B.Sc Biophysics program

The objectives of B.Sc Biophysics program are:

1- To emphasize the utility of physics in biology and biomedicine

2- To introduce the students to the physical tools which have been used so powerfully in biology, such as electron microscopy, nuclear magnetic resonance,x-ray and radiation

3- To improve the skills of the students in deferent fields of study to broaden their carrier chances.

4- To provide the community with well trained graduates to work in hospitals , radiation protection agencies and researchers

5- To open new opportunities in fields that benefit from the combination of physics and biology for pharmaceutical companies

Courses of Biophysics program

أكواد ورموز المقـــررات

الكـــــود	اسم المقـــرر	الكـــــود	اسم المقـــرر
ر (Math)	رياضيـــات	م (M)	ميكروبيولوجى
ف (Phys)	فيزيـــــاء	جف (GPhys)	جيوفيزيـــاء
ك (Chem)	كيميـــــاء	ف ح (BioPhys)	فيزياء حيويـة
ج (G)	جيولوجيـــا	ك ح (BioChem)	كيمياء حيويـة
ح (Z)	حيـــوان	ع ب (ES)	علوم بيئية
ن (B)	نبـــات	ع (Uni)	متطلبات جامعة

أولاً : متطلبات الجامعة : (8 س.م)

أ-- مقررات إجبارية : " القائمون بالتدريس "

- حقوق الإنسان ومكافحة الفساد (ع101) (2 س.م) كلية العلوم أو كلية الحقوق
- مقدمة فى علم الحاسب (ع102) (2 س.م) كلية العلوم

- **مصطلحات علمية باللغة الإنجليزية (ع201) (2 س.م) كلية العلوم**

ب -- مقررات إختيارية : عدد (2 س.م) فى المواد الثقافية فى أحد المقررات الأتية:

- **الثقافة البيئية (ع202) كلية العلوم**
- **تاريخ وفلسفة العلوم (ع203) كلية العلوم**

- **أخلاقيات مزاولة المهنة (ع205) كلية العلوم**
- **مهارات التواصل (ع206) كلية العلوم**
- **دراسة الجدوى (ع207) كلية العلوم أو كلية التجارة**
- **الجودة والتخطيط الإستراتيجى (ع208) كلية العلوم أو كلية التجارة**
- **الأمان المعملى (ع210) كلية العلوم**

<u>ثانياً : متطلبات الدرجة العلمية :</u>

أ-- متطلبات الكليــة : (30 س.م)
ب-- متطلبات التخصص : (98 س.م)

كما هو مبين فى الجداول المرفقة

المقررات الدراسية لبرنامج الفيزياء الحيوية (المستوى الاول)

الفصل الدراسى	كود المقرر	إسم المقرر	متطلبات المقرر	حالة المقرر		توزيع عدد الساعات أسبوعيا				الدرجة					ملاحظات
				إجبارى	إختيارى	نظرى	عملى تطبيقى	تمرينات تطبيقية	المعتمدة	عملى	شفهى	تطبيقى/ فصلى	نظرى	المجموع	
الأول	ر 111	تفـاضل و تكامل (1)	--	1	--	2	--	2	3	--	10	20	70	100	
	ك102	كيمياء عامة (2)	--	1	--	2	3	--	3	20	10	10	60	100	
	ف 101	خواص الماده والحراره	--	1		2	2	1	3	20	10	10	60	100	
	ح101	مقدمة فى علم الخلية والأنسجة والوراثة	--	1	--	2	2	--	3	20	10	10	60	100	
	ن101	مورفولوجيا وتشريح النبات	--	1	--	2	2	1	3	20	10	10	60	100	
	ع101	حقوق الإنسان ومكافحة الفساد	--	1	--	2	--	--	2	--	--	--	100	--	متطلبات جامعة
المجموع				6					17					500	
الثانى	ر112	جبر و هندسة	--	1	--	2	--	2	3	--	10	20	70	100	
	ف 102	كهربية ومغناطيسية وضوء	--	1	--	2	2	1	3	20	10	10	60	100	
	ك101	كيمياء عامة (1)	--	1	--	2	3	--	3	20	10	10	60	100	
	ك131	أسس الكيمياء العضوية (1)	--	1	--	2	--	--	2	--	10	20	70	100	
	ن 102	تنوع أحيائى وأساسيات فسيولوجيا النبات	--	1	--	2	2	1	3	20	10	10	60	100	
	ع102	مقدمة فى علم الحاسب	--	1	--	2	--	1	2	--	10	20	70	100	متطلبات جامعة
المجموع				6					16					600	
مجموع الفصلين				12					33					1100	

المقررات الدراسية لبرنامج الفيزياء الحيوية (المستوى الثانى)

