Courses Contents - محتوى المقررات

First Level

Phys 101 Properties of Matter and heat: (2h lecture, 2h practical and 1h tutorial/Weekly)

This course aims at developing a clear understanding of the basic concepts in Thermal physics and Properties of Matter. The thermal physics course includes; the zeroth law of Thermodynamics. Thermal Expansion of Solids and Liquids. Heat and Thermal Energy. Heat Capacity and Specific heat-Latent heat.
The Properties of matter course includes; Units and Dimensions, Vectors, Elasticity, Oscillatory Motion. Fluids (Static and Dynamic) and Surface Tension.

Math111 Differentiation and integration (1): (2h lecture and 2h tutorial /Weekly)

Descriptions: A. Inequalities and Absolute Values- Functions and Their Graphs- Types of Functions New Functions from Old Functions- Exponential Functions- Inverse Functions and Logarithms. B. Limits and Their Properties, Limits at Infinity, Horizontal Asymptotes- Indeterminate Forms and L'Hospital's Rule. C. Differentiation. D. Applications of Differentiation: Rates of Change in the Natural and Social Sciences- Exponential Growth and Decay- Related Rates- Linear Approximations and Differentials- Maximum and Minimum Values. E. Integration: Antiderivatives, The Definite Integral, Indefinite Integrals and the Net Change Theorem. F. Applications of Integration.

Math 121 Mechanics (1): (2h lecture and 2h tutorial /Weekly)

Descriptions: Vector Algebra: Operations on vectors, Plane, Straight line. Reduction of forces, Equivalent sets of forces. Smooth hinges, Equilibrium of Frames- Motion of particles in a straight line, Motion in a resisting medium, Vertical motion under the earth's attraction.- Simple harmonic motion, Hook's law, Applications.

Z101 Introduction of Cytology, Histology & Genetics: (2h lectures and 2h practical/Weekly)

Cell components and ultrastructure- cell division (mitosis and meiosis)- epithelial tissues- connective tissues- vascular tissues- muscular tissues- nervous tissues- basic molecular biology- genetic engineering techniques- DNA modifying enzymes- the biology of genetic engineering.

Chem 101 Principles of Inorganic, Organic and Biochemistry: (2h lectures + 3h practical weekly)

Inorganic Chemistry: (12 lecture x 1 hr)

Chemical calculations. Atomic spectra (Electromagnetic waves, Bohr's theory, principles of wave mechanics). Atomic structure. Electronic configuration of atoms. Periodic Table and the general properties of representative elements (size of atoms and ions, ionization energy, electronic affinity, electronegativity, electropositivity and polarization). Oxidation states. Types of chemical bonds (ionic, covalent, coordinate, hydrogen and metallic). Lewis structure and formal charge. Theories of bonding: valance shell electron pair repulsion (VSEPR), valence bond theory(VBT), molecular orbital theory (MOT) and molecular geometry.

Organic Chemistry: (9 lecture x 1 hr) Covalent Bonds of carbon – Atomic Orbitals – Molecular Orbitals - Hybirdization- Molecular Geometry - Polar Covalent Bonds - Polar and Nonpolar Molecules – Drawing Organic compounds (molecular formulae – structural formulae - displayed formulae 3- dimentional formulae - Skeletal formulae) - Functional Groups – Structure, Nomenclature and Representative Examples of: alkanes, alkenes, alkynes, and Aromatic Compounds, Alkyl Halides, Alcohols, Ethers, Amines, Aldehydes and Ketones, Carboxylic acids and Carboxylic acid derivatives.

Biochemistry: (3 lecture x 1 hr) Chemistry of carbohydrates, lipids and amino acids: Nomenclature, Classes: – Chemical Reactions – Clinical importance of Carbohydrates; Fatty acids- Lipoproteins – Membrane structure – Functions; Structure of amino acids - Reactions of amino acids - Peptides – Protein Structures - Globular and Fibrous Proteins – Protein folding.

Practical: Inorganic lab work (3 hours lab x 5 weeks), Identification of simple Organic compounds (3 hours lab x 5 weeks).

Phys 102 Electricity, Magnetism and Optics: (2h lecture, 2h practical and 1h tutorial/Weekly)

Electricity and Magnetism course includes Electric Force, Electric Field. Gauss's law. Electric potential. Capacitance and Dielectric. Electric current and Ohm's law, Work, power and energy. Magnetic fields. Source of the magnetic field. Biot savart and Ampers law. Faraday law, Inductance. **Optics course** includes Nature of light and the law of Geometric optics, propagation of light, deviation of light by prisms and dispersion, image formation.

