ADVANCED LEVEL PHYSICS TEACHING SCHEMES
LOWER SIXTH SCIENCE

FIRST TERM

WEEK	TOPIC	LESSON	CONTENTS	OBJECTIVES	REMARKS/ ACTIVITIES
FIRST SEQUENCE					
1	**1.0 PHYSICAL QUANTITIES AND EXPERIMENTAL PHYSICS**	1.1 Physical quantities 1.2 Base quantities and base units 1.3 Derived quantities and derived (SI) units Homogeneity of physical equations	- the magnitude of a physical quantity - base quantities and their units - derived quantities and their units - homogeneity of an equation - physical correctness of an equation	a) Explain what is meant by a physical quantity b) Represent a physical quantity c) Name base quantities and their units d) Obtain base units from derived or SI units e) Distinguish between homogeneity and physical correctness of an equation f) Prove homogeneity of physical equations	
2		1.4 Scalar and vector quantities	- scalar quantities - vector quantities - vector nature of physical quantities - representing vector quantities - combining vectors: co-linear, coplanar and concurrent - resolving vectors	a) Distinguish between scalar and vector quantities b) Calculate magnitude of vectors c) Add or subtract vectors d) Resolve vectors into perpendicular components e) Explain the usefulness of the vertical component	
1		1.5 Experimental physics	- use of standard measuring instruments - null deflection methods	a) Measure physical quantities using standard measuring instruments. b) Use a galvanometer in null methods	
2		1.6 Accuracy and Sensitivity	- the use of standards to calibrate measuring instruments.	a) Distinguish between precision and accuracy b) Determine the accuracies of measuring instruments c) calibrate measuring instruments	
3		1.7 instruments	- Use of the Cathode Ray Oscilloscope	a) Use CRO to measure p.d., current and time of an a.c. b) Use of CRO as a voltmeter, ammeter and clock	

3	**2.0** **MECHANICS**	**2.1 Rectilinear Motion** 2.11 Definitions of related terminology 2.12 Equations of uniformly accelerated linear motion 2.13 Motion Graphs	- displacement / distance - velocity / speed: average, instantaneous, uniform and terminal - acceleration / deceleration - equations of uniformly accelerated linear motion - displacement / time graphs - velocity / time graphs - measurement of velocity and acceleration by appropriate means	(i) Define each quantity, stating its SI units (ii) Derive the equations of motion (iii) Determine velocity/ acceleration using suitable apparatus (iv) Sketch and interpret motion graphs (v) use the equations of motion to solve related problems (vi) Apply rectilinear motion in sports	
4		2.14 Motion under gravity **8.1 Projectile Motion** 2.2 **Circular motion**	- motion under gravity - time and speed symmetry in vertical motion under gravity - Measurement of acceleration due to gravity, g - projectile motion - motion with non-uniform acceleration - angular speed - angular velocity - centripetal acceleration - centripetal force - motion in a vertical circle	(vii) Measure the acceleration of free fall (viii) Determine the range and maximum height reached in projectile motion (ix) Calculate time of flight (i) Define angular speed, angular velocity and centripetal acceleration, and the unit vectors **r** and **θ** (ii) Derive the equations: $\mathbf{v} = r\omega\,\mathbf{r}$ and $\mathbf{a} = r\omega^2\,\mathbf{r}$ (iii) Express angular displacements in radians (iv) Use the concepts of angular velocity to solve problems (v) Use the equations in (ii) above to solve problems (vi) Describe qualitatively, motion in a curved path due to a perpendicular force (vii) Recall and apply centripetal force as $\mathbf{F} = mr\omega^2\,\mathbf{r}$	
5		**2.3 Forces**	- definition of force - types of forces	(i) Name and explain the nature of the different types of forces (ii) Calculate weight using $\mathbf{W} = m\,\mathbf{g}$	

5		**2.4 Turning Effects of Forces**	- effects / applications of friction - calculation of weight - moments - couples - torques - static and dynamic equilibrium - coplanar forces - conditions for equilibrium	(iii) State the importance of friction in everyday activities (i) Define the moment of a force, a couple (ii) Calculate moments and torques (iii) State and apply the principle of moments (iv) State and use the conditions of static and dynamic equilibrium of a body (v) Explain the use of couples and torques in everyday life	
6	**2.0** **MECHANICS** **END OF FIRST SEQUENCE EVALUATION**	**2.5 Newton's Laws of Motion and Momentum** **END OF FIRST SEQUENCE EVALUATION**	- Newton's first law and inertia - Newton's second law and momentum - Newton's third law and reaction pairs - momentum - conservation of linear momentum - elastic and inelastic collisions **END OF FIRST SEQUENCE EVALUATION**	(i) State Newton's laws of motion (ii) State the application of each law in everyday life (iii) Define momentum and state its units (iv) Use the expression **F** = m **a** as a special case of Newton's second law (v) Do appropriate calculations using F= ma (vi) Define the newton (vii) State and apply the principle of conservation of linear momentum (viii) Distinguish between elastic and inelastic collisions **END OF FIRST SEQUENCE EVALUATION**	
SECOND SEQUENCE BEGINS					