الفصل الدراسى	كود المقرر	إسم المقرر	متطلبات المقرر	حالة المقرر		توزيع عدد الساعات أسبوعيا				الدرجة					ملاحظات
				إجبارى	إختيارى	نظرى	عملى تطبيقى	تمرين تطبيقى	المعتمدة	عملى	شفهى	تطبيقى/ فصلى	نظرى	المجموع	
الثالث	ف 201	عملى فيزياء (1)	--	1	--	--	4	--	2	60	--	40	--	100	
	ف 209	فيزياء ذرية وحديثة	--	1	--	2	--	1	2	--	10	20	70	100	
	ف 213	فيزياء نووية (1)	--	1	--	2	--	1	2	--	10	20	70	100	
	ر 210	معادلات تفاضلية	ر 111	1	--	2	--	1	2	--	10	20	70	100	
	ح 211	تشريح ادمى	--	1	--	2	2	--	3	20	10	10	60	100	
	ك 211	أسس الكيمياء التحليلية	ك 102	1	--	2	--	1	2	--	10	20	70	100	
	ف 211	موجيات واهتزازات	--	--	1	2	--	1	2	--	10	20	70	100	إختيار مقرر واحد
	ف 215	فيزياء المرونة				2	--	1		--	10	20	70		
	ع 201	مصطلحات علمية باللغة الإنجليزية	--	1	--	2			2	--	10	--	90	100	متطلبات جامعه
المجموع				6	1				17					700	
الرابع	ف ح 210	الكهربية فى الأنظمة الحيوية	--	1	--	2	--	1	2	--	10	20	70	100	
	ف 202	عملى فيزياء (2)	--	1	--	--	4	--	2	60	--	40	--	100	
	ف 221	ضوء فيزيائى	--	1	--	2	--	1	2	--	10	20	70	100	
	ف 224	ميكانيكا الموائع	--	1	--	2	--	1	2	--	10	20	70	100	
	ح 212	فسيولوجى ادمى	--	1	--	2	2	--	3	20	10	20	60	100	
	ك 221	كيمياء العناصر الممثلة	ك 101	1	--	2	--	1	2	--	10	20	70	100	
	ك ح 278	أسس الكيمياء الحيوية (2)	ك101	1	--	2	--	--	2	--	10	20	70	100	
	ف 222	أسس النظريه الكهرومغناطيسية	--	--	1	2	--	1	2	--	10	20	70	100	إختيار مقرر واحد
	ن 206	بيوفيزياء التمثيل الضوئى				2	--	1		--	10	20	70		
	ع 202- ع210	مواد ثقافية (اختيار مقرر واحد)	--	--	1	2	--	--	2	--	--	--	100	--	متطلبات جامعه
المجموع				8	2				19					900	
مجموع الفصلين				14	3				36					1600	

المقررات الدراسية لبرنامج الفيزياء الحيوية (المستوى الثالث)

الفصل الدراسى	كود المقرر	إسم المقرر	متطلبات المقرر	حاله المقرر		توزيع عدد الساعات اسبوعيا				الدرجه					ملاحظات
				إجبارى	إختيارى	نظرى	عملى تطبيقى	تمرين تطبيقى	المعتمدة	عملى	شفهى	تطبيقى/ فصلى	نظرى	المجموع	
الخامس	ف ح 301	عملى فيزياء حيوية (1)	--	1	--	--	6	--	2	60	--	40	--	100	
	ف ح 310	فيزياء حيويه اشعاعية	ف 220	1	--	2	--	1	2	--	10	20	70	100	
	ف ح 311	فيزياء حيويه جزيئيه	--	1	--	2	--	1	2	--	10	20	70	100	
	ف 311	فيزياء الجوامد (1)	ف210	1		2	--	1	2	--	10	20	70	100	
	ف 313	فيزياء الكم	--	1	--	2	--	1	2	--	10	20	70	100	
	م 314	مقدمة فى الميكروبيولوجيا التطبيقية	--	1	--	2	2	--	3	20	10	10	60	100	
	ر 330	الإحصاء الحيوى	--	--	1	2	--	1	2	--	10	20	70	100	أختيار مقرر واحد
	ف 320	يرمجه حاسب	--			2	--	1		--	10	20	70		
	ف ح 315	ميكانيكا حيوية	--	--	1	2	--	1	2	--	10	20	70	100	أختيار مقرر واحد
	ف 329	أطياف جزيئية	ف210			2	--	1		--	10	20	70		
المجموع				6	2				17					800	
السادس	ف ح 302	عملى فيزياء حيوية (2)	--	1	--	--	6	--	2	60	--	40	--	100	
	ف ح 321	الأشعة المؤينة	--	1	--	2	--	1	2	--	10	20	70	100	
	ف 323	فيزياء نووية (2)	ف213	1	--	2	--	1	2	--	10	20	70	100	
	ف 324	الكتروديناميكا (1)	--	1	--	2	--	1	2	--	10	20	70	100	
	ح 311	بيوفيزياء الجهاز العصبى	--	1	--	2	--	1	2	--	10	20	70	100	
	ك 341	كيمياء كهربية (1)	ك102	1	--	2	--	1	2	--	10	20	70	100	
	ف ح 322	طاقه حيوية	--	--	1	2	--	1	2	--	10	20	70	100	أختيار مقرر واحد
	ف 327	فيزياء البلمرات				2	--	1		--	10	20	70		
	ك ح 378	كيمياء حيوية اكلينيكية	--	--	1	2	--	1	2	--	10	20	70	100	اختيار مقرر واحد
	ك 316	التحليل الحيوي	ك211			2	--	1		--	10	20	70		
المجموع				6	2				16					800	
مجموع الفصلين				12	4				33					1600	

المقررات الدراسية لبرنامج الفيزياء الحيوية (المستوى الرابع)