Phys 103 Electric Circuits: (2h lecture, 2h practical and 1h tutorial/Weekly)

This course aims at developing a clear understanding of the basic concepts of electric circuits. The course includes Definitions and Circuit Parameters, Sinusoidal Current and Voltage, Complex numbers, Complex Impedance and Phasor Notation, Series and Parallel Circuits, Power and Power Factor Correction, Series and Parallel Resonance, Mech Current Network Analysis, Node Voltage Network Analysis, Mutual inductance, Fourier Method of

waveform analysis.

Phys 104 Thermodynamics: (2h lecture, 2h practical and 1h tutorial/Weekly)

This course aims at introducing a clear understanding of the basic concepts of Thermodynamics. The course includes; Thermodynamic systems, Equations of state, work, The first law of thermodynamics, Some consequences of the first law, Changes of phase, The second law of thermodynamics, Entropy, combined first and second laws, some engineering applications of thermodynamics.

Math113 Differentiation and integration (2): (2h lecture and 2h tutorial /Weekly)

Descriptions: Hyperbolic Functions. Applications of Differentiation: The Mean Value Theorem How Derivatives Affect the Shape of a Graph- Graphing with Calculus and Calculators Optimization Problems- Newton's Method. INTEGRALS: Areas between Curves- Volumes, Work. Integration Techniques. Approximate Integration, Improper Integrals. Applications of Integration: Arc Length, Area of a Surface of Revolution. Further Applications in Physics, Engineering, Economics and Biology.

Med Phys 101 Introduction to Medical Physics: (2h Lectures and 1h tutorial/Weekly**)**
An introduction to key physical principles as applied to medical imaging and radiation therapy. Topics covered will include: imaging metrics, ionizing radiation and radiation safety, radioactivity, radiation therapy, computed tomography, nuclear medicine, ultrasound, and magnetic resonance imaging

Chem 102 Principles of Physical and Analytical Chemistry :(2h lectures + 3h practical weekly)

Physical Chemistry: (12 lecture x 1 hr) Significant figures, Measurement and unit: The gaseous state, the gas laws, real and ideal gases, the liquid state and the solid state. Thermochemistry, thermo- chemical equations, Hess's law; ΔH for various processes; bond energies, variation of ΔH with temperature; heat capacities: Kirchhoff's equation. The Solution Process, Ways of Expressing Concentration. Factors Affecting Solubility. Raoult's Law Colligative Properties - Lowering the Vapor Pressure - Boiling-Point Elevation - Freezing Point Depression – Osmosis -Determination of Molar Mass. Chemical equilibria: The equilibrium state. The Reaction Quotient – The relationship between Kc and Kp - Heterogeneous Equilibria - Le-**Chatelier's** Principle and Chemical Equilibrium. Equilibria in Aqueous Solutions The Arrhenius Theory of Acids and Bases, Bronsted-Lowry and Lewis theory of Acids and Bases - Auto-ionization of water and pH - Ionization Constants of Weak Electrolytes and Polyprotic Acids - Common Ion Effect and Buffers - Hydrolysis Constants - Acid-Base Titration Curves. Solubility and Ksp relationship.

Analytical Chemistry: (12 lecture x 1 hr) Qualitative and quantitative analysis; Data Handling, Accuracy and precision; rounding off; determination of errors; indeterminate errors; standard deviation; propagation of error; significant figures and propagation of error; the confidence limit; the Q test; the correlation coefficient; detection limits and static of sampling Stoichiometric Calculations , Review of fundamental concepts; concentrations of solutions and titer .. Acid – Base titrations, Neutralization reactions of different acids with different bases and their titration curves. Solubility and Ksp - Relationship of Ion Product to Solubility – predicting. Precipitation titrations; their types and their curves, Complexometric Titrations, Formation constants of complexes; EDTA titrations, their curves and their indicators. Oxidation–Reduction reactions and titrations Oxidation–Reduction reactions; electrochemical cells; electrode potentials; the potential of electrochemical cell; redox titrations curves; indicators and applications.

