 100 Marks

Text book:

An experimental manual will be available for the student in the laboratory.

Time table for distributing practical course contents		
Week	**Experiment**	**Remarks**
1	Registration	
2	Safety & Regulations	
3	Friction	
4	Free fall	
5	Force table	
6	Newton's law	
7	Projectile motion	

8	Air track	
9	Rotational motion	
10	Simple pendulum	
11	Hook's law	
	Final exam.	

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COURSE TITLE	ENGLISH CODE /No.	ARABIC CODE/NO.	CREDITS			
			Th.	Pr.	Tr.	CH
Concepts of Electronics	MPHY 313	ف ط ٣١٣	2			2
PRE-REQUISITES		PHYS 202, MATH 202				

Objectives:
The course aims to teach students the fundamental and conceptual materials of electronics to enable them to understand and appreciate the physics and application of bioelectronics later.

Contents:
The course covers a range of topics such as electrical and electronic quantities, circuit principles, circuit components, DC and AC circuits, signal processing, diodes, transistors, operational amplifiers, electronic devices, digital electronics, and analog electronics.

Course Outcomes:

B- Knowledge:

C-

1- Understand the various theories of electrical and electronic circuit's analysis.
2 - Identify the characteristics of semiconductor materials and electronic devices how to manufacture them

B-Cognitive Skills

1 - The student should learn how to design a constant voltage sources, as well as stabilizers.
2 - The student should learn how to test electronic devices and determine its validity.
3- The student should learn how to design a simple circuit to amplify the voltage.

C- Interpersonal skills and responsibilities

Students gain skills analog electronic circuit design and trained to analyze the results and outputs of the services.

D- Analysis and communication:

The student in conjunction with his colleagues in the discussions and design of electronic circuits, which benefit them in their daily lives.

Assessment methods for the above elements

1- Weekly quizzes 10%
2- First intermediate Exam. 25%
3- Second intermediate Exam. 25%

4- Final Exam. 40%

Text book:

Electronics: Circuits and Devices, by R. Smith, (1987).

Supplementary references

1- Electronic Circuits: Fundamentals and Applications, by M. Tooley, (2006).

2- Electronics Devices and Circuits, by T. Boogart, J. Beasley, and G. Rico, (2003).

3- Electronics Fundamentals: Circuits, Devices, and Applications, by T. Floyd, (2006).

Other Information Resources

1-Introduction to Digital Systems, John Crisp, Newnes, (2004).

2- Analog and Digital Circuits for Electronic Control System Applications, Jerry Luecke, (2005).

Time table for distributing Theoretical course contents		
Week	**Theoretical course contents**	**Remarks**
1	Dc circuits(Ohm's law ,Kirchhoff's 1^{st} and 2^{nd} laws, the potential divider, the current divider	
2	The Wheatstone bridge, Thevenin's theorem, Norton's theorem, R-C circuits, L-R circuits	
3	AC circuits, RC circuits, RL circuits, RLC circuits	
4	Semiconductor diode, Ideal diode, semiconductor materials, concept of energy band, Extrinsic semiconductor, n and p-Type semiconductor, forward-bias conduction	
5	Backward-bias conduction, diode resistance AC and DC, different diode models, Diode applications, half-wave rectifier, full-wave rectifier, smoothing circuits, improved ripple filters, clipper circuits, zener diode.	
6	Bipolar Junction Transistor (BJT), common-base configuration, common-emitter configuration, common-collector configuration	
7	Transistor applications, transistor as a switch, transistor difference amplifier, emitter follower, A-stable multi-vibrator	
8	Field Effect Transistor (FET) construction and characteristics of JFETs	
9	Operational amplifier, inverting and non-inverting amplifiers, peak-detector amplifiers, logarithmic and anti-log amplifiers	
10	Window comparator amplifiers, summing and subtracting amplifiers, integrators and differentiator amplifiers, relaxation oscillators, Instrumentation amplifier	
11	Timer circuits.	
12	Digital systems, Binary system, Hexadecimal system	
13	Logic gates, logic design, flip-flop circuits, binary counter circuits	
14	Digital to Analog circuits (D/A), Analog/Digital circuits (A/D)	
15	Introduction to computer interface and data acquisition systems.	
	Final exam.	

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COURSE TITLE	ENGLISH CODE /No.	ARABIC CODE/NO.	CREDITS			
			Th.	Pr.	Tr.	CH
Bioelectronics	MPHY 314	ف ط ٣١٤	2			2
PRE-REQUISITES		PHYS 313, PHYS 255				

Objectives:
To make students to understand the applications of electronics in diagnostic and therapeutic area, provide an introduction to the use of electrical theory and electronics in biological systems and to develop an understanding of how engineering skills from previous year's course can be more generally applied.

Contents:
Ionic conduction, the metal-electrolyte double layer, models of the cell membrane; Electrical signal detection in biological systems: silicon, glass and metal electrodes; amplifier design. Bio-electronic device production: microelectronic fabrication methods as adapted to bioelectronics, hard and soft lithography, bio-compatibility of materials; Existing types of biosensors: micro-systems including sensing using optical techniques, field effect transistors, ion-selective and enzymatic sensitive electrodes, as well as impedance monitoring.
To study the methods of recording various bio-potentials
•To study how to measure biochemical and various physiological information
•To understand the working of units which will help to restore normal functioning

Course Outcomes: Mathematical modeling of the nervous system; analysis of biosensor measurements; use of model neurons for associative computer memory; electrical Circuit treatment of biological environments: ionic conduction, the metal-electrolyte double layer, models of the cell membrane.

Text book:
Bioelectronics. Edited by Itamar Willner and Eugenii Katz, 2005 WILEY-VCH Verlag GmbH & Co. KGaA, Weinheim, ISBN: 3-527-30690-0

Supplementary references:
Bioelectronics: From Theory to Applications, Itamar Willner, Eugenii Katz, WILEY-VCH Verlag GmbH, 2005

Time table for distributing Theoretical course contents		
Week	**Theoretical course contents**	**Remarks**
1	Evaluation of biosensors. Mathematical modeling of the nervous system	
2	Analysis of biosensor measurements.	
3	Use of model neurones for associative computer memory.	
4	Electrical Circuit treatment of biological environments: ionic conduction, the metal-electrolyte double layer, models of the cell membrane.	
5	Electrical signal detection in biological systems: silicon, glass and metal electrodes, amplifier design.	
6	Electrical signal detection in biological systems: silicon, glass and metal electrodes, amplifier design.	
7	Electrical signal detection in biological systems: silicon, glass and metal electrodes, amplifier design.	
8	Bio-electronic device production: microelectronic fabrication methods as adapted to bioelectronics, hard and soft lithography, bio-compatibility of materials.	
9	Bio-electronic device production: microelectronic fabrication methods as adapted to bioelectronics, hard and soft lithography, bio-compatibility of materials.	
10	Existing types of biosensors: miniaturisation and micro-systems including sensing using optical techniques, field effect transistors, ion-selective and enzymatic sensitive electrodes, as well as impedance monitoring.	
11	Existing types of biosensors: miniaturisation and micro-systems including sensing using optical techniques, field effect transistors, ion-selective and enzymatic sensitive electrodes, as well as impedance monitoring.	
12	Existing types of biosensors: miniaturisation and micro-systems including sensing using optical techniques, field effect transistors, ion-selective and enzymatic sensitive electrodes, as well as impedance monitoring.	
13	Examples of industrial biosensors, e.g. for glucose monitoring and for DNA analysis.	
14	Examples of industrial biosensors, e.g. for glucose monitoring and for DNA analysis.	
15	Examples of industrial biosensors, e.g. for glucose monitoring and for DNA analysis.	
	Final exam.	

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COURSE TITLE	ENGLISH CODE /No.	ARABIC CODE/NO.	CREDITS			
			Th.	Pr.	Tr.	CH
Optics and Laser	MPHY 315	ف ط ٣١٥	3			3
PRE-REQUISITES		PHYS 255, PHYS 344				

Objectives:

Study of geometrical, physical optics, coherence and interference is mandatory to enable determining the proper lenses, optics and proper thin films required in the field of vision refraction correction.