الفصل الدراسى	كود المقرر	إسم المقرر	متطلبات المقرر	حالة المقرر		توزيع عدد الساعات أسبوعيا				الدرجة						ملاحظات
				إجبارى	إختيارى	نظرى	عملى تطبيقى	تمرين تطبيقى	المعتمدة	عملى	شفهى	تطبيقى/ فصلى	نظرى	المجموع		
السابع	ف ح 401	عملى فيزياء حيوية (3)	--	1	--	--	6	--	2	60	--	40	--	100		
	ف ح 410	فيزياء حيوية تجريبية	--	1	--	2	--	1	2	--	10	20	70	100		
	ف ح 411	فوق صوتيات وتطبيقاتها الحيوية	--	1	--	2	--	1	2	--	10	20	70	100		
	ف ح 412	فيزياء العلاج الاشعاعى	ف ح 310	1	--	2	--	1	2	--	10	20	70	100		
	ف ح 413	فيزياء المواد الحيوية والبديلة	ف ح 311	1	--	2	--	1	2	--	10	20	70	100		
	ف 410	الليزر وتطبيقاتها	--	1	--	2	--	1	2	--	10	20	70	100		
	ح 421	بيوفيزياء إتصال الخلية	--	1	--	2	--	1	2	--	10	20	70	100		
	ف 411	اشباه الموصلات	--	--	1	2	--	1	2	--	10	20	70	100		إختيار مقرر واحد
	ف 418	فيزياء الطاقة الجديدة والمتجددة				2	--	1		--	10	20	70			
المجموع				7	1				16					800		
الثامن	ف ح 400	مشروع بحث ومقال	--	1	--	2	--	--	2	--	20	20	60	100		
	ف ح 402	عملى فيزياء حيوية (4)	--	1	--	--	6	--	2	60	--	40	--	100		
	ف ح 420	فيزياء نووية طبية	--	1	--	2	--	1	2	--	10	20	70	100		
	ف ح 421	وقاية أشعاعية	--	1	--	2	--	1	2	--	10	20	70	100		
	ف ح 423	حسابات بيوفيزيقية	--	1	--	2	--	1	2	--	10	20	70	100		
	ف 422	اليكترونيات	--	1	--	2	--	1	2	--	10	20	70	100		
	ح408	مناعة وبيولوجيا جزيئية	ح101	1	--	2	--	1	2	-	10	20	70	100		
	ح 422	وراثة خلوية	ح101	1	--	2	--	1	2	--	10	20	70	100		
	ف ح 422	فيزياء التصوير الطبى	ف ح 310	--	1	2	--	1	2	--	10	20	70	100		إختيار مقرر واحد
	ف432	أجهزة بصرية	ف 221			2	--	1		--	10	20	70			
المجموع				8	1				18					900		
مجموع الفصلين				15	2				34					1700		

Courses Contents

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.

Math112 Algebra and Geometry: (2h lecture and 2h tutorial /Weekly)

Descriptions: Algebra: Mathematical induction and Partial fractions. Binomial theorem and its applications, Solution of cubic equations, Solution of 4th degree equations, Sets, subsets, set operations and inductively definition of sets, equivalence relations, equivalence classes, partitions and partial order, maps, composition of maps, kinds of maps and inverse functions. Geometry: 1- coordinate plane: Rectangular coordinates and polar coordinate – distance – change of axes - Straight line in plane and the common equation of two lines - Circle - The conic section: Parabola – Ellipse –Hyperbola - The general equation of the second degree in two variables.

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

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.

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).

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:. Kirchoff'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 K_c and K_p - 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.

Physics Department

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).Surface Tension.

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.

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), Alternating Current and Electronic Measurements and Instrumentation.

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 210 Atomic Physics :(2h lecture and 1h tutorial/Weekly)

This course aims to introduce and explain the principles, models, and methods required to understand the behavior of atoms. The course includes: Black body radiation, Rayleigh-Jeans law, Planck's law. Photoelectric effect. Compton effect.X-rays { production of X-rays, continuous X-rays, characteristic x-rays, Moseley's law – Diffraction and absorption of x-rays}, Bohr model of H atom, energy level diagram, spectral series of H atom, H like ions. Wilson-Sommerfeld elliptical orbits {fine structure, degenerate orbits, mass relativistic effect, energy level diagram, selection rule}, Vector atom model. Normal Zeeman effect.

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.

Phys 212 Astronomy and Physics of Atmosphere :(2 h lectures and 1h tutorial/Weekly)

This course is aiming at introducing. The concept of Astronomy in order to be award with the knowledge of the following: Central Forces and Planetary Motion, Planetary orbits and Kepler's Laws, The planets in the Solar system, The Earth and Its Atmosphere, The Earth's Atmosphere, Planetary atmosphere, Equilibrium temperatures, Hydrostatic equation, Adiabatic lapse rate.

Phys 213 Nuclear physics (1) :(2h lecture and 1h tutorial/Weekly)

This course aims to introduce and explain the principles models and methods required for understanding the properties of the nucleus. The course includes; Structure of the nucleus: Basic properties of the nucleus Binding energy of the nucleus, Nuclear stability, Liquid-Drop model, 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. Accelerators.

Phys 214 Classical Mechanics :(2h lecture 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

Phys 215 Physics of Elasticity :(2h lecture and 1h tutorial/Weekly)

The course aims at introducing the concept of elasticity. It consists of; The Concept of the Force, plane stress, plane strain and Different Physical Properties of Material, The Mechanism of Fracture of Different Material, and Fundamental of Fracture Mechanics, Fatigue, Creep. Torsion and Twisting of the metallic beam.

Phys 220 Modern Physics :(2h lecture and 1h tutorial/Weekly)
Pre-requisite: Phys 213

This course aims at developing a clear understanding of the basic concepts of 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, Experimental verification of the relativity theory, The concepts of waves and particles: Black-body radiation, The photo-electric effect, The continuous X-ray spectrum, The photon, The Compton effect, The de-Broglie hypothesis, The diffraction of waves and particles, Introductory quantum mechanics, Bohr's principle of complementarity, Wave-packet description of material particles, Statistical interpretation of the wave function, Heisenberg uncertainty principle.Schrödinger wave equation, Particle in a one-dimensional potential well.

