9.2 Curriculum for B.Sc. Degree in Physics with Electronics

100 LEVEL HARMATTAN SEMESTER

Course Code	Course Title	Pre-requisite	Units	Status
BIO 101	Basic Biology I	-	3	C
BIO 107	Experimental Biology I	-	1	C
CHM 101	General Chemistry I	-	3	C
CHM 107	Experimental Chemistry I	-	1	C
MTH 101	General Mathematics I	-	3	C
PHY 101	General Physics I	-	3	C
PHY 107	Experimental Physics I	-	1	C
CIT 111	Introduction to Information & Communication Technology	-	2	R
GNS 101	Use of English I	-	2	R
LIB 101	Library Studies	-	1	R
FRN 221	Basic French	-	2	R
Total			**22**	

RAIN SEMESTER

Course Code	Course Title	Pre-requisite	Units	Status
CIT 112	Introduction to Computer Programming	-	2	R
CHM 102	General Chemistry II	-	3	C
CHM 108	Experimental Chemistry II	-	1	C
MTH 102	General Mathematics II	-	3	C
MTH 104	General Mathematics III	-	3	C
PHY 102	General Physics II	-	3	C
PHY 108	Experimental Physics II	-	1	C
GNS 102	Use of English II	-	2	R
FRN 222	French for Specific Purpose	-	2	R

Total		20

200 LEVEL HARMATTAN SEMESTER

Course Code	Course Title	Pre-requisite	Units	Status
PHY 201	Analytical Mechanics I	MTH102, PHY101	2	C
PHY 203	Elementary Modern Physics I	PHY102, MTH102	2	C
PHY 205	Vibration and Waves	PHY101, PHY102	2	C
PHY 207	Experimental Physics IIA	PHY107, PHY108	1	C
PHY 209	Thermal Physics	PHY102, MTH102	2	C
MTH 201	Mathematical Methods 1	-	2	C
STA 201	Statistics for Physical Science & Engineering	-	4	R
GNS 201	Nigerian Peoples and Culture	-	2	R
EPS 201	Entrepreneurial Studies	-	2	R
Total			**19**	

RAIN SEMESTER

Course Code	Course Title	Pre-requisite	Units	Status
PHY 202	Analytical Mechanics II	PHY201, MTH201	2	C
PHY 204	Elementary Modern Physics II	MTH102, PHY203	2	C
PHY 206	Electric Circuit & Electronics	MTH102, PHY102	3	C
PHY 208	Experimental Physics IIB	MTH102, PHY102, PHY207	1	C

PHY 210	Workshop Practice	-	2	C
PHY 212	General Physics III (Energy & Environment)	-	1	C
PHY 214	Physics of the Solid Earth	-	2	C
MTH 202	Elementary Differential Equation I	-	2	C
CIT 202	Low Level Language	-	2	R
GNS 202	Osun Peoples and Culture	-	2	R
Total			**19**	

300 LEVEL HARMATTAN SEMESTER

Course Code	Course Title	Pre-requisite	Units	Status
PHY 211	Introduction to Space Science	-	2	C
PHY 301	Electromagnetic Waves and Optics	PHY201, PHY203	2	C
PHY 303	Quantum Physics	PHY204, MTH202	2	C
PHY 305	Solid State Physics I	PHY202, PHY203	2	C
PHY 307	Experimental Physics III A	PHY208	1	C
PHY 309	Electronics	PHY206	2	C
PHY 311	Mathematical Methods in Physics I	MTH202, PHY202	3	C
PHY 313	Electromagnetism	-	2	C
GNS 301	Entrepreneurship Skills Development and Practice	-	2	R
Electives: One of the following				
PHY 315	Nuclear and Particle Physics I	-	2	E

PHY 317	Vector and Tensor Analysis	-	2	E
Total			**20**	

RAIN SEMESTER

Course Code	Course Title	Pre-requisite	Units	Status
PHY 399	Industrial Attachment	-	16	C
Total			**16**	