It is also vital to understand lasers techniques and types suitable for vision correction.

Contents:

Light rays – light waves – light propagation in matter – optical images – coherence and interference measurement – light and matter – Lasers – Laser dynamics – semiconductor laser – light sensors.

Course Outcomes:

A. Knowledge:

Refraction and reflection laws – Polarization – Interference – Diffraction – Human eye – Optical microscope – distortion in lenses – Lasers.

B. Cognitive Skills:

Depending on what they studied, the students would be able to solve, theoretically, the vision problems and deal with optical instruments.

C. Interpersonal skills and responsibilities:

The students, independently, would be able to analyze the problems and find the solution by research, the way which enrich thier knowledge about the subject.

D. Analysis and communication:

Despite the students depend on the facts and rules to solve vision-related problems, they have to communicate with other information resources to find more accurate solutions of the problems.

Assessment methods of the above elements

Continuous assessment and theoretical exams are the main methods of assessment.

Text book:

"Optics, Light and Lasers" by Dieter Meschede .2004 WILEY-VCH Verlag GmbH & Co .KGaA, Weinheim

Supplementary references:

"Handbook of Optics "2nd ed .Vol .III "Classical, Vision and x-ray optics" by Michael Bass .2000, McGraw-Hill.

“Handbook of Optics "3rd ed .Vol .I “Geometrical and Physical Optics, Polarized Light, Components and Instruments” by Michael Bass .2010, McGraw-Hill.

Other information resources:

Time table for theoretical course contents		
Week	**theoretical course contents**	**Remarks**
1	Light Rays	
2	Wave Optics	
3	Light Propagation in Matter	
4	Optical Images, Lenses	
5	Coherence and Interferometry	
6	Light and Matter	
7	The Lasers	
8	Solid State Lasers –Gas Lasers – Tunable Lasers	
9	Laser Dynamics	
10	Semiconductor Laser	
11	Diode Laser	
12	Light Sensors	
13	Quantum Sensors	
14	Laser Spectroscopy: Laser induced fluorescence - Absorption and Dispersion	
15	Laser Spectroscopy: The spectral line width – Doppler-free Spectroscopy – Light Forces	
	Final Exam.	

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COURSE TITLE	ENGLISH CODE /No.	ARABIC CODE/NO.	CREDITS			
			Th.	Pr.	Tr.	CH
Waves and Ultrasound	MPHY 323	ف ط ٣٢٣	2			2
PRE-REQUISITES		PHYS 202, PHYS 255				

Objectives:

The course mainly aims to outline the fundamental and conceptual physics of ultra sonography including safety issues and competency in the use of widely used ultrasound equipment and their techniques.

Contents:

The structure of this course consists of the physics of ultrasound, transducer technology, diagnostic equipment technology, Doppler, bio-acoustics, basic acoustical physics and acoustical waves in human tissue with emphasis on ultrasound transmission in soft tissues, attenuation of ultrasound energy, interaction of ultrasound with tissues, mechanics of ultrasound production and display.

Text book:

Foundations of Biomedical Ultrasound, by R. S. Cobbold, Oxford (2006).

Supplementary references

1- Essentials of Ultrasound Physics, by J. A. Zagzebski, (1996).

2- Understanding Ultrasound Physics, by S. K. Edelman, (2004).

Other Information Resources

Objectives: The student will explain the pulse-echo principle

- The student will be able to manipulate and explain the controls on the ultrasound equipment to demonstrate an adequate sonographic image, to get overview of the basic physics of ultrasonography, to equip individuals with the knowledge, professional skills, attitudes and clinical competencies to use ultrasound imaging in an appropriate and safe manner.

Contents: Basic acoustical physics and acoustical waves in human tissue;

1. Emphasis on ultrasound transmission in soft tissues, attenuation of sound energy, parameters affecting sound transmission,
2. resolution of sound beams, interaction of ultrasound with tissues,
3. mechanics of ultrasound production and display, various transducer designs and construction, quality assurance,
4. Bio- effects and image artifacts. It may, also, introduce methods of Doppler flow analysis.

Course Outcomes:

D- Knowledge:

- The pulse-echo principle, Controls on the ultrasound equipment to demonstrate an adequate sonographic image, Methods of Doppler flow analysis, The basic physics of ultrasonography, including safety issues and ensure competency in the use of commonly used ultrasound machines.

Assessment methods:

Continuous assessment and theoretical exams are the main methods of assessment.

Text book:

Bioelectronics. Edited by Itamar Willner and Eugenii Katz, 2005 WILEY-VCH Verlag GmbH & Co. KGaA, Weinheim, ISBN: 3-527-30690-0

Supplementary references

An Introduction to Systems Biology: Design Principles of Biological Circuits (Chapman & Hall/CRC Mathematical & Computational Biology- Uri Alon

Publisher: Chapman and Hall/CRC; 1 edition (July 7, 2006)

Time table for distributing Theoretical course contents		
Remarks	**Theoretical course contents**	**weak**
	Physics of sound basics	1
	Basic acoustical physics and acoustical waves in human tissue;	2
	Emphasis on ultrasound transmission in soft tissues	3
	attenuation of sound energy,	4
	attenuation of sound energy,	5
	parameters affecting sound transmission,	6
	parameters affecting sound transmission,	7
	resolution of sound beams,	8
	interaction of ultrasound with tissues	9
	interaction of ultrasound with tissues	10
	interaction of ultrasound with tissues	11
	mechanics of ultrasound production and display,	12
	mechanics of ultrasound production and display,	13
	various transducer designs and construction, quality assurance, bio-effects, and image artifacts.	14
	methods of Doppler flow analysis.	15
	Final exam.	

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COURSE TITLE	ENGLISH CODE /No.	ARABIC CODE/NO.	CREDITS			
			Th.	Pr.	Tr.	CH
Atomic and Molecular Spectra	MPHY 344	ف ط ٣٤٤	2			2
PRE-REQUISITES		MPHY 255, MPHY 242				

Objectives:
This course aims to give the student the key idea of understanding and identifying the contents and spectra of the materials by studying the atomic and molecular spectra emitted from these materials.

Contents:
Electromagnetic radiation and its interaction with atoms and molecules - General features of experimental methods - Molecular symmetry - Rotational spectroscopy - Vibrational spectroscopy - Electronic spectroscopy.

Course Outcomes:

A. Knowledge:
   Getting the idea of using the spectroscopy in determining the composition and structure of the materials even nano-scale matter.
B. Cognitive Skills:
   By the end of this course, the student will be capable of using the proper method to study materials using the best method of spectroscopy.
C. Interpersonal skills and responsibilities:
   The student will be capable to cooperate and form team work to exechange ideas and solutions to a specific problem depending on what he has studied in this course.
D. Analysis and communication:
   The students will be prepared to exchange information, the way by which no progress will be achieved without it.

Assessment methods of the above elements

Applications of this course are discussed with each student separately. The scientific outcomes are assessed by forming small groups of students to solve each problem using various ideas. In addition to this, an essay question test is carried out to evaluate the analytical level of each student.

Text book:
Biophysics: An Introduction, by R. Glasser, Springer (2000).

Supplementary references:

1- Physics in Biology and Medicine, P. Davidevits, Academic Press (2007).
2- Molecular and Biological Physics of living Systems, by R. Mishra, Academic Press (2005).
3- Living Systems, by L. Margorlis and A. Robinson, (2007).

Other Information Resources:

Time table for theoretical course contents		
Week	theoretical course contents	Remarks
1	Introduction	
2	Molecular Symmetry	
3	Atomic Spectroscopy	
4	Rotational Spectroscopy	
5	Rotational Spectroscopy (continued)	
6	Vibrational Spectroscopy, Diatomic Molecules	
7	Vibrational Spectroscopy (continued), Vibrational Motion of Polyatomic Molecules	
8	Vibrational Spectroscopy (continued) , Vibrational Spectra of Symmetric Tops	
9	Vibrational Spectroscopy (continued), Infrared Transitions of Spherical TopsVibrational Spectra of Asymmetric Tops, Fermi and Coriolis Perturbations Inversion Doubling and Fluxional Behavior	
10	The Raman Effect	
11	The Raman Effect (continued), Rotational Raman Effect	
12	Electronic Spectroscopy of Diatomic Molecules	
13	Electronic Spectroscopy of Diatomic Molecules (continued), The Symmetry of Diatomic Energy Levels: Parity	
14	Electronic Spectroscopy of Polyatomic Molecules, Orbitals and States	
15	Electronic Spectroscopy of Polyatomic Molecules, Vibrational Structure of Electronic Transitions, Vibronic Coupling: The Herzberg-Teller Effect	
	Final Exam.	