Uni 102 Introduction to Computer Science: (2h lecture and 1h tutorial /Weekly)

Descriptions: Computer hardware: input and output devices, memory, CPU, ALU, control unit, and Expansion Cards. Computer networks: Model and protocol, LAN, MAN, and WAN nets. Data representation: Data types, text, numbers, images, audio, and video. Hexadecimal and octal notation and their conversion. Number representation: binary and decimal system and their conversion. Integer representation, Unsigned, sign-and-magnitude, one's complement, two complement methods. Floating point representation, normalization, sign, exponent and mantissa, IEEE standards. Operations on Bits: arithmetic and logical operations, truth table, unary operator, binary operator, applications. Algorithms: concept, construct (sequence, decision, and repetition), flowchart, pseudocode, subalgorithms, basic algorithms (summation, product, smallest, largest, sorting, and searching.

Second Level

Phys 201 Practical Physics (1): (4h practical/Weekly)

The Laboratory is designed to illustrate physical principles and to develop experimental skills; and how to emphasize proper report writing. The course includes; Experiments dealing with the basic laws of mechanics, Vibrational and circular motion, Fluids, elasticity, Feat, thermal properties of materials, Error analysis and the concept of computer-controlled experiments.

Phys 202 Practical Physics (2) : (4h practical /Weekly)

The Laboratory is designed to illustrate physical principles and to develop experimental skills; and how to emphasize proper report writing. The course includes; Experiments dealing with the basic laws of Physical optics (As; Young Double Slit, Mickelson's Interferometer, Abbe's Refractometer, Polarization of Light, Diffraction Grating, Newton's Rings).

Phys 209 Atomic and Modern Physics :(2 h lectures and 1h tutorial/Weekly)

This course aims to introduce and explain the principles, models, and methods required to understand the behavior of atoms and modern physics. The course includes; The special theory of relativity, Galilean transformations and their limitations, Einstein's postulates and Lorentz transformations, Length, time and simultaneously in relativity, Mass and momentum in relativity,
Relativistic Mechanics, Mass and Binding Energy. Black body radiation and Quantum hypothesis. Photoelectric effect. Compton effect. X-rays, old quantum mechanics and Bohr model of H atom. Vector atom model. Normal Zeeman effect, anomalous Zeeman effect and Stark effect. Tutorial: 1h/W

Phys 214 Classical Mechanics :(2 h lectures and 1h tutorial/Weekly)
This course aims at developing a clear understanding of the structure and fundamental principles of Classical Mechanics. The course includes: Coordinate Systems, Mechanics of a Single Particle and of Systems of Particles, Motion in a Central Force Field, Oscillations, Collisions of Particles, Moving Coordinate Systems, and Motion of a Rigid Body

Med Phys 201 Introduction to Ophthalmic Optics:(2h Lectures and 1h tutorial/Weekly**) Prerequisite: Phys 102**

This course provides the student with the basic theory of optics as it relates to optometric refraction, ophthalmic corrective lenses, ophthalmic instruments, and low vision devices. In addition, the course covers the optical properties of the eye and the *techniques used for assessing these properties. Topics include vergence, refraction,* reflection, ray tracing, prisms, thin and thick lenses, and mirrors, optical models of the eye, refractive errors, and optical effects of correcting

lenses

Math 210 Ordinary Differential Equations :(2 h lectures and 2 h tutorials /Weekly) **Prerequisite: Math 111**

Descriptions: Definitions. First-order differential equations: linear, separable, exact and homogenous, Second-order differential equations, reduction of order, constant coefficients; Second-order linear equations: ordinary points and regular singular points. Euler's equation. Introduction to systems of first-order equations. Solutions of two linear first-order equations. Introduction to Partial differential equations – order – homogenous and non homogenous – degree-linear and nonlinear- Heat equation, Wave equation and Laplace's equation in both one and higher dimensions. Separation of Variables and solutions of boundary value problems.

Uni 201 Scientific Terminology in English :(2 h lectures /Weekly)

Phys 211 Vibration and Waves: (2h lecture and 1h tutorial/Weekly)
This course aims at introducing a clear understanding of the basic concepts of Vibration and Waves. The course includes; Periodic motions, The Superposition of periodic motions, The free vibrations of the physical system, Forced vibrations and Resonance, Normal mode of Continuous System, Doppler effect.

Bio-Phys 210 the Electricity in Bio-systems :(2h lecture and 1h tutorial/Weekly)

This course aims at developing a clear understanding of the basic concepts in physics of electricity in bio-systems. The course includes Membrane potentials, Nerve Impulses, Electromagnetic Blood Flow-meters, Effects of electric current in the human Body, Electrical conductivity of the cellular membrane at rest, Tissues conductivity, and Medical electronics

Med Phys 204 Nuclear and Radiation Physics :(2 h lectures and 1h tutorial/Weekly)

This course aims to introduce and explain the principles models and methods required for understanding the properties of the nucleus and radiation. The course includes; Structure of the nucleus: Basic properties of the nucleus Binding energy of the nucleus, Nuclear stability, , Semi-empirical mass formula. The decay of the nucleus: The law of radioactive decay, Natural radioactivity and Alpha decay, Beta decay, Gamma decay, Interaction of Nuclear radiation with matter. Detectors and Accelerators. Concepts of Biophysical Radiation, dosimetry of ionizing radiation.