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

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.

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

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.

Phys 223 Analytical Mechanics :(2 h lectures and 1h tutorial/Weekly)

This course aims at introduces a clear understanding of the basic concepts of Analytical Mechanics. The course includes; Lagrangian Mechanics, Hamilton equations of motion, canonical transformations, Hamilton- Jacobi theory, canonical perturbation theory, introduction to the Lagrangian and Hamiltonian formulations for continuous and fields, Poisson brackets. Tutorial: 1h/W

Phys 224 Fluid Mechanics: (2h lecture and 1h tutorial/Weekly)

The course aims at introducing the concept of fluid mechanics. It consists of: The Concept of the Stream line and turbulent flow, Bernoulli's equation, Poiseulle's law, Power dissipation. Reynolds's number, cardiovascular system, viscous drag forces Stock's law and centrifugation. Tutorial: 1h/W

Phys 225 Sonic And Ultrasonic :(2h lecture and 1h tutorial/Weekly)

This course aims at developing a clear understanding of the basic concepts of Ultrasonic. The course includes; Velocity of sound in fluids, Acoustic intensity and impedance, Decibel scales. Doppler Principles, Ultrasonic generators and receivers, Detection of Ultrasonic Waves, Ultrasonic Imaging.

Phys 228 Alternating Current and Electric Circuits:(2h lecture and 1h tutorial/Weekly)

This course aims at developing a clear understanding of the basic concepts of alternating current and electric circuits. The course includes: Definitions and Circuit Parameters, Analysis of circuits with non-sinusoidal A.C. waveform using Graphical solution, Average and effective values, 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.

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, Medical electronics.

Bio-Phys 211 Introduction in 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 301 Practical Physics (3): (6h practical/Weekly)

The Laboratory is designed to illustrate physical principles and to develop experimental skills; The course includes; Selected experiments on topics of Solid state, advanced optical and Electronics, Digital circuits (As: bipolar junction, bipolar junction transistors. oscillators. logical circuits).

Phys 302 Practical Physics (4): (6h practical/Weekly)

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, Uniboplar transistor, Photodiode, phototransistor and solar cell, work function and contact potential, a Light emitting diode, Digital: operation of various types of bistables or flip-flops. Also, to design counters).

Phys 310 Statistical Mechanics (1): (2h lecture and 1h tutorial/Weekly)
Pre-requisite: Phys 104

The course is devoted to study the Statistical thermodynamics. A basic theory is given. Different examples and problems are presented. The course includes: kinetic .theory of an ideal gas, the distribution of molecular velocities, Transport phenomena, The maxwell-boltzmann statistics, applications of the boltzmann statistics, quantum statistics , fluctuations.

Phys 311 Solid State (1): (2h lecture and 1h tutorial/Weekly)
Pre-requisite: Phys 210

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.

Phys 312 Physics of Reactors and Neutrons: (2h lecture and 1h tutorial/Weekly)
Pre-requisite: Phys 213

This course aims at developing a clear understanding of the basic concepts of Physics of reactors and neutrons. The course includes: Neutron and its Interaction with Matter, differential Scattering Cross-section, Nuclear Fission, The Fission Chain Reaction and Nuclear Reactors, Slowing Down of Neutrons, Neutron Moderation by Inelastic Scattering, Thermal Neutron Scattering, The scattering law.

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 314 Quantum Mechanics (1): (2h lecture and 1h tutorial/Weekly)
Pre-requisite: Phys 220

This course aims at developing a clear understanding of the basic concepts of Quantum Mechanics. The course includes; Wave Mechanics: Schrödinger wave equation in momentum space. One-Dimensional problems: Infinite and finite potential well, Tunneling effect, Radioactive decay and penetration of potential barrier, The periodic potential, Simple harmonic oscillator, The Morse potential. Three-Dimensional Problems: Solution of Schrödinger equation in cylindrical coordinates, Solution of Schrödinger equation in spherical coordinates, Space rotator, Solution of the harmonic oscillator in spherical coordinates, The Hydrogen atom. Time-Independent Perturbation Theory.

Phys 315 Mathematical Physics (1):(2h lecture and 1h tutorial/Weekly)
Pre-requisite: Math 210

This course aims at introducing students to some of the basic mathematical physics of Special function and techniques relevant to undergraduate physics further develop student's skill in solving problems. The course includes; Gamma and Beta functions, The hypergeometric Equation, the confluent hypergeometric function, The Legendre functions, Bessel functions, Laguerre Polynomials, Hermite polynomials, other special function.

Phys 316 Advanced Optics: (2h lecture and 1h tutorial/Weekly)
Pre-requisite: Phys 221

This course aims at developing the basic concepts of physical optics and their applications. The course includes; The origin of the refractive index, Dispersion, The electromagnetic character of light, Absorption, Scattering of light, interference, Polarization of light, optical activity and birefringence.

Phys 317 Physics of Metals :(2h lecture and 1h tutorial/Weekly)

This course aims at developing a clear understanding of the basic concepts of physics of Metals. The course includes; Free-Electron Theory of Metals. The crystal structure of Metals and Energy Bands in Metals.Crystallization. Mechanical properties, Strain Hardening and Recrystallization, The Structure of Alloys, Constitutional Diagrams, Heat Treatment and Metal Technology.