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COURSE TITLE	ENGLISH CODE /No.	ARABIC CODE/NO.	CREDITS			
			Th.	Pr.	Tr.	CH
Medical Statistics	MPHY 357	ف ط ٣٥٧	2			2
PRE-REQUISITES		MPHY 255, MPHY 242				

Objectives:
The purpose of the course is to introduce and deepen the basic knowledge of statistical and methodological aspects for medical and health care issues and hypothesis.

Contents:
The course explains the probability, permutation and combinations, measure of central tendency, standard deviation, and statistics of genetics, normal distribution, errors in quantities, errors in averages, T-test, Poisson distribution, Chi square test and experimental errors.

Course Outcomes:

A. **Knowledge:**
Different statistical methods – tabulating of data suitable for the problem – statistical tests for data – probability – methods of calculating regression and standard deviation.

B. **Cognitive Skills:**
Applying the statistical studies on real life bio samples.

C. **Interpersonal skills and responsibilities:**
The student practices on how to select the ideal statistical method for the studied case, and how to apply what has been studied on similar and variant bio cases.

D. **Analysis and communication:**
The work team formed of small groups of students enriches the analytical skills.

Assessment methods of the above elements

Different examples – Practical application on pre-studied biological samples and the theoretical test. (Not likes this , Exam I , Exam II and so on…….)

Text book:
"An Introduction to Medical Statistics" 3rd Ed .By Martin Bland .2000 Oxford University Press

Supplementary references:
"Statistics in Medicine" 2nd Ed .By Robert H .Reffenburgh.
"Medical Statistics at a Glance "2nd Ed .By Aviva Petry and Caroline Sabine .2005 Blackwell Publishing.

Other information resources:

Time table for theoretical course contents		
Week	**theoretical course contents**	**Remarks**
1	Introduction	
2	Sampling and observational studies	
3	Summarizing data	
4	Presenting data	
5	Probability	
6	The Normal distribution	
7	Estimation	
8	Significance tests	
9	Comparing the means of large samples	
10	Comparing the means of small samples	
11	Regression and correlation	
12	Choosing the statistical method	
13	Determination of sample size	
14	MCQs for the whole course	
15	Solving problems	
	Final Exam.	

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COURSE TITLE	ENGLISH CODE /No.	ARABIC CODE/NO.	CREDITS			
			Th.	Pr.	Tr.	CH
Physics of Living Systems	MPHY 361	ف ط ٣٦١	3			3
PRE-REQUISITES		MPHY 261				

Objectives:
The physical concepts of the living systems of the human beings will be introduced in this course.

Contents:
The course studies energetic and dynamics of biological systems, bioelectric properties of membranes, resting potential, Hodgkin-Huxley theory, cardiac flow, hemodynamic, mechanical properties of cells, tissues, organs, biophysical properties of skeleton, joints, muscles, and optics of the eye.

Course Outcomes:

A-Knowledge:
Living systems are subject to laws of physics. Lectures stress the elementary behavior of ions, proteins and molecules in the biological membranes and systems.

B-Cognitive Skills
Purpose of the course is to identify physical laws and their effects on biological phenomena and our life.

C- Interpersonal skills and responsibilities
Solved problems will cover the living systems and the relationship between physical and biological phenomena.

D- Analysis and communication:
The course objectives will be accomplished through lectures and group discussions. Students will be encouraged to discuss the class lectures.

Text book:
Biophysics: An Introduction, by R. Glasser, Springer (2000).

Supplementary references:
1- Physics in Biology and Medicine, P. Davidevits, Academic Press (2007).
2- Molecular and Biological Physics of living Systems, by R. Mishra, Academic Press (2005).
3- Living Systems, by L. Margorlis and A. Robinson, (2007).

Other Information Resources:

Time table for distributing Theoretical course contents		
Week	**Theoretical course contents**	**Remarks**
1	Molecular and ionic interactions	
2	Interfacial phenomena and membranes	
3	Surface and interfacial tensions	
4	Molecular structure of membranes	
5	Mechanical properties of membranes	
6	Introductory concepts of nervous system	
7	Action potential and Hodgkin Huxley theory	
8	Structure of Heart and its functions	
9	Biomechanics of fluid behaviour	
10	Fluid dynamics and blood circulation	
11	Biomechanics of human body	
12	nd functions of tissuesStructure a	
13	Biological properties of skeleton	
14	Biomechanics of joints and muscles	
15	Optics of the eye	
	Final exam.	

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COURSE TITLE	ENGLISH CODE /No.	ARABIC CODE/NO.	CREDITS			
			Th.	Pr.	Tr.	CH
Nuclear and Radiation Physics	MPHY 363	ف ط ٣٦٣	3			3
PRE-REQUISITES		MPHY 242, MPHY 261				

Objectives:
This course presents the basic concepts of nuclear physics, radiations and their interaction with materials.

Contents:
The course concentrates on the basic concepts of nuclear models, semi-empirical mass formula, interaction of radiation with matter, nuclear detectors, nuclear structure and instability, radioactive decay processes, particle accelerators, fission and fusion processes.

Course Outcomes:

A- Knowledge:

Definitions of nuclear models, mass formula, radioactive decay, fission and fusion processes

B-Cognitive Skills

Calculations of activity of isotopes, binding energy, fission and fusion energy, thinking how to make a simple accelerator

C- Interpersonal skills and responsibilities

Urged students to work in groups, each group assigned a mini-job search that includes one of the topics to be that the students explaining the school hall and urged them to interact with their colleagues by asking questions and attempts to find a solution.

D- Analysis and communication:

Urged the students to understand the importance of analyzing the knowledge they have obtained and linked to reality and how to communicate what they received from the knowledge and practical touch with reality

Assessment methods for the above elements

Quizzes, periodical tests, assignments and researches

Text book:
Nuclear Physics: Principles and Applications, by J. Lilley, Wiley (2001)

Supplementary references

1- Nuclear Physics: An Introduction, by W. Burcham, Longman (2003).
2- Nuclear Radiation Physics, by R. Lapp and H. Andrews, Prentice-Hall (1972).

Time table for distributing Theoretical course contents		
Week	**Theoretical course contents**	**Remarks**
1	introduction	
2	Definitions of nucleus	
3	basic concepts of nuclear models	
4	semi-empirical mass formula	
5	interaction of radiation with matter (alpha particles)	
6	interaction of radiation with matter (beta)	
7	interaction of radiation with matter (gamma rays)	
8	nuclear detectors (G.M counter)	
9	nuclear detectors (Scintillation Detector)	
10	nuclear detectors (Na I detector)	
11	nuclear structure and instability	
12	radioactive decay processes,	
13	particle accelerators	
14	Fission processes	
15	fusion processes	
	Final exam.	

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COURSE TITLE	ENGLISH CODE /No.	ARABIC CODE/NO.	CREDITS			
			Th.	Pr.	Tr.	CH
Bioelectronics Lab.	MPHY 384	ف ط ٣٨٤		3		1
PRE-REQUISITES		MPHY 200, MPHY 313				

Objectives:
This course aims to measure the ability to handle live biological materials and to maintain viable conditions for survival.

Contents:
Diffusion in semi-membrane, Nernst effect, Hauk's phenomenon, Electric Acoustic stimulation (combining both acoustic amplification and hearing implant technology), EEG Electroencephalography, Electrocardiography, ECG.

Course Outcomes: The culturing of a standard cell lines. The use of microscopes and sterile techniques and the assessment of biocompatibility on a variety of "electronic" materials, suitable for sensors (metals, semi-conductors etc). Particular importance will be placed on the relevance of the experiments to the design of sensors and implants for the medical engineering industry.