400 LEVEL HARMATTAN SEMESTER

Course Code	Course Title	Pre-requisite	Units	Status
PHY 401	Quantum Mechanics I	PHY 303	3	C
PHY 403	Solid State Physics II	PHY 305	2	C
PHY 405	Mathematical Methods in Physics II	PHY 313	3	C
PHY 407	Digital Electronics	PHY 309	3	C
PHY 409	Experimental Physics IV	PHY 207	1	C
PHY 411	Computational Physics	PHY 202, ICT 201	3	C
PHY 413	Statistical and Thermal Physics	-	3	C
PHY 498	Project I	-	2	C
Electives: One of the following				
PHY 415	Medical Physics	-	2	E
PHY 417	Electrodynamics I	-	2	E
PHY 419	Measurement and Instrumentation	-	2	E
PHY 421	Geophysics	-	2	E

Total		**20**

RAIN SEMESTER

Course Code	Course Title	Pre-requisite	Units	Status
PHY 402	Quantum Mechanics II	PHY 401	3	C
PHY 404	Analytical Mechanics III	PHY 202	2	C
PHY 406	Advanced Physics of Earth Interior	-	2	C
PHY 408	Atomic and Molecular Spectroscopy	PHY 403	3	C
PHY 498	Project II	-	4	C
GNS 302	Introduction to Logic and Philosophy	-	2	R
Electives: One of the following				
PHY 410	Nuclear and Particle Physics II	PHY 315	2	E
PHY 412	Reactor Physics	PHY 102, MTH 102, PHY 207	2	E
PHY 414	Electronic Communication Theory	-	2	E
PHY 416	Solar and Atmospheric Physics	PHY 102, MTH 102	2	E
PHY 418	Biophysics	-	2	E
PHY 420	Astronomy	-	2	E
Total			**20**	

COURSE DESCRIPTION (B.Sc. Physics with Electronics)

PHY 101: GENERAL PHYSICS I (3 units) (L30HRS: P 0: T15HRS)

Pre-requisite MTH 101

Space and time, units and dimensions, Kinematics. Fundamental laws of Mechanics, statics and dynamics; Work and energy; Conservation laws.Elasticity; Hooke's law, Young's, Shear and Bulk moduli; Hydrostatics; Pressure; buoyancy, Archimedes'

Principles; Surface tension; adhesion, cohesion, capillarity, drops and bubbles. Temperature: Heat, gas laws, laws of thermodynamics; kinetic theory of gases. Sound. Applications.

PHY 102 GENERAL PHYSICS II (3 units) (L30HRS: P0: T15HRS)

Pre-requisites: MTH 102

Electromagnetic waves. Waves and their phenomena: Interference, Diffraction, Reflection, Refraction and polarization. Geometrical optics. Electrostatics – Electric charges and fields. Gauss's Law. Electric Potential, conductors and dielectrics in electrostatics. Electric current and resistance, Electric circuits. The forces exerted by a magnetic field. Magnetic fields produced by steady current. Magnetic properties of matter, Maxwell's equations. Electromagnetic oscillations and waves; Applications, Elementary modern Physics – Bohr's Theory, Photo electric effect, De Broglie equation and elementary semiconductor Physics.

PHY 107/108: EXPERIMENTAL PHYSICS I/II (1 unit)(L0: P15HRS: T0)

Introductory experiments in general measurements, errors and graphical analysis. The experiment includes simple experiments in mechanics and properties of matter, heat and thermodynamics. Electrical and mechanical resonant system, etc covered in PHY 107 and PHY108, STATUS: COMPULSORY.

PHY 201: ANALYTICAL MECHANICS I (2 units)(L15HRS: P0: T15HRS)

Pre-requisites: PHY 101, MTH 102

Newtonian Mechanics: Motion of a particle in one, two and three dimensions. Systems of particles and collision theory; Newtonian gravitation. conservative forces and potentials; oscillations, central force problems and accelerated frames of reference. Rigid body dynamics, generalized motion. mechanics of continuous media.