Phys 320 Computer Programming :(2h lecture and 1h tutorial/Weekly)

This course introducing the concept of programming with Fortran Language and 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 FORTRAN 77, Transfer of control, (Arithmetic and logical IF Statement, Goto ,…), The subscripted variables and dimension, Examples of the Subscript Notation, The dimension Statement and other information, The DO statement, Explicit uses of DO Loop and Dimension, Read Statement of one data item per line, Read Statement for more than one data item per line, Implied DO List.

Phys 321 Electronics Circuits :(2h lecture and 1h tutorial/Weekly)
Pre-requisite: Phys 103

This course aims at developing a clear understanding of the basic concepts of electronics circuits. The course includes; Quadra poles (two-port networks) and equivalent circuits, Semiconductor materials and Pn junctions, Bipolar Junction Transistor, Bipolar Transistor Biasing, Bipolar transistor as a small signal amplifier, Operational Amplifiers.

Phys 322 Non-Crystalline Material :(2h lecture and 1h tutorial/Weekly)
Pre-requisite: Phys 311

This course aims at developing a clear understanding of the basic concepts of Non-Crystalline material. The course includes; Nature and structure of glass, Electrical properties, Thermal properties, Viscosity Density and molar volume, Special types of glassy materials.

Phys 323 Nuclear Physics (2):(2h lecture and 1h tutorial/Weekly)
Pre-requisite: Phys 213

This course aims to introduce and explain the principles, models, and methods required to understand the behavior of nuclei. The course includes; Nuclear Models: Single-Particle potential; Analysis of shell Model predictions. Single-particle Model, Magnetic moment; Nuclear Rotational Motion nuclear moments; Optical Model, Nuclear Forces, properties of the nuclear force, The exchange force Model, Nuclear Reactions, Nuclear Fusion.

Phys 324 Electrodynamics (1): (2h lecture and 1h tutorial/Weekly)

This course an understanding of the development of elementary ideas of electromagnetism up to Maxwell's equations and the existence of electromagnetic waves. The course includes; Conservation Laws, Charge and Energy, Momentum, Electromagnetic Waves, Waves in One Dimension, Electromagnetic Waves in Vacuum, Electromagnetic Waves in Matter, Absorption and Dispersion, Guided Wave, Potentials and Fields, The Potential Formulation, Continuous Distributions, Point Charges, Radiation, Dipole Radiation.

Phys 325 Mathematical Physics (2): (2h lecture and 1h tutorial/Weekly)
Pre-requisite: Phys 315

This course aims at introducing students to some of the basic mathematical physics of Partial Differential Equations and techniques relevant to undergraduate physics, further develop students skill in solving problems. The course includes; Concepts and Definitions, Mathematical Models. Classification of Second-order Equations, Second-order Equations in Two Independent Variables.The Cauchy Problem, Homogeneous Wave Equation.Initial-boundary Value Problems.Nonhomogeneous Boundary Conditions.Finite String with Fixed Ends, Nonhomogeneous Wave Equation. Fourier's Series, Method of Separation of Variables, The Heat Conduction Problem. Existence and Uniqueness of Solution of the Heat Conduction Problem, The Laplace and Beam Equations, Nonhomogeneous Problems, Laplace and Fourier Transforms.

Phys 326 Fine Magnetism :(2h lecture and 1h tutorial/Weekly)

This course aims at developing a clear understanding of the basic concepts of Fine magnetism. The course includes; Introduction and review of basic formulas, Class of magnetic materials, Ferromagnetism, Ferrimagnetism, Antiferromagnetism. Magnetic properties of electrons. Magnetic moments of free atoms and ions, Structure of unfilled shells, Hund's rules, Electronic configurations. Langevin diamagnetism equation, Quantum theory of paramagnetism, Rare earth ions, Iron group ions, Crystal field splitting, Quenching of the orbital angular momentum. Ferromagnetism, antiferromagnetism and spin wave, Magnetic domains. Magnetic resonance and its applications.Magnetic resonance, the resonance phenomenon, Magnetization, Nuclear magnetic resonance, Calculating transition energy.

Phys 327 Polymer Physics: (2h lecture and 1h tutorial/Weekly)

This course aims at developing a clear understanding of the basic concepts of Polymer physics. The course includes An introduction to polymers, Polymer structure, Physical states of polymers, Thermal properties of polymers, Mechanical properties of polymers, Electrical properties of polymers, Viscoelasticity of polymers, Relaxation properties of polymers, Glass-transition in polymers, Rheology of polymers.

Phys 328 Nonlinear physics: (2h lecture and 1h tutorial/Weekly)
Pre-requisite: Phys 315

This course aims at developing a clear understanding to explain the main principles of nonlinear physics. One-Dimensional Flows, A Geometric Way of Thinking, Fixed Points and Stability, Population Growth , Linear Stability Analysis, Existence and Uniqueness, Impossibility of Oscillations, Potentials, Bifurcations, Saddle-Node Bifurcation, Transcritical Bifurcation, Laser Threshold, Pitchfork Bifurcation, Overdamped Bead on a Rotating Hoop, Imperfect Bifurcations and Catastrophes, Two-Dimensional Flows, Linear Systems,Classification of Linear Systems, Phase Plane, Phase Portraits, Fixed Points and Linearization, Rabbits versus Sheep, Conservative Systems, Reversible Systems, Pendulum, Index Theory, Limit Cycles, Ruling Out Closed Orbits. Weakly Nonlinear Oscillators. Nonlinear waves in physics, KdV equation and soliton solutions, travelling wave solution to some nonlinear PDE. Introduction to similarity and lie group analysis, Inverse scattering methods.