Text book:
Lab Manual

Supplementary references:
An Introduction to Systems Biology: Design Principles of Biological Circuits (Chapman & Hall/CRC Mathematical & Computational Biology)

Time table for distributing Theoretical course contents		
Week	**Theoretical course contents**	**Remarks**
1	Diffusion in semi-membrane,	
2	Diffusion in semi-membrane,	
3	Nernst effect, Hauk's phenomenon,	
4	Nernst effect, Hauk's phenomenon,	
	Electric Acoustic stimulation	
6	Combining both acoustic amplification and hearing implant technology.	

7	Mid-Exam	
8	Electric Acoustic stimulation (combining both acoustic amplification and hearing implant technology),	
9	EEG Electroencephalography,	
10	EEG Electroencephalography,	
11	Electrocardiography, ECG.	
12	Revision	
13	Revision	
14		
15		
	Final exam.	

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COURSE TITLE	ENGLISH CODE /No.	ARABIC CODE/NO.	CREDITS			
			Th.	Pr.	Tr.	CH
Nuclear and Spectroscopy Lab.	MPHY 385	ف ط ٣٨٥		3		1
PRE-REQUISITES		PHYS 200, MPHY 242				

Objectives:
This laboratory covers the main topics and concepts presented in the theoretical course of Atomic and Molecular Spectra PHYS344.

Contents:
A number of experiments in modern physics and atomic spectra are studied, such as Faraday Effect, Spectrophotometer, Thermal Radiation, Hydrogen Atom, Photoluminescence and Kerr Effect.

Course Outcomes:

A. **Knowledge:**
   Polarization, line spectra and birefringence.
B. **Cognitive Skills:**
   The student would be able to select the best experiment or analytical method suitable for the physics phenomena under study.
C. **Interpersonal skills and responsibilities:**

D. **Analysis and communication:**

Assessment methods of the above elements
The practical test and suitable application on some phenomena not studied during the course.

Text book:
"Experiments and Demonstrations in Physics" by Yaakov Kraftmakher. 2007 World Scientific Publishing Co .Pte .Ltd.

Supplementary references:
"Concepts of Modern Physics" 6th edition by Arthur Beiser. 2003 The McGraw Hill Companies

Time table for practical course contents		
Week	**practical course contents**	**Remarks**
1	Introduction	
2	Faraday effect	
3	Theoretical introduction about light spectrophotometers and related equations	
4	Practice on the usage of spectrophotometer	
5	Practical exam.	
6	Thermal radiation	
7	Zeeman effect (an application to the atomic spectra)	
8	Periodic practical exam.	
9	Introduction to florescence instruments and application	
10	Usage of florescence instrument and applying to one sample	
11	Periodic practical exam.	
12	Optical Kerr effect experiment and its capabilities	
13	Revision	
14	Revision	
15	Revision	
	Final Exam.	

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COURSE TITLE	ENGLISH CODE /No.	ARABIC CODE/NO.	CREDITS			
			Th.	Pr.	Tr.	CH
Training I	PHYS 390	ف ٣٩٠	1		3	2
PRE-REQUISITES		Approval of the Department				

Objectives:
This course tends to train the students in conducting research work and provides them an opportunity for the acquisition of skill through practical work.

Contents:
In this training course, students will have several visits to university hospital to involve them in medical applications and the proper use of the medical devices.

Course Outcomes:

B- Knowledge:
(Specific facts and knowledge of concepts, theories, formula etc.)

B-Cognitive Skills
(Thinking, problem solving)

C- Interpersonal skills and responsibilities
(group participation, leadership, personal responsibility , ethic and moral behavior, capacity for self directed learning)

D- Analysis and communication:
(communication, mathematical and IT skills)

Assessment methods for the above elements

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COURSE TITLE	ENGLISH CODE /No.	ARABIC CODE/NO.	CREDITS			
			Th.	Pr.	Tr.	CH
Computer and Image Modeling	MPHY 394	ف ط ٣٩٤	2			2
PRE-REQUISITES		CPIT 100, MPHY 205, MPHY 255				

Objectives:
This course presents algorithms that analyze images generated by computer-aided diagnosis. It also introduces a discussion of a wavelet method for image enhancements and partitioning the images into meaningful segments. It prepares the student ability to familiarize him (her) with the automated methods.

Contents:
Introduction to Computer Aided Detection (CAD) - Medical-Image Processing and Analysis for CAD Systems - Texture and Morphological Analysis of Ultrasound Images - Biomedical-Image Classification Methods and Techniques - Texture Characterization Using Autoregressive Models with Application to Medical Imaging - Locally Adaptive Wavelet Contrast Enhancement - Three-Dimensional Multi scale Watershed Segmentation of MR Images - A MRF-Based Approach for the Measurement of Skin Thickness - Graph-Based Analysis of Amino Acid Sequences - Estimation of Human Cortical Connectivity with Multimodal Integration of fMRI and High-Resolution EEG - Evaluation Strategies for Medical-Image Analysis and Processing Methodologies

Course Outcomes:

A. **Knowledge:**
Getting information about medical imaging and image processing using computer aided diagnosis.

B. **Cognitive Skills:**
The student gets information about identifying the images processed using the CAD technology.

C. **Interpersonal skills and responsibilities:**
The student proceeds independently to analyze results and make use of studied facts and theories to interpret problems.

D. **Analysis and communication:**
The analysis of related problems in this subject depends mainly on the statistical and computational information the student studied, and he has to communicate with other students to exchange computational information and ideas to increase mutually their skills.

Assessment methods of the above elements

The practical application of the studied ideas is mainly the method of assessment in addition to practical exam.

Text book:

"An introduction to the principles of medical imaging" by Chris Guy and Dominic ffytche. Copyright 2005 by Imperial College Press.

Supplementary references:

1. "Handbook of Medical Image Processing and Analysis" by Isaac H. Bankman. Copyright © 2009, Elsevier Inc.
2. "Medical Image Analysis Methods" by Lena Costaridou. 2005 by Taylor & Francis Group, LLC.

Other information resources:

Time table for theoretical course contents		
Week	**theoretical course contents**	**Remarks**
1	Introduction to Medical Imaging and Image Analysis, Introduction to Computer aided diagnosis (CAD)	
2	Processing and analysis of images produced by CAD system, Principles of CAD – the basic structure of CAD – image processing	
3	Classifying and evaluating images, A brief review of 3d CAD = image processing – classifying images	
4	Basic steps of restructuring 3D images	
5	An introduction for ultrasonic imaging – Examples for image interpretation, Texture and Morphological Analysis of Ultrasound Images	
6	Biomedical-Image Classification Methods and Techniques	
7	Texture Characterization Using Autoregressive Models witt Application to Medical Imaging	
8	Locally Adaptive Wavelet Contrast Enhancement	
9	Wavelet Contrast Enhancement	
10	Three-Dimensional Multiscale Watershed Segmentation of MR Images	
11	Graph-Based Analysis	
12	Evaluation Strategies for Medical-Image Analysis and Processing Methodologies	
13	Applications	
14	Applications	
15	Applications	
	Final Exam.	

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COURSE TITLE	ENGLISH CODE /No.	ARABIC CODE/NO.	CREDITS			
			Th.	Pr.	Tr.	CH
Laser Applications in Medical Physics	MPHY 415	ف ط ٤١٥	3			3
PRE-REQUISITES		MPHY 315				

Objectives:
This course enriches the knowledge of the lasers and their uses in biological and medical fields.

Contents:
Light and Matter-Basics of Lasers-Interaction Mechanisms-Optical and Thermal Response of Tissue to Laser Radiation- Medical Applications of Lasers-Uses and Effects of Ultraviolet Radiation on Cells and Tissues-The Physics of Ultraviolet Laser Ablation-Low-Power Laser Effects-Laser safety.

Course Outcomes:

A. **Knowledge:**
Enrichment about laser knowledge and uses and getting information about the properties of lasers that leads to use it with soft tissues.

B. **Cognitive Skills:**
The student would be able to handle the biological problem that should be solved using the proper laser.

C. **Interpersonal skills and responsibilities:**
The use of lasers requires careful and fine handling, the way which deepened the student's responsibility toward laser tissue interaction.