PHY 202: ANALYTICAL MECHANICS II (2 units) **(L15HRS: P0: T15HRS)**

Pre-requisite: PHY 201, MTH 201

Degrees of freedom; Generalized coordinates; Lagrange's formulation of mechanics; Applications. The calculus of variations and the action principle. Hamilton's formulation of mechanics; Applications. Invariance and conservation laws. Oscillatory systems, including damped, forced and coupled oscillations; Normal modes.

PHY 203: ELEMENTARY MODERN PHYSICS I (2units) (L15HRS: P0: T15HRS)

Pre-requisites: PHY 102, MTH 102

Electromagnetic spectrum, Basics of quantum theory of radiation, Black body radiation, Wien's law, Rayleigh-Jeans' and Planck`s theory. The photo-electric effect, Compton Effect, pair-production and annihilation; Production of X-ray: continuous and discrete, discovery evidence from electrolyses. The discharged tube, charges of electrons, mass of the electron. Geiger-Marsden experiment; Thomson's model of the atom. Rutherford's theory of alpha scattering, sizes of the nucleus and the atom. De- Broglie's hypothesis. Heisenberg's uncertainty principle. The correspondence principle.

PHY 204: ELEMENTARY MODERN PHYSICS II (2units) (L15HRS: P0: T15HRS)

Pre-requisites: PHY 203, MTH 102

Special relativity: Defects in Newtonian Mechanics; The Michelson-Morley experiment and interpretations, Einstein postulate simultaneity. The Lorentz transformations. Time dilation. The twin paradox. Transformation of velocities; the composition of nuclei. Nuclear sizes, nuclear masses and abundances. Nuclear models; alpha, beta and gamma radiations; radioactivity and fusion; nuclear energy; nuclear forces; properties of elementary particles and particle detector.

PHY 205: VIBRATION AND WAVES (2units)(L15HRS: P0: T15HRS)

Pre-requisite:PHY101, PHY102

Wave phenomena, acoustical wave. The harmonic oscillator, waves on a string; energy in wave motion; Wave types: Longitudinal, Transverse, Standing and Spherical; group and phase velocities, Doppler effects; Physical optics; Interference and diffraction, thin films; crystal diffraction; holography; dispersion and scattering. Geometrical Optics; Waves and rays, reflection at spherical surface, thin lenses, optical lenses; mirrors and prisms.

PHY 206: ELECTRIC CIRCUIT AND ELECTRONICS (3units) (L30HRS: P0: T15HRS) Pre-requisites: PHY 102, MTH 102

DC circuits; Kirchhoff's Laws. Sources of emf and current, network analysis and circuit theorems. A.C circuits, Inductance, Capacitance, the transformer, sinusoidal wave-forms, rms and and peak values, power, impedance and admittance, series RLC circuit, Q-factor, resonance. Network analysis and circuit theorem, filters. Electronics: semiconductors the pn-junction, field effect transistors; Characteristics and equivalent circuits, amplifiers, feedback, oscillators.

PHY 207: EXPERIMENTAL PHYSICS IIA (1unit)(L0HRS: P15: T15HRS)

Pre-requisite: PHY 107, PHY 108

The laboratory course consists of a group of experiments drawn from diverse areas of Physics (Optics, Electromagnetism, Mechanics, Modern Physics, etc.). It is

accompanied by seminar studies of standard experimental technique and analyses of famous and challenging experiments.

PHY 208: EXPERIMENTAL PHYSICS IIB (1unit) (L0: P30HRS: T0).

Pre-requisite: PHY 102, MTH102, PHY 207

Basic experiments in electronics, optics and modern physics.