Phys 222 Principals of Electromagnetic Theory: (2h lecture and 1h tutorial/Weekly) **Prerequisite: Phys 102**

This course aims at studying the Electromagnetic theory from the Electrostatic, magnetostatic and Electromagnetic relations. The course includes: Vector Analysis, Coulomb's Law and Electric Field, The Electrostatic Potential, Electrostatic Dipole, Dielectric Polarization, Poisson and Laplace Equations, Biot-Savart Law and Magnetic Field Potential, Magnetic Vector Potential and Induction, Magnetic Dipole, Poisson and Laplace Equations for Magnetic Potentials, Electromagnetic induction and Faraday's law, Maxwell's equations, Electromagnetic wave equations, electromagnetic plane wave propagation.

Med physics 205. Biomechanics and Fluid flow: (2h lecture and 1h tutorial/Weekly)

This course aims at developing a clear understanding of the basic concepts of Biomechanics and fluid dynamics. The course includes: Static, Dynamic forces and Friction. Bone Mechanics, Biomechanics of biological tissues. Fluid dynamics and application of Bernoulli's equation, Newtonian and Non-Newtonian fluids. Viscoelasticity, Blood Rheology, Laminar and turbulent flow, Red blood cells and their deformabi1ity RBC 's dimensions and shape, Viscosity and Poiseuille's law application to cardiovascular systems.

؛hysics 229: Fundamentals Computer Programming :(1h lecture and 2h practical/Weekly) **Prerequisite: Uni 102,**

This course introducing the concept of programming Language and their applications in computerizing physics data collected in the laboratory and use of computers programs in graphical and statistical analysis of the collected data.to give practice in the use of the language to solve scientific problems. The course includes: Elements of statements, Mathematical Functions, Arithmetic Assignment Statements, how to write the program Statements? Input and Output Statements, Application for programming language,

Med Phys 207. Physics of Non-ionizing Radiation : (2h lecture and 1h tutorial/Weekly) **Prerequisite: Med Phys 101**

This course presents medical applications of non- ionizing radiation. Students will study; the generation and detection of ultrasound, interaction of ultrasound with materials, medical applications of ultrasound, principles of magnetic resonance spectroscopy and imaging, medical application of low energy electromagnetic radiation (visible light, ultraviolet, infrared, and lasers), biological effects and safety.

M 207. Principals of General Microbiology: (2h lecture, 2h practical & 1h

tutorial/weekly)

Microbial diversity - Prokaryotes (Bacteria & Archaea): Cell Envelopes, Cell Walls, Cell Components, External Structures - Eukaryotic cell structure (fungi) - Isolation & cultivation of microorganisms - Environmental factors affecting microbial growth - Modes of nutrition in microorganisms - Control of microbial growth - Microbial interactions & biogeochemical cycles in the environment

Z212 Human Physiology: (2 h lectures and 2h practical/Weekly)

Digestive system (nutrition – digestion – absorption – metabolism – defecations). Circulatory system – blood components – Factors affecting blood synthesis-blood diseases. Muscle & nerve structure and factors affecting its activity-Excretion and urine formation – Kidney functions - respiration- gas transport and exchange - Endocrine glands (types, secretion-functions abnormalities

Uni 202-210 One course only from cultures Courses: (2h lecture /weekly)

Phys 221 Physical Optics :(2h lecture and 1h tutorial/Weekly) **Prerequisite: Phys 102**

An understanding of the basic physical optics and describes the behavior and properties of light and interaction of light with matter. The course includes; the wave theory of light, Interference of two beams of light, Interference with multiple-beams, Diffraction of light, Polarization of light, Dispersion and absorption of light.

Bio-Phys 211 Introduction to Biophysics :(2h lecture and 1h tutorial/Weekly)

This course aims at developing a clear understanding of the basic concepts of biophysics. It includes; Experimental studies on living cells, Electromagnetic waves, Spectrum and range and their applications, Photobiological process, Acoustical phenomena of biophysical interest.