D. **Analysis and communication:**
The student may realize that, from communications and other resources of information, that modern technology had an important role in improvement of lasers handling in biological and medical fields.

Assessment methods of the above elements

Periodic and final exams.

Text book:

"Laser-Tissue Interactions – Fundamentals and Applications" 3rd Ed .By M .Niemz . Springer 2007.

Supplementary references:
"Lasers in Medicine" by Ronald W .Waynant.2002 by CRC Press LLC.
"Fundamentals of Light Sources and Lasers" by Mark Csele .2004 by John Wiley & Sons, Inc.

Other information resources:

Time table for theoretical course contents		
Week	**theoretical course contents**	**Remarks**
1	**Light and Matter**: Reflection and Refraction, Absorption, Scattering, Turbid Media, Photon Transport Theory, and Measurement of Optical Tissue Properties.	
2	**Interaction Mechanisms**: Photochemical Interaction, Thermal Interaction, Photo ablation, Plasma-Induced Ablation, Photo disruption.	
3	Medical Applications of Lasers, Ophthalmology	
4	Dentistry	
5	Gynecology	
6	Urology	
7	Neurosurgery	
8	Angioplasty and Cardiology	
9	Dermatology	
10	Orthopedics	
11	Gastroenterology	
12	Otorhinolaryngology and Pulmology	
13	Laser Safety and Precautions	
14	Eye Hazards, Skin Hazards, Associated Hazards from High Power Lasers	
15	Laser Safety Standards and Hazard Classification	
	Final Exam.	

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COURSE TITLE	ENGLISH CODE /No.	ARABIC CODE/NO.	CREDITS			
			Th.	Pr.	Tr.	CH
Magnetic Resonance and Medical Imaging	MPHY 434	ف ط ٤٣٤	2			2
PRE-REQUISITES		MPHY 363				

Objectives:
This course is designed to provide a basic understanding of nuclear magnetic resonance and its use in medicine. Magnetic resonance imaging techniques will be discussed.

Contents:
Introduces magnetic resonance imaging from the basic concepts to cutting edge applications. Basic physics of magnetic resonance, Resonance and detection, fundamentals of image formation, interpretation of images.

Course Outcomes:

A-Knowledge:

Lectures will provide a basic understanding of the key concepts of nuclear magnetic resonance and imaging techniques and relationship with anatomical feratures.

B-Cognitive Skills

It is desirable to understand the basic physics and techniques involved in MRI and its applications.

C- Interpersonal skills and responsibilities

Students will be encouraged to attempt the problems independently and then collaborate and solve together.

D- Analysis and communication:

Course objectives will be accomplished through group discussions and lectures..

Assessment Methods for the above elements: Besides the final examination at the end of semester, there will be a mid term examination, two quizzes and two assignments. Students will be graded as the given scheme (40 + 20 + 20 + 20).

Text book:
M.A. Brown & R.C. Cohen, MRI: Basic Principles and Applications, Mosby, 2010

Supplementary references

1. D.G. Mitchell & M.S. Cohen, MRI principles, Saunders, 2004
2. A.B. Wolbart, Physics of Radiology, Prentics Hall, Inc. 1993
3. R.H. Hashemi, M.G. Bradley & C.J. Lisanti, MRI: The Basics, Lippincott Williams & Wilkins, 1010

Time table for distributing Theoretical course contents		
Week	**Theoretical course contents**	**Remarks**
1	Nuclear magnetic dipole field and moment	
2	Nucleus in a strong external magnetic field	
3	Transition within a two state systems	
4	clear magnetic resonance experimentNu	
5	Proton density weighted imaging	
6	Thermal equilibrium of nuclear spins	
7	Magnetization at the Larmor frequency	
8	Resonance and detection of NMR	
9	Fourier transform nuclear magnetic resonance	
10	times Relaxation	
11	Determination of relaxation times	
12	Magnetic resonance imaging	
13	Instrumentation and experimental techniques	
14	Bloof flow and Magnetic Resonance Angiography	
15	Determinants of image quality	
	Final exam.	

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COURSE TITLE	ENGLISH CODE /No.	ARABIC CODE/NO.	CREDITS			
			Th.	Pr.	Tr.	CH
Radiation Dosimetry	MPHY 464	ف ط ٤٦٤	2			2
PRE-REQUISITES		MPHY 363				

Objectives:

This course explains the prime quantities in medical radiation Dosimetry, theoretical basis for medical dosimetry and the basics of the TRS-398 measurement protocol for high energy photons and electrons

Contents:

The course introduces dosimetry in radiotherapy, diagnostics/imaging and nuclear medicine, how is the intensity of the radiation sources characterized (mA, fluence, activity), absorbed dose, exposure, linear energy transfer (LET), use of MC in dosimetry, The general framework for cavity Dosimetry, high-energy photon dosimetry and high-energy electron dosimetry.

Course Outcomes:

A- Knowledge:

• define the prime quantities in medical radiation dosimetry.
• define the basic concepts in metrology (e.g. traceability and uncertainty).
• describe the interactions between radiation and matter.
• explain the theoretical basis for medical dosimetry (i.e. cavity theory).
• explain the basics of the TRS-398 measurement protocol for high-energy photons and electrons.

B-Cognitive Skills

• solve dosimetry problems related to measurements in standard conditions using the TRS-398 formalism.
• identify and analyze dosimetry problems related to measurement in non-standard conditions. (e.g. measurements in the build-up zone, in small fields or in heterogeneous media).
• calculate fluence spectra and dose deposition for simple situations using the EGSnrc Monte Carlo user codes flurznrc and dosnrcrz.
• explain the signal-generating mechanisms and the basis characteristics for a range of dosimetry systems such as ion chambers and solid-state detectors.
• define the dose deposition kernel of a radionuclide decaying in water.
• explain the concept of biokinetic distribution models.
• calculate organ doses from S-factors and MIRD values

C- Interpersonal skills and responsibilities

Urged students to work in groups, each group assigned a mini-job search that includes one of the topics to be that the students explaining the school hall and urged them to interact with their colleagues by asking questions and attempts to find a solution.

D- Analysis and communication:

Urged the students to understand the importance of analyzing the knowledge they have obtained and linked to reality and how to communicate what they received from the knowledge and practical touch with reality

Assessment methods for the above elements

Quizzes, periodical tests, assignments and researches

Text book:

F.H. Attix: Introduction to radiological physics and radiation dosimetry (1986).

Supplementary references:

• ICRU 60: Fundamental quantities and units for ionizing radiation (1998).
• TRS398: Absorbed dose determination in external beam radiotherapy (can be downloaded from the IAEA web site).
• NIST Technical Note 1297: Guidelines for evaluating and expressing the uncertainty of NIST measurement results (1994) (can be downloaded from the NIST web site).
• PIRS-702: D.W.O. Rogers, I. Kawrakow, J.P. Seuntjens, B.R.B. Walters, and E. Mainegra-Hing: ”NRC user codes for EGSnrc (2010) (can be downloaded from the NRC web site).
• PIRS-801: E. Mainegra-Hing: ”User manual for egs inprs, a GUI for the NRC RZ user-codes (2005) (can be downloaded from the NRC web site).
• Software: The NRC user codes for EGSnrc called flurznrc and dosrznrc.

Time table for distributing Theoretical course contents		
Week	**Theoretical course contents**	**Remarks**
1	introduction	
2	Definations of the prime quantities in medical radiation dosimetry and the basic concepts in metrology (e.g. traceability and uncertainty).	
3	dosimetry in radiotherapy, diagnostics/imaging and nuclear medicine	
4	how is the intensity of the radiation sources characterized (mA, fluence, activity)	
5	absorbed dose, exposure, linear energy transfer (LET),	
6	use of MC in dosimetry, The general framework for cavity Dosimetry	
7	high-energy photon dosimetry and high-energy electron dosimetry	
8	Dosimetry protocols. Code of practice for absorbed-dose-to-water measurements	
9	chemical dosimetry (”free-radical dosimetry”, Fricke, change in optical properties)	
10	Cavity theory (cont.). An iteration over cavity theory as applied to ion chambers.	
11	Physics of neutron interactions and dosimetry	
12	Micro dosimetry	
13	Internal dosimetry	
14	EPR and Film dosimetry in practice	
15	Solid-state dosimetry	
	Final exam.	