Phys 329 Molecular Spectroscopy :(2h lecture and 1h tutorial/Weekly)
Pre-requisite: Phys 210

This course aims at developing a clear understanding of the basic concepts of Molecular Spectroscopy, The course includes; Basic Elements of Spectroscopy. Microwave Spectroscopy. Infra-Red Spectroscopy, Raman spectroscopy, Electronic Spectroscopy of Molecules, Spin Resonance Spectroscopy.

Phys 335 Electronics Circuits and Digital electronics :(2 h lectures and 2h tutorial/Weekly)

This course aims at developing a clear understanding of the basic concepts of electronics circuits and digital electronics. The course includes:
I- Semiconductor materials and Pn junctions, Bipolar Junction Transistor, Transistor operation characteristics, Biasing, Bipolar transistor as a small signal amplifier, Operational Amplifiers. Applications.
II- Digital Concepts: Number systems and codes.- Logic Gates. AND - OR – Not – NAND, Nor, XOR, XNOR, Boolean Algebra, Logic circuits Design and application, AND – OR LOGIC, ALL-NAND Gates, or-AND Logic, ALL-NOR Gates, Application. Applications.

Bio-Phys 301 Practical Bio-Physics (1) :(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 Molecular Biophysics.

Bio-Phys 302 Practical Bio-Physics (2): (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 Health Physics.

Bio-Phys 310 Biophysical Radiation: (2h lecture and 1h tutorial/Weekly)
Pre-requisite: Phys 220.

This course aims at developing a clear understanding of the basic concepts of Biophysical Radiation. The course includes; Mater, Energy and radiation, Interaction of radiation with mater, dosimetry of ionizing radiation radiobiology; "Biological effects of radiation exposure on human cells", Production of radionuclides used in nuclear medicine, Nuclear magnetic resonances (NMR).

Bio-Phys 311 Molecular Biophysics :(2h lecture and 1h tutorial/Weekly)

This course aims at developing a clear understanding of the basic concepts of Molecular Biophysics. The course includes; Physical methods of Determining the size and shape of molecules, Intermolecular Forces, Absorption spectroscopy and molecular structure.

Bio-Phys 315 Biomechanics :(2h lectures and 1h tutorial/Weekly)

This course aims at developing a clear understanding of the basic concepts of Biomechanics. The course includes: Testing the mechanical properties of biological materials, The Newtonian fluid. Viscoelasticity, Blood Rheology, Laminar flow, Red blood cells and their deformabi1ity RBC ' s dimensions and shape, The flow properties of suspended particles.

Bio-Phys 321 ionizing radiation :(2 h lectures and 1h tutorial/Weekly)

This course aims at developing a clear understanding of the basic concepts of Health Physics. The course includes; Ionizing Radiation Dosimetry standards, Exposure Dose measurement, Ionizing chamber , Bragg-Gray principle, Kerma, specific gamma ray emission, Dosimetry of internally deposited radioisotopes, Basic ionizing radiation safety criteria. Dose measuring instruments,

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

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

Fourth Level

Phys 400 Research Project and Essay in physics: (2h 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 give a talk on it. The student chooses the project in consultation with a member of staff. The subject of the project may be experimental physics or theoretical physics. They should have produced an impressive report on their project, which they can show at career interviews and discuss its content with confidence.

Phys 401 Practical Physics (5): (6h practical/Weekly)

The Laboratory is designed to illustrate introduction for nuclear Experiments, Electronic Experiments, Polarization in Optics and Microwave, Solid State Experiments, Simulation for physics Experiments Using the Computer.

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

The Laboratory is designed to illustrate introduction for nuclear Experiments, Electronic Experiments, Diffraction in Optics and Microwave, Solid State Experiments, Simulation for physics Experiments Using the Computer.

Phys 403 Experimental Physics :(2h lecture and 1h tutorial/Weekly)

This course aims at developing a clear understanding of the experimental techniques of physics. The course includes; Errors of observation, Scientific Foundations of vacuum technique, Electron microscope, Applied emission spectroscopy, photography of the spectrum. Tutorial: 1h/W

Phys 405 Research Project and Essay in 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 give a talk on it. The student chooses the project in consultation with a member of staff. The subject of the project may be experimental physics or theoretical physics. They should have produced an impressive report on their project, which they can show at career interviews and discuss its content with confidence.

Phys 410 Laser and its Applications :(2 h lectures and 1h tutorial/Weekly)

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).

Phys 411 Semiconductors :(2 h lectures and 1h tutorial/Weekly)

This course aims to learn about the physics and applications of Semiconductors, The course includes; The crystal structure of Semiconductors and Energy bands in Semiconductors, Properties of Semiconductors, The P – N junction, Semiconductors Devices.

Phys 412 Quantum Mechanics (2) :(2h lecture and 1h tutorial/Weekly)
Pre-requisite: Phys 314

This course aims at developing a clear understanding of the basic concepts in physics of Quantum Mechanics. The course includes; Approximation Methods, The Variational Method, Zemman Effect, Time-dependent perturbation theory, Electromagnetic radiation field, Frequency bands, Spin, Scattering in three dimensions, Resonances, Ram Sauer Effect, Born Approximation.

Phys 413 Statistical Mechanics (2):(2h lecture and 1h tutorial/Weekly)
Pre-requisite: Phys 310

This course aims at developing a clear understanding of the basic concepts of Statistical Mechanics. The course includes; Density Operators, The Symmetry Character of Many-Particle Wavefunctions, Grand Canonical Description of Ideal Quantum Systems. The Ideal Bose Gas.Ideal Fermi Gas, Applications of Relativistic Bose and Fermi Gases. Real Gases, Classification of Phase Transitions, The Models of Ising and Heisenberg.