PHY209: THERMAL PHYSICS (2units) (L15HRS: P0: T15HRS)

Pre-requisite: PHY 102, MTH102

The foundations of classical thermodynamics including the zeroth and definition of temperature; the first law, work, heat and internal energy; Carnot cycles and the second law; entropy and irreversibility, Thermodynamics potentials and the Maxwell's relations. Application: Qualitative discussion of phase transitions: Third law of thermodynamics; Ideal and real gases. Elementary kinetic theory of gases, including Boltzman counting, Maxwell-Boltzman law of distribution of velocities; simple application of the distribution law. Application of thermodynamics to simple system-chemical potential, phase equilibrium and the phase rule, electrical potential, magnetism, surface energy.

PHY 210: WORKSHOP PRACTICE (2 Units) (L30HRS: P15HRS: T0)

Introduction to electronics components. Principle of operation of common instruments such as multimeters, Voltmeters, Ammeters, Oscilloscope, Wave form analyzer etc. Use of bread board and printed circuit board; fault finding techniques in instruments. Maintenance of batteries and charging 1-phase 2-phase, 3-phase wiring system. System maintenance e.g. radio, TV set, all forms of other gargets; Introduction to the use of simple machine tools. Welding, soldering. Geometric drawing of work under design.

PHY 211: INTRODUCTION TO SPACE SCIENCE (2 UNITS) (L30HRS: P0: T15HRS)

Introduction to Astronomy and Astrophysics, Satellite communication, Introduction to Atmospheric Science, Space environment, Space craft system and dynamics, Aero/astrodynamics engineering, Rocket engineering, Cosmology, Origin of the universe and life, space law and business development.

PHY 212 GENERAL PHYSICS III (Energy and Environment) (1 UNIT) (L30HRS: P0: T15HRS)

Energy and power; Principle, demand and outlook; transformation of energy and its costs; thermal pollution; electrical energy from fossils fuels; hydroelectric generation; Principle and problems. Costs, capacity, storage, reserves, efficiency, new environmental effects. Electrical energy from nuclear reactors, energy in future

breeder reactors; fusion power, solar power, geothermal power, tidal power etc. Promise and problems. Lectures (15)/ Excursions.

PHY 214 PHYSICS OF SOLID EARTH (2 UNITS) (L30HRS: P0: T15HRS)

Origin, shape, structure and major divisions of the Earth. The Earth's main magnetic fields and its distribution. Electrical theory of the Earth's core and origin of the magnetic field. Seafloor, spreading continental drift and plate tectonics.

PHY 301: ELECTROMAGNETIC WAVES AND OPTICS (2units) (L15HRS: P0: T15HRS) Pre-requisite: PHY 201, PHY 203

Maxwell's equations and electromagnetic potentials; The wave equation. Propagation of plane waves; Reflection and refraction. Transmission lines, wave guides and resonant cavities; Radiation, Geometrical optics, Interference of waves; Diffraction.

PHY 303: QUANTUM PHYSICS. (2 UNITS) (L15HRS: P0: T15HRS)

Pre-requisite: PHY 204, MTH202

Wave particle duality and the Uncertainty Principle. Basic principles of the quantum theory. The Schrödinger wave equation: time-dependent and time-independent forms, Expectation values, Application of steady state Schrödinger equation to particles in rigid and non rigid box and Harmonic Oscillator; energy levels in potential wells. Reflection and transmission at potential barriers. Atomic and molecular structure and spectra

PHY 305: SOLID STATE PHYSICS I (2 UNITS) (L15HRS: P0: T15HRS)

Pre-requisite: PHY 202, PHY 203

Crystal Structure and crystal binding. Elastic properties; lattice vibrations. Thermal conductivity. Debye model. Free electrons, Fermi gas. Heat Capacity of electron gas. Electrical conductivity and Ohm's law. Hall Effect, thermal conductivity of metals and energy bands.

PHY 307: Experimental Physics IIIA (1 unit) (L0: P15HRS: T0)

Pre-requisite: PHY 208

PHY 309: ELECTRONICS (2 UNITS) (L15HRS: P0: T15HRS)

Pre-requisite: PHY 206

Elementary physical electronics: junction diode, zener diode, Bipolar transistors, Field effect transistors (FET) and MOSEFET. Characteristics and biasing of bipolar and FET transistors; CE, CB, CC, CS, CG, CD. Review of two part network theory applied to transistor circuits. Small signal models. Electron and energy band

schemes. Semiconductor devices: diodes, transistors, zener diodes, photocells and solar cells.