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COURSE TITLE	ENGLISH CODE /No.	ARABIC CODE/NO.	CREDITS			
			Th.	Pr.	Tr.	CH
Radiation Therapy Physics	MPHY 465	ف ط ٤٦٥	3			3
PRE-REQUISITES		MPHY 363				

Objectives:
This course explains different types of radiations that are used for diagnosis
Contents:
The course introduces X-ray generators, tubes, and survey of mammography, fluoroscopy, image intensifiers, cine systems, radiodosimetry, image quality, CT scanners, ultrasound, and magnetic resonance imaging
Course Outcomes:
A- Knowledge:
Definitions of X-ray generators, tubes, and survey of mammography
B-Cognitive Skills
Calculations of dose deposition and radiation dosimetry, thinking how to make a calibration and maintenance
C- Interpersonal skills and responsibilities
Urged students to work in groups, each group assigned a mini-job search that includes one of the topics to be that the students explaining the school hall and urged them to interact with their colleagues by asking questions and attempts to find a solution.
D- Analysis and communication:
Urged the students to understand the importance of analyzing the knowledge they have obtained and linked to reality and how to communicate what they received from the knowledge and practical touch with reality
Assessment methods for the above elements
Quizzes, periodical tests, assignments and researches
Text book:
Nuclear Radiation Physics, by R. Lapp and H. Andrews, Prentice-Hall (1972).

Supplementary references
1. Radiation Protection and Dosimetry: An Introduction to Health Physics by Michael G. Stabin (2007)

2. Basic Health Physics: Problems and Solutions by Joseph John Bevelacqua (1999).

Time table for distributing Theoretical course contents		
Week	**Theoretical course contents**	**Remarks**
1	introduction	
2	definations	
3	X-ray generators	
4	X-ray tubes	
5	X-ray properties	
6	mammography	
7	fluoroscopy	
8	image intensifiers	
9	cine systems	
10	radiodosimetry	
11	image quality	
12	CT scanners	
13	ultrasound	
14	principles of magnetic resonance	
15	magnetic resonance imaging	
	Final exam.	

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COURSE TITLE	ENGLISH CODE /No.	ARABIC CODE/NO.	CREDITS			
			Th.	Pr.	Tr.	CH
Radiation Protection	MPHY 467	ف ط ٤٦٧	2			2
PRE-REQUISITES		MPHY 363				

Objectives:
The course aims to introduce the essential concepts of radiation protection and emphasize the practical aspects of radiation protection in hospitals and/or industries.

Contents:
The course explains the measurement of radiation, scintillators, radiation biology, modes of radiation cell, cell survival, radiation and carcinogenesis, current models, risks, International Commission of radiation Protection (ICRP) system, radiation safety, and protection and legislation.

Course Outcomes:

A-Knowledge:
The purpose of the course is to introduce the basic principles of radiation physics and the physical concepts necessary to understand radiation dosimetry.

B-Cognitive Skills
Students will be able to describe the basic interactions of ionizing radiation with matter. It is desirable to understand the various modes and the radiation products of radioactive decay.

C- Interpersonal skills and responsibilities
provide the concepts of conventional therapy equipments and detectors.

D- Analysis and communication:
Laboratory studies and the group discussions will enable the students to appreciate the interaction of radiation with the living organism.

Text book:

Textbook:
Essentials of Radiation Biology and Protection, by Steve Forshier, (2001).

Supplementary references

Supplementary references:
1- Radiation Protection: A Guide for Scientists, Regulators, and Physicians, by J. Shapiro, (2002).
2- Radiation Protection in the Health Sciences, by M. Noz and G. Maguire, (1995).

Time table for distributing Theoretical course contents		
Week	**Theoretical course contents**	**Remarks**
1	Matter energy and radiation	
2	Radioactuive decay and counting	
3	Scintillators and detectors	
4	Effects of radiation on cells	
5	f cellsRadio sensitivity o	
6	Radiation damage	
7	Acute effects of body irradiation	
8	Long term effects of radiation	
9	Principles of radiation protection	
10	Personnel monitoring	
11	Radiation protection practices	
12	Radiation regulations	
13	ommissionNuclear regulatory c	
14	Monitoring of radioactives packages	
15	Transportation and legislations	
	Final exam.	

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COURSE TITLE	ENGLISH CODE /No.	ARABIC CODE/NO.	CREDITS			
			Th.	Pr.	Tr.	CH
Calibration and Quality Control	MPHY 474	ف ط ٤٧٤	2			2
PRE-REQUISITES		MPHY 363				

Objectives:

The course objectives are to provide routine and consistent checks to ensure data integrity, correctness, andcompleteness; Identify and address errors and omissions; Document and archive inventory material and record all QC activities.

Description:

QC activities include general methods such as accuracy checks on data acquisition and calculations and the use of approved standardised procedures for emission calculations, measurements, estimating uncertainties, archiving information and reporting. Higher tier QC activities include technical reviews of source categories, activity and emission factor data, and methods. *Quality Assurance* (QA) activities include a planned system of review procedures conducted by personnel not directly involved in the inventory compilation/development process. Reviews, preferably by independent third parties, should be performed upon a finalised inventory following the implementation of QC procedures. Reviews verify that data quality objectives were met, ensure that the inventory represents the best possible estimates of emissions and sinks given the current state of scientific knowledge and data available, and support the effectiveness of the QC programme.

Course Outcomes:

A-Knowledge:

A fundamental knowledge of QC/QA is *Quality Control* (QC) is a system of routine technical activities, to measure and control the quality of the inventory as it is being

developed. *Quality Assurance* (QA) activities include a planned system of review procedures conducted by personnel not directly involved in the inventory compilation/development process.

B-Cognitive Skills

Teaching students how to make judgments on the following basis

Resources allocated to QC for different source categories and the compilation process;

Time allocated to conduct the checks and reviews of emissions estimates;

Availability and access to information on activity data and emission factors, including data quality;

Procedures to ensure confidentiality of inventory and source category information, when required;

Requirements for archiving information;

Frequency of QA/QC checks on different parts of the inventory;

The level of QC appropriate for each source category;

Whether increased effort on QC will result in improved emissions estimates and reduced uncertainties;

Whether sufficient expertise is available to conduct the checks and reviews.

C- Interpersonal skills and responsibilities

Students will be encouraged to attempt the problems independently and then collaborate and solve together.

D- Analysis and communication:

Course objectives will be accomplished through group discussions and lectures..

Student Evaluation:

1- 5 Quizzes	40 Marks
2- Mid. Term Exam.	20 Marks
3- Presentation	10 Marks
4- Final Exam.	30 Marks
Total	100 Marks

Text book:

Intergovernmental Panel on Climate Change (IPCC) (1997). *Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventoires: Volumes 1, 2 and 3.* J.T. Houghton et al., IPCC/OECD/IEA, Paris, France.

1- The Physics of Radiation Therapy, by Faiz M. Khan, 2010
2- Physics of Nuclear Medicine, 2006, by James. A. Sorenson and Michael. E. Phelps

Subsidiary Books:

International Organization for Standardization (ISO) (1994). *Air Quality, Determination of Performance*

Characteristics of Measurement Methods. ISO 9196:1994. ISO, Geneva, Switzerland.

Time table for distributing Theoretical course contents		
Week	Theoretical course contents	Remarks
1	Clinical Generators structure and function, Co-60 and Linear accelerator	
2	Phantoms, isodose lines, TAR, MAR and TMR	
3	Beam Profile, Beam Quality collimation and wedge isodose angle	Quizze 1
4	Mechanical quality control & electrical quality control procedures for Co-60 and linear accelerator.	
5	Beam profile, and beam quality for Co-60 and linear accelerator.	Quizze 2
6	Ion chambers correction and absolute dosimetry correction factors	
7	Performance of unsealed radioactive sources used in brachytherapy	Quizze 3
8	Calibration and quality control of brachytherapy	
9	Imaging and non-imaging detectors performance, Energy peak shift	
10	Detector Uniformity, Sodium iodide detector Linearity and accuracy	Mid term Exam
11	Dose calibrator constancy, linearity, uniformity and resolution	
12	SPECT analysis and quality control.	Quizze 4
13	Peak energy measurement and adjustment, Radiation beam alignment	
14	Contrast, resolution measurements, scattered dose calculations	Quizze 5
15	Students presentation	
1	Final exam.	