Third Level:

Phys 302 Practical Physics (3): (4h practical/Weekly) **Prerequisite: Phys 103**
The Laboratory is designed to illustrate physical principles and to develop experimental skills; The course includes; Selected experiments on topics of Electronics and Digital circuits (As: Electronics: the operational amplifier, Unipolar transistor, Photodiode, phototransistor and solar cell, work function and contact potential, a Light emitting diode, Digital: operation of various types of biostable or flip-flops.

Phys 311 Solid State (1): (2h lecture and 1h tutorial/Weekly)
This course aims at introducing a clear understanding of the basic concepts of physics of Solid Materials. The course includes; Crystal Structure, Crystal Diffraction and Reciprocal Lattice, Diffraction Techniques, Crystal binding, Ionic crystals, Imperfections in crystals, Diffusion.

Med Phys 309 Selected topics in medical physics: (2h lecture and 1h tutorial/Weekly)
Directed reading course on advanced topics in Medical Physics to be designated by the staff instructing the course.
Topics will be selected in anticipation of new scientific developments in the field of study.
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Phys 313 Quantum physics: (2h lecture and 1h tutorial/Weekly)
This course aims at developing a clear understanding of the basic concepts of Quantum Physics. The course includes; Early Days of Quantum Theory and the Wave Nature of Electrons,. The Schrödinger Equation and Operators in Quantum Mechanics, Particles in Potential Wells and Tunnelling through Barriers, The Harmonic Oscillator: A Model for Molecular Vibrations, The Rigid Rotator: A Model for Molecular Rotations and the Angular Momentum, The Hydrogen Atom: Energy Levels and Atomic Orbitals, The Electron Spin and Related Phenomena, Chemical Bonding: Molecular, Orbitals and Energy Levels of Electrons in Molecules, Perturbation Theories and Selection Rules for Transitions, Elements of Molecular Spectroscopy and Lasers, Symmetry Elements of Molecules and Group Theory, Weak Bonds and the Molecules of Life.

Phys 330 Mathematical Physics for non-physics Major (1), (2h lecture and 1h tutorial/Weekly) **Prerequisite: Math210**

This course aims at introducing students to some of the basic mathematical physics of Special function & partial differential Equation and further develop students skill in solving problems. The course includes. Concepts and Definitions, Laplace transforms - Fourier's Series & Fourier integrals Mathematical Models, Method of Separation of Variables. Gamma and Beta

Functions, The Legendre Functions. Bessel Functions, and other functions.

Med Phys 301 Optical devices and Photonics : (2h lecture and 1h tutorial/Weekly) **Prerequisite: Phys330 concurrent**

This course provides students with a working knowledge of optics and photonics, including wave optics, physical optics and introductory laser physics. It also provides a basis for further study in photonics.
Wave optics content: solutions of the wave equation, including Hermite-Gaussian laser modes, optical cavities, Fresnel and Fraunhofer diffraction integrals; Fourier optics; Array Theorem; amplitude and phase spatial filtering. Physical optics content: Fresnel equations; Lorentz electron oscillator model & dispersion, polarization, birefringence, and applications; optical activity; Faraday Effect. Laser physics content: laser resonators; Einstein coefficients; stimulated amplification of light; laser oscillators; mode control; overview of some real lasers.

Med Phys 302 Introduction to Anatomy and Physiology (this course will be taught in faculty of Medicine) : (2h lecture and 2h practical/Weekly) **Prerequisite: Z 212**

Introduction to Anatomy and Physiology explores basic concepts of both structure and function of the human body developed and delivered as an integrated approach. Students cover basic principles of anatomy and physiology and study in further detail six of the eleven systems of the body (skeletal, joint, muscular, nervous, cardiovascular, and respiratory). Students will be exposed to human cadaveric specimens during teaching, learning and assessments in this subject.
Students with a medical history of immunosuppression, who are pregnant or believe that a relative or family friend has donated their remains to the laboratory, need to directly contact the subject coordinator regarding subject enrolment advice.
Important notice: This subject involves visual inspection and gloved handling of cadaveric material. Students with any medical conditions or if they may be pregnant should consult their Medical Practitioner before participating in this subject.

Med Phys 303. Biomedical Instrumentations :(2h lecture and 1h tutorial/Weekly) **Prerequisite: Phys 103**

This course will provide an overview of instrumentation systems used in clinical medicine and biomedical research. A review of some circuit theory, and its application to bioinstrumentation. Systems for measuring biologic signals will be discussed including biopotentials, , pressure, temperature. Electrical hazards, safety, measuring instruments and techniques will be discussed. Transducer systems and sensing and driving circuits.