PHY 311: MATHEMATICAL METHODS IN PHYSICS I (3 UNITS) (L30HRS: P0: T15HRS) Pre-requisite: PHY 202, MTH202

Linear algebra and functional analysis; Vectors integral Calculus: Theorems of green, Gauss's and Stokes' and multiple connected domains, path independence of integral. Finite dimensions, Linear vector spaces and matrix theory. The eigenvalue, product, matrix properties of finite dimensional linear spaces. The scalar product, Hermitian and unitary matrices. Further properties of self-adjoint and unitary operators, symmetric and orthogonal matrices. Hilbert space and complete set of orthogonal functions. Special functions of mathematical physics: The gamma function, hyper-geometric functions; Bessel functions; Legendre functions. Hermite and Languerre function.

PHY 313: ELECTROMAGNETISM. (2 UNITS) (L15HRS: P0: T15HRS)

Electrostatics and magnetostatics: Maxwell-equations, Gauss' law, Faraday's law, Ampere's law, Biot-Savart Law, Ampere-Maxwell's law. Poynting vector and Application. Laplace's equation and boundary value problems; Lorentz covariance and special relativity. A.C. circuits; Multiple expansions, dielectric and magnetic materials

PHY 315: NUCLEAR AND PARTICLE PHYSICS I (2 Units) (L15HRS: P0: T15HRS)

Nuclear structure: Nuclear properties, nuclear size, nuclear masses; Nuclear forces, nuclear-nucleon scattering; the deuteron. Nuclear models; Radioactive decay: Alpha, beta and gamma decays. Nuclear reactions: fission and fusion; nuclear magnetic resonance; elementary particles.

PHY 317 VECTOR AND TENSOR ANALYSIS (2 UNITS) (L15HRS: P0: T15HRS)

Differentiation of vectors; Integration of vectors; Space curves; Vector functions of several variables; Scalar and vector fields; Vector operators; Vector operator formulae; Cylindrical and spherical polar coordinates; General curvilinear coordinates; Tensor notation; Change of basis; Cartesian tensors; First- and higher-order Cartesian tensors; The algebra of tensors; The quotient law; Physical application of tensors; Integral theorems for tensors.

PHY 401: QUANTUM MECHANICS I (3 UNITS) (L30HRS: P0: T15HRS)

Pre-requisite: PHY 303

The formulation of quantum mechanics in terms of state vectors and linear operators. Three dimensional spherically symmetric potentials. The theory of angular momentum and spin. Identical particles and the exclusion principle. Methods of

approximation. Multielectron atoms. Schrödinger equation, Solution of one dimensional problem. Linear vector functions, probability density, operator formalism. Linear vector space, eigenvalues and eigen functions of Hermitian operator. Complete set of commuting operators. Angular momentum and spin, matrix formalism.

PHY 402: QUANTUM MECHANICS II (3 UNITS) (L30HRS: P0: T15HRS)

Pre-requisite: PHY 401

Time-independent and time-dependent perturbation theory. Scattering theory, elastic potential scattering. Green's function and partial wave methods. Selected phenomena from each of atomic Physics, molecular Physics, solid state Physics and nuclear Physics are described and then interpreted using quantum mechanical models.

PHY 403: SOLID STATE PHYSICS II (2 UNITS) (L15HRS: P0: T15HRS)

Pre-requisite: PHY 305

Dynamics and electrons in solids, transport phenomena with applications to metals and semiconductors, Optical properties of solids-application to solids, semiconductors and insulators, magnetic phenomena in solids e.g. para-dia- and Ferro-magnetism. Super conductivity.