Time table for distributing Theoretical course contents		
Week	**Theoretical course contents**	**Remarks**
1	Introduction	
2	Practical considerations in developing qa/qc systems	
3	Elements of a qa/qc system	
4	Inventory agency	
5	Qa/qc plan	
6	General qc procedures	

7	Source catergory-specific qc procedures	
8	Emissions data QC	
9	Activity data QC	
10	QC of uncertainty estimates	
11	QA procedures	
12	Verification of emissions data	
13	Documentation, archiving and reporting	
14	Internal documentation and archiving	
15	Reporting	
	Final exam.	

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COURSE TITLE	ENGLISH CODE /No.	ARABIC CODE/NO.	CREDITS			
			Th.	Pr.	Tr.	CH
Physics of Biosensors	MPHY 475	ف ط ٤٧٥	2			2
PRE-REQUISITES		MPHY 313				

Objectives:
The course represents the classification and main parameters of chemical and biosensors.

Contents:
The course explains the definitions and classification of sensors, parameters of sensors, physical transducing principles for sensors, gravimetric sensors, electrical and electrochemical sensors, optical sensors, nanostructured materials for sensing, sensors based on inorganic and organic materials, organic vapor sensors based on Calixarenes, and composite membranes for biosensing.

Course Outcomes:

E- Knowledge:

Definitions of sensors, parameters of sensors, physical transducing principles for sensors, gravimetric sensors, electrical and electrochemical sensors, optical sensors,

B-Cognitive Skills

Calculations of sensor parameters and sensitivity, thinking how to make a sensor

C- Interpersonal skills and responsibilities

Urged students to work in groups, each group assigned a mini-job search that includes one of the topics to be that the students explaining the school hall and urged them to interact with their colleagues by asking questions and attempts to find a solution.

D- Analysis and communication:

Urged the students to understand the importance of analyzing the knowledge they have obtained and linked to reality and how to communicate what they received from the knowledge and practical touch with reality

Assessment methods for the above elements

Quizzes, periodical tests, assignments and researches (Explain)

Text book:

Biosensors: Theory and Applications, by D. Buerk, (1995).

Supplementary references:

1- Biosensors, by J. Cooper and A. Cass, Oxford University Press, (2004).
2- Chemical Sensors and Biosensors, by B. Eggins, Wiley & Sons, (2007).

Time table for distributing Theoretical course contents		
Week	**Theoretical course contents**	**Remarks**
1	introduction	
2	Definitions of sensors	
3	Importance of sensors in biology	
4	classification of sensors	
5	parameters of sensors	
6	physical transducing principles for sensors	
7	gravimetric sensors	
8	Electrical sensors	
9	electrochemical sensors	
10	optical sensors	
11	nanostructured materials for sensing	
12	sensors based on inorganic	
13	sensors based on organic materials	
14	organic vapor sensors based on Calixarenes	
15	composite membranes for biosensing	
	Final exam.	

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COURSE TITLE	ENGLISH CODE /No.	ARABIC CODE/NO.	CREDITS			
			Th.	Pr.	Tr.	CH
Nanoscience in Medical Physics	MPHY 476	ف ط ٤٧٦	2			2
PRE-REQUISITES		MPHY 344				

Objectives:
This course represents the definition of nanomaterials, how it can be synthesized and how it can be used for detection of different diseases

Contents:
A Brief History of Nano revolution, Revolutionary Nanotechnologies, Solid State against Soft Matter in Nanotechnologies, Chemical Routes for Nanostructure Processing, Sol-Gel Deposition, Electrostatic Self-Assembly, Langmuir-Blodgett Technique, Spin Coating, Nano materials and diseases, Cancer therapy, Kidney therapy, Tissue engineering, Protein detection

Course Outcomes:

A-Knowledge:
It is desirable to understand and appreciate the key concepts of nano biotehnology, cell interactions and cancer biology

B-Cognitive Skills
Students will be able to appreciate the concepts of nano materials and their interactions with the living cells. students will learn the techniques to control and check the movement of nano materials in living systems.

C- Interpersonal skills and responsibilities
Students will be encouraged to attempt the problems independently and then collaborate and solve together.

D- Analysis and communication:
Course objectives will be accomplished through group discussions and lectures..

Assessment Methods for the above elements: Besides the final examination at the end of semester, there will be a mid term examination, two quizzes and two assignments. Students will be graded as the given scheme (40 + 20 + 20 + 20).

Main Text Books:

Nanomaterials For Application In Medicine And Biology, (Paperback - 2008) by Gennady B. Khomutov, Michael Giersig

Subsidiary Books:

Nanomaterials And Nanosystems For Biomedical Applications, (Hardcover - 2007), by M. Reza Mozafari

Time table for distributing Theoretical course contents		
Week	**Theoretical course contents**	**Remarks**
1	Introduction to nanomaterials	
2	Bio inspired nanomaterials	
3	anomaterials for sensingN	
4	DNA detection	
5	Nano scale optical sensors	
6	Cellular interfacing	
7	Development of Genetic probes	
8	Genetic circuits	
9	Tracers for DNA	
10	Cellular imaging	
11	Nanoparticles in medical diagnostics	
12	ogy fundamentalsCancer biol	
13	Nanotechnology for imaging	
14	Challenges in cancer therapy	
15	Role of nanotechnology in cancer therapy	
	Final exam.	

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COURSE TITLE	ENGLISH CODE /No.	ARABIC CODE/NO.	CREDITS			
			Th.	Pr.	Tr.	CH
Physics of Drug Delivery	MPHY 477	ف ط ٤٧٧	3			3
PRE-REQUISITES		MPHY 363 , MPHY 473				

Objectives:

The course objectives are to give participants an insight into fundamental principles for optimizing drug delivery based on biological, physico-chemical, and pharmaceutical approaches.

Description:

How to deliver a drug substance at the biological target site in a therapeutically optimal amount. This encompasses both the relationships between the chemical and physico-chemical characteristics of a drug substance, the pharmaceutical formulation, and the biological response. A basic understanding of the extent to which these factors affect the relative rate and amount of the drug which reaches the target site is of utmost importance in drug research and development.

Course Outcomes:

A-Knowledge:

A fundamental knowledge of the complex release characteristics in biological environments as well as transport to the target site is of importance in optimisation of drug delivery. An understanding of the structural and dynamic functions of biomembranes, e.g. the interplay between lipid bilayer structure and drug molecules or excipients, specific transports, and efflux mechanisms, may also add to a more rational design of drug substances and pharmaceutical formulations.

B-Cognitive Skills

Three basic aspects are in focus, i.e., release of drug from the formulation, transport to and through biological membranes, and biotransformation.

C- Interpersonal skills and responsibilities

Students will be encouraged to attempt the problems independently and then collaborate and solve together.

D- Analysis and communication:

Course objectives will be accomplished through group discussions and lectures..

Assessment Methods for the above elements: Besides the final examination at the end of semester, there will be a mid term examination, two quizzes and two assignments. Students will be graded as the given scheme (40 + 20 + 20 + 20).

Text Books:

Controlled Drug Delivery: Challenges and Strategies, (Hardcover-2011, amazon .com) by Kinam Park

Supplementary references:

Nanoparticulate Drug Delivery Systems, (Hardcover-2010, amazon .com) by Thassu Deepak , Michel Deleers, Yashwant Vishnupant Pathak

Time table for distributing Theoretical course contents		
Remarks	**Theoretical course contents**	**weak**
1	an overview: Biomembranes as absorption barriers and biotransformation as a barrier	
2	Biological barriers to drug absorption	
3	Physico-chemical characteristics of drug substances	
4	Chemical approaches in optimisation of drug delivery:	
5	Polymeric delivery systems	
6	lipid based delivery systems	
7	Methods for evaluation of bioavailability:	
8	Dissolution	
9	membrane permeability	
10	in vivo methodology	
11	the interplay between lipid bilayer structure	
12	structural and dynamic functions of biomembranes	
13	influence of luminal contents on the dissolution/solubilisation	
14	Rational design of drug substances and pharmaceutical formulations.	
15	key parameter in drug delivery	
	Final exam.	