Phys 414 Mathematical Physics (3): (2h lecture and 1h tutorial/Weekly)
Pre-requisite: Phys 325

This course aims at introducing; students to some more advanced mathematical concepts that are used in undergraduate physics courses and to develop further their problems solving skill. The course includes Integral Equations, Their Origin and Classification. Modeling of Problems as Integral Equations.Volterra Integral Equations, The Green's Function. Fredholm Integral Equations. The existence of the Solutions: Basic fixed Point Theorems. Complex Variables, Analytic Function.Integrals. Series Representation of Analytic Function, Residues and Poles.

Phys 415 Nuclear Physics and Elementary Particle:(2h lecture and 1h tutorial/Weekly)
Pre-requisite: Phys 312

This course aims to introduce and explain more advanced models, and methods required to understand the behavior of nuclei. The course includes, Fermi theory of beta decay; angular momentum and Parity selection rules; comparative half-life and Forbidden decays; Neutrino Physics, Nuclear spin and moments; hyperfine structure, Meson physics, Yukawa's Hypothesis; properties of Pi mesons,. Elementary particle dynamics, relativistic kinematics and bound states. Electrodynamics of Quarks and Hadrons, Quantum Chromodynamics, Weak Interactions, Gauge theories.

Phys 417 Digital electronics :(2h lecture and 1h tutorial/Weekly)
Pre-requisite: Phys 321

This course aims at developing a clear understanding of the basic concepts of digital electronics. The course includes; Number systems and codes. - Logic Gates. Design with AND-OR logic and ALL NAND. Design with OR-AND logic and ALL NOR. Logic Functions, Adders. Comparators. Encoders and Decoders, Multiplexers and De-Multiplexers, Flip-Flop and Related Devices, Counters, Design of sequential circuits, counter applications.

Phys 418 Renewable Energy:(2h lecture and 1h tutorial/Weekly)

This course aims at developing a clear understanding of the basic concepts of Renewable Energy. The course includes; Solar Energy and Sun Construction, Thermal Radiation and Black Body Radiation, Sun-Earth Astronomical Relations: Earth's Orbit, The Eccentricity correction factor, The Solar Day, Seasons of year, Position Of Sun Relative To Horizontal Surface, Position Of Sun Relative To Inclined Surfaces. Terrestrial Solar Insolation: Structure of the Earth's Atmosphere, The Troposphere Region, The stratosphere Region, The Mesosphere Region, The Thermosphere Region, and the variation of molecular weight with altitude, Aerosols, Effect of Altitude on Pressure and Density.

Phys 419 Quantum Electronics :(2 h lectures and 1h tutorial/Weekly)
Pre-requisite: Phys 314

This course aims at developing a clear understanding of the basic concepts of Quantum electronics. The course includes: Crystal structures, Translational Reciprocal lattice. X-ray scattering, Bragg law, The Maxwell- Boltzmann, Bose- Einstein, and Fermi- Dirac statistics, Band Theory of Solids: Properties of semiconductors, Lattice vibration and thermal properties of crystals, Transport properties, Collision processes in solids- relaxation time.

Phys 420 Solid State (2): (2h lecture and 1h tutorial/Weekly)

Pre-requisite: Phys 311

This course aims at developing a clear understanding of the advanced principle of solid State physics.The course includes; Lattice vibrations, free electron model, Energy bands in solids, Dielectric and optical properties of solids, polarizability.

Phys 421 Elementary Particle :(2h lecture and 1h tutorial/Weekly)
Pre-requisite: Phys 323

In this course, the student extrapolates his knowledge about the matter. Presumably, the student has to know about the structure of the atom and the nucleus. Particle Physics impresses the discussion of the substructures of the particles in the nuclei (nucleons). Such kind of discussion needs to know elementary particle dynamics, relativistic kinematics and bound states. The Feynman Calculus Quantum Electrodynamics, Electrodynamics of Quarks and Hadrons, Quantum Chromodynamics, Weak Interactions, Gauge theoriesm.
Phys 422 Electronics :(2h lecture and 1h tutorial/Weekly)
Pre-requisite: Phys 103

This course aims at developing a clear understanding of the basic concepts of electronics. The course includes; I- Digital electronic concepts, Number systems and codes, Logic gates, Logic circuit Design, Adders, Comparators, Multiplier, Demultipliers, Flip-Flops and counters. Ii- Transistor as a small signal amplifier, Differential Amplifiers, Operational Amplifiers application, D/A converters and A/d converters.

Phys 423 Plasma Physics: (2h lecture and 1h tutorial/Weekly)
Pre-requisite: Phys 224

The objective of this course is to provide a basic text for the students to study plasma physics. The course includes; Nature of Plasma, Plasma Characteristics, Magnetic Configuration and Particle Orbit, Velocity Space Distribution Function and Boltzmann's Equation, Plasma as Magnetohydrodynamic Fluid, Equilibrium, Diffusion of Plasma, Confinement Time, Magnetohydrodynamic Instabilities, Resistive Instability.

Phys 424 Electrodynamics (2): (2h lecture and 1h tutorial/Weekly)
Pre-requisite: Phys 324

This course aims at developing a clear understanding of more advanced Electrodynamics. The course includes: Classical and quantum-mechanical energy loss, Density effect in collision energy loss, Energy loss in electronic plasma, an Elastic scattering of fast particles by atoms, Electrical conductivity of plasma, Radiation emitted during collisions, Relativistic bremsstrahlung, Screening, relativistic radiative energy loss, Method of Virtual Quanta, Radiative Beta Processes.