PHY404 Analytical Mechanics III (2 UNITS) (L15HRS: P0: T15HRS)

Pre-requisite: PHY 202

General methods of mechanics, Generalized coordinates, Notation, Transformation equation, Classification of mechanical systems, Scleromic and rheonomic systems. Holonomic and non-holomic systems, Conservative and non-conservative systems. Kinetic energy generalized velocities. Generalized forces. Lagrange's equations for non-holomic systems. Lagrange's Equations with impulsive forces.

PHY 405: MATHEMATICAL METHODS IN PHYSICS II (3 UNITS) (L30HRS: P0: T15HRS) Pre-requisite: PHY 313

The Dirac Delta functions. Integral Transforms and Fourier series and transforms. Laplace transforms. Application of Laplace transforms to the solution of elementary differential equation of interest in Physics and Engineering. Partial Differential Equation. Solution of boundary value problems of partial differential equation by various methods, which include; separation of variable, the methods of integral transform and Sturm Louisville theory. Uniqueness of solution, calculus of residues and applications to evolution of integrals and summation of series; Application to various Physical situation which may include the electromagnetic theory, sound waves and diffusion phenomenon.

PHY 406: ADVANCED PHYSICS OF EARTH'S INTERIOR (2 Units) (L15HRS: P0: T15HRS)

Structure of the Earth. Conductivity and heat flow. Elasticity, dynamo theory, magnetic field.

PHY 407: DIGITAL ELECTRONICS (3 units) (L30HRS: P0: T15HRS)

Pre-requisite: PHY 309

The Transistor as a switch, power dissipation; storage drive and switching speed, logic gates ; NAND, OR with close logic, the TTL; AND gate, Truth table, noise margins, Television pole, open collector and transient, TTL, CMOS, NMOS, ECL combinational systems, Bolean algebra, identities, De-Morgan's law, Karmaugh maps; Quin McChusky minimization by computer aided techniques. The half and full adder. Flip-flop: R-S , J-K and D types edge and level trigger, master slave types, the shift register, circuit techniques ; Oscillation sine wave amplitude control, sequencing frequency stability, waveform discrimination. Practical ramp generators; Conversion techniques, frequency to voltage staircase generators; analogue to digital; digital to analogue; Termination of pulse lines; Beargon diagram, Low noise amplifier design, use of discrete components to minimize noise.

PHY 409: Experimental Physics IV (1 Unit) (L0: P15HRS: T0)

Pre-requisite: PHY 207

PHY 408: ATOMIC AND MOLECULAR SPECTROSCOPY (3 UNITS)(L30HRS: P0: T15HRS)

The hydrogen atom; relativistic effect and spin. Identical particles and symmetry. Many electron atoms. Coupling schemes and vector models. Zeeman effect. Hyperfine structures. The diatomic molecules; The Frank-Condon principle. X-ray diffraction. Microwave methods. Resonance phenomena; ESR, NMR, and Optical pumping and Mossbauer scattering.

Pre-requisite PHY 403, STATUS: COMPULSORY

PHY 410: NUCLEAR AND PARTICLE PHYSICS II (2 UNITS) (L15HRS: P0: T15HRS) Pre-requisite: PHY 315

Nuclear Instrumentations and radiation detection techniques; detectors. Nuclear spectroscopy. Neutron Physics: Production, detection of neutrons. Fission and fusion. Nuclear reactor and nuclear energy. Elementary particles: Conservation laws, particle classification. Strong, electromagnetic and weak interactions. Resonances.

PHY 411: COMPUTATIONAL PHYSICS (3 UNITS) (L30HRS: P0: T15HRS)

Pre-requisite: PHY 202, ICT201

Use of numerical methods in Physics; Various method of numerical integration, differentiation, numerical solutions of some differential equations in Physics. Statistical analysis of experimental data.

PHY 412: REACTOR PHYSICS (2 UNITS) (L15HRS: P0: T15HRS)

Pre-requisite: PHY 102, MTH102, PHY 207

Neutron Physics Flux, cross-section. Thermalisation and fundamentals of thermonuclear reactions. Nuclear reactors, homogenous and heterogenous reactors, Fission products and nuclear poisons on reactor dynamics. Reactor parameters and critical sizes. Reactor kinetics, the fundamentals of reaction shielding.