Med Phys 310 Nanobiotechnology :(2h lecture and 1h tutorial/Weekly)

This course provides perspective for students and researchers who are interested in nanoscale physical and biological systems and their applications in medicine. It introduces concepts in nanomaterials and their use with biocomponents to synthesize and address larger systems. Applications include systems for visualization, biosensing, labeling, drug delivery, and cancer research. Technological impact of nanoscale systems, synthesis, and characterizations of nanoscale materials are discussed.

Bio Phys 302 Practical Biophysics: (6h practical/Weekly)

The Laboratory is designed to illustrate Bio-physical principles and to develop experimental skills; and how to emphasize proper report writing. The course includes selected experiments on topics of viscosity of fluids and blood, spectrophotometric analysis of plant chlorophyl pigments and hemoglobin and dielectric properties red blood cells.

Med Phys 304. Radiobiology : (2h lecture and 1h tutorial/Weekly)
Prerequisite: Phys 204

This course is an interface between clinical practice and quantitative radiation biology. Micro dosimetry, dose-rate effects and biological effectiveness thereof; radiation biology data, radiation action at the cellular and tissue level; radiation effects on human population, carcinogenesis, generic effects; radiation protection; tumor control, normal-tissue complication probabilities; treatment plan optimization

Med Phys 305 Digital Signal Processing :(2h lecture and 1h tutorial/Weekly)
Prerequisite: Phys 303

The course covers theory and methods for digital signal processing including basic principles governing the analysis and design of discrete-time systems as signal processing devices. Review of discrete-time linear, time-invariant systems, Fourier transforms and z-transforms. Topics include sampling, impulse response, frequency response, finite and infinite impulse response systems, linear phase systems, digital filter design and implementation, discrete-time Fourier transforms, discrete Fourier transform, and the fast Fourier transform algorithms.

Med Phys 307.Sources and detection devices of radiation :(2h lecture and 1h tutorial/Weekly)**Prerequisite: Phys 204**

This a multidisciplinary course on the fundamental physics of radiation production and its detection with an emphasis on medical application. Topics covered will include properties of radiation detectors, scintillator and semiconductor detector physics, linear accelerator beam production for therapy, cyclotron radionuclide production, and x-ray tube physics.

Med Phys 308. Bio Electronic Materials :(2h lecture and 1h tutorial/Weekly)
Prerequisite: Phys 311

In this subject, the following topics relevant to the nature of electronic materials will be covered: atomic bonding and crystal structure. Electrons in solids, band theory: insulators, conductors, semiconductors, and superconductors. The free and nearly free electron theories. Electrical conductivity, Hall effect. Types of magnetic materials. Semiconductors - intrinsic, extrinsic, the hole, the p-n junction. Superconductors - phenomena, BCS theory. Production of semiconductors and superconductors, control of processing to achieve desired properties. Design and production of novel materials to achieve improved performance in electronic devices, modern applications.

Math 330 Biostatistics :(2h lecture and 1h tutorial /Weekly)

Descriptions: Introduction; What is Biostatistics? Observations and Variables, Scales Used with Variables, Randomized Response Technique. Descriptive Methods: - Introduction to descriptive methods, tabular and graphical presentation of data, frequency tables, frequency graphs, Measures of Central Tendency, Measures of Variability, Measures of Change over Time (Linear Growth, Geometric Growth, Exponential Growth), Correlation Coefficients (Pearson Correlation Coefficient, Spearman Rank Correlation Coefficient). Probability and Life Tables: - A Definition of Probability, Rules for Calculating Probabilities, Conditional Probabilities, Definitions from Epidemiology, Probability in Sampling (Sampling with Replacement, Sampling without Replacement), Some Uses of the Life Table, Expected Values in the Life Table. Probability Distributions: - The Binomial Distribution, The Poisson Distribution, The Normal Distribution, The Central Limit Theorem and Approximations to the Binomial and Poisson Distributions. Study Designs: - Sampling and Sample Designs, Designed Experiments and Variations in Study Designs. Interval Estimation: - Confidence Intervals Based on the Normal Distribution, Confidence Interval for the Difference of Two Means and Proportions, Confidence Interval and Sample Size and Prediction and Tolerance Intervals Based on the Normal Distribution. Tests of Hypotheses: - Preliminaries in Tests of Hypotheses, Testing Hypotheses about the Mean, Testing Hypotheses about the Proportion and Rates, Testing Hypotheses about the Variance.