Phys 425 Mathematical Physics (4) :(2h lecture and 1h tutorial/Weekly)
Pre-requisite: Phys 414

This course aims at developing a clear understanding of the basic concepts of Mathematical Physics of Numerical Analysis and Computational Physics, further develop students skill in solving problems. The Numerical Analysis course includes; Roots of an Equation. Numerical Solutions of Simultaneous Equations.interpolation and Approximation. Numerical Differentiation and Integration.And Computational Physics includes; Models and simulation. Finite-difference methods.The Monte Carlo method.The finite-element method.

Phys 426 Waves and Instability in Plasma Physics: (2h lecture and 1h tutorial/Weekly)

Pre-requisite: Phys 224

The objective of this course is to provide a basic text for the students to study plasma physics. The course includes: Nature of Plasma, Plasma Characteristics, Equilibrium, Diffusion of Plasma, Confinement Time, Plasma Instabilities, Resistive Instability, Magnetic Configuration and Particle Orbit, Different Velocity Space Distribution Functions, Plasma as Magneto-hydrodynamic Fluid.

Phys 430 Mathematical Physics non-physicist: (2h lecture and 1h tutorial/Weekly)

This course aims at introducing students to some more advanced mathematical physics of Integral Equations and Complex Variables concepts that are used in undergraduate physics courses and to develop further their problems solving skill. The course includes; Integral Equations, Their Origin and Classification, Modeling of Problems as Integral Equations, Volterra Integral Equations. The Green's Function, Fredholm Integral Equations, Existence of the Solutions, Basic fixed Point Theorems, Complex Variables, Analytic Function, Integrals, Series Representation of Analytic Function, Residues and Poles.

Phys 431 Colors Physics: (2h lecture and 1h tutorial/Weekly)
Pre-requisite: Phys 221

The course introduces the students to the fundamental of color measurements. The course includes; Electromagnetic radiation in the visible spectrum-physical basis of color specification - spectroradiometer (colorimetric, spectrophotometers) - CIE system of color measurement- Color difference metrology- Color formulation- Color matching formulation.

Phys 432 Optical Instruments: (2h lecture and 1h tutorial/Weekly)
Pre-requisite: Phys 221

This course aims to developing the basic concepts of some optical instruments and their applications for a wide variety of physical measurements. The course includes: Microinterferometry, Modern Microinterferometers, Interference microscopes, Spectrophoto-meters, Optical instruments used in medicine.

Phys 435 Scientific Computer Language: (2h lecture and 1h tutorial/Weekly)

This course introducing the concept of programming with Fortran Language and 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 FORTRAN 77, Transfer of control, (Arithmetic and logical IF Statement, Goto), The subscripted variables and dimension, Examples of the Subscript Notation, The dimension Statement and other information, The DO statement, Explicit uses of DO Loop and Dimension, Read Statement of one data item per line, Read Statement for more than one data item per line, Implied DO List.

Bio-Phys 400 Research Project and Essay in Biophysics: (2h 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 give a talk on it. The student chooses the project in consultation with a member of staff. The subject of the project

may be experimental physics or theoretical physics. They should have produced an impressive report on their project, which they can show at career interviews and discuss its content with confidence.

Bio-Phys 401 Practical Bio-Physics (3) :(6h Practical/Weekly)

The Laboratory is designed to illustrate Bio-physical principles and to develop experimental skills; the course includes selected experiments on topics of Physics of Radiotherapy and Electronics Simulation for Biological Systems.

Bio-Phys 402 Practical Bio-Physics (4) :(6h Practical/Weekly)

The Laboratory is designed to illustrate Bio-physical principles and to develop experimental skills; the course includes selected experiments on topics of Radiation Protection and Optical Instruments.

Bio-Phys 410 Experimental Biophysics: (2h lecture and 1h tutorial/Weekly)

This course aims at developing a clear understanding of the experimental methods Biophysics.The course includes; Separation methods, classification of the techniques, Nuclear magnetic resonance,
Mass spectrometry, Dielectric techniques.

Bio-Phys 411 Ultrasonic and Bio-Applications :(2h lecture and 1h tutorial/Weekly)

This course aims at developing a clear understanding of the basic concepts of Ultrasonic. The course includes; Velocity of sound in fluids, Acoustic intensity and impedance, Decibel scales. Doppler Principles, Ultrasonic generators and receivers, Detection of Ultrasonic Waves, Ultrasonic Imaging.

Bio-Phys 412 Physics of Radiotherapy :(2h lecture and 1h tutorial/Weekly)
Pre-requisite: Bio-Phys 310.

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.

Bio-Phys 413 Physics of Biomaterials and their substitutions: (2h lecture and 1h tutorial/Weekly)
Pre-requisite: Bio-Phys311

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.

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

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.

Bio-Phys 421 Radiation Protection: (2h lecture and 1h tutorial/Weekly)
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.

Bio-Phys 422 Physics of Imaging Medicine: (2h lecture and 1h tutorial/Weekly)
Pre-requisite: Phys 310

This course aims at developing a clear understanding of the basic concepts of imaging processes. The course includes: Imaging concepts, Transforms. Atomic imaging, NMR. MRI. Ultrasonography, Electron microscope, Devices used in medical diagnosis and therapy.

Bio-Phys 423 Computational Biophysics :(2h lecture and 1h tutorial/Weekly)

This course aims at developing a clear understanding of the basic concepts of Computational Biophysics. The course includes; Mathematical Basics, Stochastic processes, Molecular conformation, Population Dynamics, Fourier transform, Action potential.