PHY 413: STATISTICAL AND THERMAL PHYSICS (3 Units) (L30HRS: P0: T15HRS)

Basic concept of statistical mechanics; microscopic basis of thermodynamics and applications to macroscopic systems, condensed states, phase transformations, quantum distributions; elementary kinetic theory of transport processes, fluctuation phenomena. Applications.

PHY 414: ELECTRONIC COMMUNICATION THEORY II (2 UNITS) (L15HRS: P0: T15HRS)

Brief review of probability for information theory: Quantitative measure of information. Discrete information sources and channels. Effects of noise; Maximum information rates Channel capacity. Differential coding system. Error detection and correct codes. Random signals, Auto-correction functions and power spectra densities, optical signal processing.

PHY 415: MEDICAL PHYSICS (2 Units) (L15HRS: P0: T15HRS)

Production of isotopes, nuclear scanning and tracer. Nuclear magnetic resonance. Interaction of radiation with matter. X-ray and gamma rays. Thomson scattering, photoelectric effect. Compton scattering, pair production, attenuation.

PHY 416: SOLAR AND ATMOSPHERIC PHYSICS (2 UNITS) (L15HRS: P0: T15HRS) Pre-requisite: PHY 102, MTH102

Solar atmosphere. Solar radiation emitted by the sun. The earth's atmospheres. Effects of the atmosphere on solar radiation reaching the earth. Atmospheric electricity. The Ionosphere and radio communication.

PHY 417: ELECTRODYNAMICS I (2 UNITS) (L15HRS: P0: T15HRS)

Poisson and Laplace equation. Boundary value problems. Multiples Magnetostatics, Static fields and matters. Electric and magnetic energy. Time varying fields. Faraday's laws and fields of uniformly moving charges. Maxwell equation and application to propagation in bounded and unbounded media. Elementary plasma Physics. Radiation of electromagnetic waves. Dipoles and antenna arrays, guided waves and diffraction.

PHY 418: BIOPHYSICS (2 UNITS) (L15HRS: P0: T15HRS)

Ionization of biomed, thermodynamics principles. Energy transfer in living systems. Bioelectricity:- ion channels, action potentials, nerve impulse transmission. Study of electric cell.

PHY 419: MEASUREMENT AND INSTRUMENTATION (2 UNITS) (L15HRS: P0: T15HRS)

Measurement of non-electrical quantities-Transducers. Instrumentation Amplifiers for measurement of DC and AC Voltage and Current. Time and Frequency measurement instruments: Counters, Voltmeters, etc. Electrometric Amplifiers for measuring of low level currents and voltage. Multipliers Sample and Hod Circuits. D to A and A to D converters. Data loggers.

PHY 420: ASTRONOMY: (2units) (L15HRS: P0: T15HRS)

Composition of atmosphere, solar terrestrial interaction, magnetic fields and storms.

PHY 421: **GEOPHYSICS** (2units) (L15HRS: P0: T15HRS)

The course is basically an introduction to geophysics prospecting which comprises the magnetic, gravity, seismic and radioactive methods. Instrument, theory and data interpretation are describe for each method.

PHY 497: PROJECT I (2 UNITS) (L15HRS: P0: T15HRS)

Undergraduate project/research report work. It could either be an experimental or theoretical work carried out under the supervision of member of staff. A detailed report of such a project or research work is expected at the end of the finding(s) and to be followed by a seminar. The final assessment will be a collective responsibility of all examiners in the department.

PHY 498: PROJECT II (4 UNITS) (L45HRS: P0: T15HRS)

An extension of PHY 497 (Project 1) showing individual/group project work should be presented as a detailed report. The project or research work is expected to be presented at the end of the finding(s) subject to the approval of the supervisor and to be followed by a seminar. The final assessment will be a collective responsibility of all examiners in the department.