Bio-Phys 322 Bioenergy :(2h lecture and 1h tutorial/Weekly)

This course aims at introducing the principles and applications of Bioenergy. The course includes :Energy and the Biological world, photosynthesis, Respiration, Phosphorylation, DNA and RNA, Metabolism and Catabolism.

BioChem. 379 Principle of Biochemistry: (2h lecture and 1h tutorial/Weekly)

Introduction, Nomenclature, Classes: Monosaccharides – Disaccharides –

Oligosaccherides- Polysaccharides- Physical properties of Carbohydrates- Sugar Derivatives – Chemical Reactions – Clinical importance of Carbohydrates.
Structure of amino acids - Interactions of amino acids - Reactions of amino acids - Peptides – Protein Structures - Protein Stability - Temperature-Sensitive Mutations - Ligand-Binding - Structural Functional Proteins.

Fourth Level

Med Phys 400 Research Project and Essay in Medical physics: (1h lecture/Weekly**)**

The project of research and report, to develop students to use their scientific knowledge, their ability to plan and execute an extended experimental or theoretical investigation and use all their communication skills to describe their results. To provide an understanding of some techniques of research, including the presentation of results. Students should have obtained an appreciation of research methodologies gained under individual supervision; ability to design and execute a project, write a report and present it in front of a committee. Student chooses the project in consultation with a staff member of the department. The subject of the project may be experimental physics or theoretical physics in the field related to Medical Physics. They should have produced an impressive report on their project, which they can show at career interviews and discuss its content with confidence.

Med Phys 402 Practical Medical Physics (1): (6h practical/Weekly)

The Laboratory is designed to illustrate physical principles and to develop experimental skills; and how to emphasize proper report writing. The course includes; Experiments dealing with the basic laws of Nuclear Physics and Solid state physics, as Geiger Muller tube, linear absorption coefficient Beta and Gama ratio, Verification of inverse square law. Application of Microwave Diffraction and diffraction of light. Polarization in Microwave, and Simulation for physics Experiments Using the Computer

Bio-Phys 412 Physics of Radiotherapy :(2h lecture and 1h tutorial/Weekly)
Prerequisite: Med 304

This course aims at developing a clear understanding of the basic concepts of Physics of Radiotherapy. The course includes: The principles of Radiotherapy Physics, Radiation sources, Radiotherapy with single photon beams, Radiotherapy with particle beams, treatment planning, techniques and equipment in teletherapy, dosimetry using small sealed sources and radionuclide sources, radiation protection

Med-Phys 409 Radiation Protection: (2h lecture and 1h tutorial/Weekly)
Prerequisite: Med 304

This course aims at developing a clear understanding of the basic concepts of Radiation Protection. The course includes: an introduction to radiation protection, Radiation hazards, Radiation intensities and doses, biological effectiveness, Radiation damage, Radiation shielding.

Med Phys 401. Physics of Diagnostic Radiology : (2h lecture and 1h tutorial/Weekly)
Prerequisite: Med 101 & Med 304

This course aims at presenting the physical principles of X-ray production and factors affecting its quality and intensity, absorption of x ray in materials, making an x-ray image, processing and quality of radiographic films, producing live radiological images, radiation protection

Med Phys 403. Magnetic resonance imaging: (2h lecture and 1h tutorial/Weekly)
Prerequisite: Med Phys 101

This course will focus on the underlying scientific theory and practice leading to magnetic resonance imaging. Includes the concepts and scientific principles employed in magnetic resonance imaging techniques. Emphasis on principles of magnetism and interactions of living matter within magnetic fields.

Bio-Phys 413 Physics of Biomaterials and their substitutions: (2h lecture and 1h tutorial/Weekly)
Prerequisite: Med 413

This course aims at developing a clear understanding of the basic concepts of Physics of Biomaterials and Their substitutions. The course includes; Biological requirements of materials, Crystalline and amorphous phases, Mechanical and Thermal properties of materials, Bone characteristics, Science of Dental Materials, Contact lens properties and interactions, Ceramic implant materials.

Math 446 Image Processing: (2 h lectures and 1h tutorial /Weekly)

Descriptions: 1- fundamentals (What is digital image Processing-Digital image representation-Image types). 2- Intensity transformations function (Histogram processing- Spatial filtering). 3- Image restoration (A model of the image degradation- Noise models - Direct inverse filtering). 4- Color image processing (Color image representation-Converting to other color spaces- Color transformations). 5- Image compression (Coding redundancy- Interpixel redundancy- JPEG compression). 6- Image segmentation (Point, line and edge detection – Thresholding - Region-Based segmentation). 7- Wavelets (The Fast wavelet Transform- Wavelet decomposition structures- Wavelet in image

processing).