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COURSE TITLE	ENGLISH CODE /No.	ARABIC CODE/NO.	CREDITS			
			Th.	Pr.	Tr.	CH
Introductory Neurophysics	MPHY 478	ف ط ٤٧٨	2			2
PRE-REQUISITES		MPHY 255, MPHY 361				

Objectives:
The purpose of this course is to provide the students a comprehensive introduction to the electromagnetic behavior of neuron and electroencephalography (EEG).

Contents:
The course introduces an overview of bio-electromagnetic fields, electric fields and currents in biological tissues, current sources in homogenous and inhomogeneous media, the physics of electroencephalography (EEG) interface, fallacies in EEG, and dynamical properties of EEG.

Course Outcomes:
A-Knowledge:
(Specific facts and knowledge of concepts, theories, formula etc.)
B-Cognitive Skills
(Thinking, problem solving)
C- Interpersonal skills and responsibilities
(group participation, leadership, personal responsibility , ethic and moral behavior, capacity for self directed learning)
D- Analysis and communication:
(communication, mathematical and IT skills)
Assessment methods for the above elements

Text book:
Electric Fields of the Brain: The Neurophysics of EEG, by P. Nunez and R. Srinivasan, Oxford University Press (2006).

Supplementary references:
1- Methods and Models in Neurophysics, by C. Chow, (2005).
2- The Neurophysics of Human Behavior: Explorations at the Interface of the Brain, Mind, Behavior, and Information, by M. Furman and F. Gallo, (2000).

Time table for distributing Theoretical course contents

Week	Theoretical course contents	Remarks
1	Brain structure and scalp potentials	
2	Current and potentials in electric circuits and brain	
3	Fluid flow and current flux	
4	Scalp potentials and electric field theory	
5	Scalp potentials and electric field theory	
6	Fallacies in EEG	
7	An overview of electromagnetic fields	
8	Electro neutrality of tissues and brain’s field	
9	Transmission lines and resonances	
10	Electric field and currents in biological tissues	
11	Brain current sources	
12	Current sources in homogenous and isotropic medium	
13	EEG recording systems	
14	Spatial sampling and resolution of EEG	
15	Spectral properties of EEG sources	
16	Applications to spontaneous EEG – Dynamic properties	
	Final exam.	

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COURSE TITLE	ENGLISH CODE /No.	ARABIC CODE/NO.	CREDITS			
			Th.	Pr.	Tr.	CH
Theory of Heart	MPHY 479	ف ط ٤٧٩	3			3
PRE-REQUISITES		MPHY 255, MPHY 361				

Objectives:
The purpose of this course is to study the electrical activity and cardiography of the heart.

Contents:
The course explains the macro and micro-structural properties of the heart, ionic models, background currents, activation and inactivation, pump and exchange currents, dynamics of cardiac oscillations, wave propagation in myocardium, and a clinical perspective of the heart.

Course Outcomes:
A-Knowledge:
(Specific facts and knowledge of concepts, theories, formula etc.)
B-Cognitive Skills:
(Thinking, problem solving)
C- Interpersonal skills and responsibilities:
(group participation, leadership, personal responsibility , ethic and moral behavior, capacity for self directed learning)
D- Analysis and communication:
(communication, mathematical and IT skills)
Assessment methods for the above elements
Text book:
Theory of Heart: Biomechanics, Biophysics, and Nonlinear Dynamics of Cardiac Function, by L. Glass, P. Hunter, and A. McCulloch, Springer (1991).
Supplementary references
1- Mathematically modeling the electrical activity of the Heart: From Cell to Body Surface and Back, by A. Pullman, World Scientific Publishing (2005).
2- Electrophysiology and Pharmacology of Heart, by K. Dangmann, (1991).
3- Physiology of the Heart, by A. Katz, (2006).

Other Information Resources

Time table for distributing Theoretical course contents		
Week	**Theoretical course contents**	**Remarks**
1	The cardiovascular system, structural organization and properties	
2	The cardiac cycle	
3	Heart as a pump and cardiac functions	
4	Pulse wave propagation	
5	Flow patterns in complex internal geometry	
6	Wall dynamics in infinitesimal and finite displacement	
7	Modeling of three dimensional flow	
8	Ventricle fluid dynamics	
9	Pathological conditions and valve dynamics	
10	Local blood flow in arteries	
11	Newtonian and non Newtonian flow	
12	Navier Stokes equations	
13	Mass transport in arteries	
14	Artery wall properties	
15	An overview of ECG and applications	
	Final exam.	

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COURSE TITLE	ENGLISH CODE /No.	ARABIC CODE/NO.	CREDITS			
			Th.	Pr.	Tr.	TCH
Imaging lab.	MPHY 487	ف ط ٤٨٧		3		1
PRE-REQUISITES		PHYS200, MPHY 434, MPHY 394				

Objectives:
By the end of this lab. The students will be able to interpret the images taken by different sources of electromagnetic waves.

Contents:
The course includes different experiments relating to interference, diffraction and polarization of electromagnetic waves.

Course Outcomes:

A. Knowledge:
Connection between theoretical study of imaging devices and techniques and applications. Practicing on the imaging devices and related theoretical concepts.

B. Cognitive Skills:
The students will practice on imaging devices conceptual experiments.

C. Interpersonal skills and responsibilities:
Following the safety and precautions limitations supplied for this lab.

D. Analysis and communication:

Assessment methods of the above elements
Practical exam and analysis of extracted data.

Text book:
Lab Manual

Supplementary references:
"Electromagnetism and Optics, an Introductory Course", Richard Fitzpatrick.
"An Introduction to the Principles of Medical Imaging". Chris Guy and Dominic ffytche. Copyright © 2005 by Imperial College Press.

Other information resources:

Time table for course contents		
Week	**Practical course contents**	**Remarks**

1	Introduction: the range of electromagnetic waves	
2	Interference of waves: Visible light – Young double slit experiment	
3	Interference of waves: Sound waves – Young double slit experiment	
4	Diffraction: Visible light – thin rod diffraction	
5	Applied practical test	
6	Diffraction and interference of x-rays: Bragg x ray diffraction	
7	X ray absorption: Imaging and interpretation	
8	Applied practical test	
9	Polarization of waves: Visible light – study and application of wave polarization	
10	Study of speed of sound dependence on the medium density	
11	Applied practical test	
12	Interpretation of light interference pattern	
13	Interpretation of x ray diffraction pattern	
14	X ray safety	
15	Revision	
	Final Exam.	

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COURSE TITLE	ENGLISH CODE /No.	ARABIC CODE/NO.	CREDITS			
			Th.	Pr.	Tr.	CH
Training II	PHYS 490	ف ٤٩٠			6	2
PRE-REQUISITES		Approval of the Department				

Objectives:
This course tends to train the student in conducting research work and provides him an opportunity for the acquisition of skill through practical work.

Contents:
This training course will initiate a work plan for the student, preparing the desired experiment, making measurements and data analysis, and writing a final report.

Course Outcomes:
A-Knowledge:
(Specific facts and knowledge of concepts, theories, formula etc.)
B-Cognitive Skills
(Thinking, problem solving)
C- Interpersonal skills and responsibilities
(group participation, leadership, personal responsibility , ethic and moral behavior, capacity for self directed learning)
D- Analysis and communication:
(communication, mathematical and IT skills)
Assessment methods for the above elements
Text book:
Supplementary references
Other Information Resources

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COURSE TITLE	ENGLISH CODE /No.	ARABIC CODE/NO.	CREDITS			
			Th.	Pr.	Tr.	CH
Special Topics in Medical Physics	MPHY 491	ف ط٤٩١	2			2
PRE-REQUISITES		Approval of the Department				

Objective:

The course aims to provide the students with special projects in medical physics which they individually arrange a general talk in topics of their choices at the end of the semester.