Med Phys 404 Practical Medical Physics (2) (Hospital Training) : (6h practical/Weekly)
Prerequisite: Med Phys 204 & Bio Phys 412

This course aims at developing a clear understanding of the experimental methods in Medical physics. The course includes; Separation methods, classification of the techniques, Nuclear magnetic resonance, Mass spectrometry, Dielectric techniques, and treatment with radiation

Phys 410 Laser and its Applications :(2 h lectures and 1h tutorial/Weekly)
Prerequisite: Med phys 301
The course introduces the students to fundamentals, operation and applications of the laser. The course includes; Quantum transition in an atomic system, Amplification of electromagnetic wave in an optical cavity, Population inversion (three-level and four-level energy system), Basis of laser operation, Characteristic of laser light, Some types of laser sources-Axial modes of laser, Modifying the laser output, Applications of laser (in industry, in optical information and storage, in medicine, in military).

Bio-Phys 420 Medical Nuclear Physics: (2h lecture and 1h tutorial/Weekly)
Prerequisite: Med phys 204

This course aims at developing a clear understanding of the basic concepts of Medical Nuclear physics. The course includes; Production of radionuclides, Gamma cameras, Characteristics of radiopharmaceuticals, Radiation Regulation, Methods of detection and imaging

Med Phys 405.Detection of Radiation: Neutrons, Electrons and X Rays : (2h lecture and 1h tutorial/Weekly)
Prerequisite: Phys 312 & Med phys 307

This course includes the Cylindrical and parallel plate ionization chambers and their optimized design and X-ray tube physics. Absolute dose calibration protocols and the relative dose concept. Semiconductor detectors and their response to radiation. Thermo-luminescent dosimeters - their properties, types and advantages. Film dosimetry - the principles of radiation film exposure and non-linearity of film response, EPR dosimetry and chemical dosimetry.

Med Phys 406. Physics of Medical Imaging with Ionizing Radiation : (2h lecture and 1h tutorial/Weekly)

Prerequisite: Med Phys 101

This is a course on the physics and principles of medical imaging systems that form images using high energy photons. Such systems are divided into two categories:
(1) those based on the transmission of x-rays through the human body, including radiography, mammography, fluoroscopy, and computed tomography (CT), and
(2) those based on the emission of gamma rays following radioactive decay of an internal tracer, including the gamma camera, single photon emission tomography (SPECT), and positron emission tomography (PET) and PET hybrid imaging systems. Emphasis is placed on understanding how physics, system design, and imaging technique determine image performance metrics such as contrast, signal-to-noise ratio, and spatial resolution. Clinical applications and radiation safety concepts are detailed for the different types of imaging systems.

Z404 Cell biology& Genetics: (2h lecture and 2h practical/Weekly)
Prerequisite: Z 101

Cell biology: Definition of cell biology – animal cell structure – plasma membrane – nucleus – cell organelles include (Golgi apparatus, Lysosomes, Ribosomes, Endoplasmic reticulum), Mitochondria. Cell structure and functions - Structure and function of cell membrane - Structure and function of extracellular matrix - Cell-Cell adhesion - Cell signaling - protein expression and protein post-transcriptional modifications - Cell cycle and cell cycle regulation - Biology of cancer.
Genetics: Cytogenetics – epigenetics inherited genetic diseases – gene therapy & targeted drug therapy – bioinformatics of genetic disorders.

Med Phys 407. Physics of Brachytherapy : (2h lecture and 1h tutorial/Weekly)
Pre-requisite: Bio Phys 412

The course aims to: Discuss patient selection, indications and contra-indications for brachytherapy. Provide an overview of the, physics background techniques, equipment and staffing for a prostate brachytherapy unit and regulatory requirements. Give an overview of the results, side effects and their management

Med phys 408. Hospital Management (Health care management) Faculty of commerce: (2h lecture and 1h tutorial/Weekly)

This is an introductory course to the planning and management in health care and hospital management. The course provides an overview of the various planning and management issues in health care. The following topics are introduced: management and leadership; conflict management and communication; organizational and quality development; leading for change;

decision-making, resource allocation and priority setting processes, and working environment. All subjects are discussed from an international perspective and illustrated with examples from healthcare in different countries. Students are encouraged to critically review the course material by relating to healthcare in their own country.