7.	**2.0** **MECHANICS** **3.0** **SIMPLE HARMONIC MOTION AND WAVES**	**2.6** **Work, Energy And Power** **3.1** **Simple Harmonic Motion**	- work - power - kinetic energy - potential energy - gravitational potential energy - elastic potential energy - law of conservation of energy - conservative forces - Periodic Motion - definition of SHM - the equation of SHM: $\mathbf{a} = -\omega^2\mathbf{r}$ - definition of terms associated with SHM - Simple Harmonic Equations and Graphs; $x = x_o \sin\omega t$, $v = v_o \cos\omega t = x_o \omega \cos\omega t$, $a = -x_o \omega^2 \sin\omega t$	(i) Define work, power and energy, stating their units. (ii) State that whenever work is done on a body it gains energy. (iii) Calculate the different forms of mechanical energy from: $E_P = \frac{1}{2} k x^2$ P.E. = m g h K.E. = $\frac{1}{2}$ m v^2 (iv) State and apply the law of conservation of energy (v) Use the work – energy equation in solving problems (vi) Apply the Einstein's mass – energy equation: $E = m c^2$ (vii) State the different applications of energy in the home (viii) Explain the relationship between power, work and energy (i) State the characteristics of a periodic motion, giving everyday examples e.g. heart beat, change of tides and rotation of the earth (ii) Explain what is meant by an oscillation (iii) Define Simple Harmonic Motion (iv) Define amplitude, period, frequency and pulsatance (v) Express the period in terms of frequency or pulsatance (vi) Recall and use the defining equation of SHM: $\mathbf{a} = -\omega^2\mathbf{r}$ (vii) Draw graphs to illustrate the variation of displacement, velocity and acceleration of a SHO with time.	
8	**3.0**	**3.1** **Simple Harmonic Motion**	- Simple Harmonic Oscillators : a) the simple pendulum b) mass-spring system - Energy of a Simple Harmonic Oscillator: $E_p = \frac{1}{2} m \omega^2 a_o^2 \cos^2\omega t$ $E_k = \frac{1}{2} m \omega^2 a_o^2 \sin^2 \omega t$	(viii) Give examples of SHO (ix) Analyze the motion of SHO (x) Describe the interchange of energy between K.E. and P.E. for a SHO.	

	SIMPLE HARMONIC MOTION AND WAVES **3.0**	**Mechanical Resonance**	$E_T = ½ \ m \omega^2 a_o^2$ - Qualitative and experimental treatment of free, damped and forced oscillations. - Mechanical resonance - Everyday occurrences and effects of mechanical resonance	(i) Give practical examples of free oscillations (ii) Describe practical examples of damped oscillations with particular emphasis on the degree of damping (iii) Give practical examples of forced oscillations (iv) Sketch graphs to show how the amplitude of oscillation varies with frequency. (v) Define resonance (vi) Give the importance of mechanical resonance	
9	**SIMPLE HARMONIC MOTION AND WAVES**	**3.2** **Mechanical Waves**	- mechanical waves on water, along strings and in air - progressive waves - graphical interpretation of amplitude, speed, wavelength, period and phase - longitudinal waves and transverse waves - wave fronts - reflection and refraction of waves Factors affecting the speed of transverse waves on taut strings	(i) Distinguish, giving examples, between: a) mechanical and e.m. waves, b) longitudinal and transverse waves c) progressive and stationary waves (ii) Draw displacement – time and displacement – distance graphs (iii) Interpret such graphs (iv) Define amplitude, period, frequency, wavelength (v) Define and describe wave fronts (vi) Draw diagrams to explain reflection and refraction of waves using wave fronts. (vii) Describe the factors that affect the speed of transverse waves	
10		**10.1** **The Doppler Effect In Sound** **10.2**	- meaning of Doppler effect - moving source - moving observer - meaning of superposition - the Principle of Superposition - illustration of superposition	(i) Describe the term ‘Doppler effect’ (ii) Derive the associated equations (iii) Use these equations to solve exercises (i) Explain the principle of superposition (ii) Apply this principle to simple exercises (iii) Demonstrate superposition using:	

	10.0 **WAVE** **PHENOMENA**	**The Superposition Of Mechanical Waves**	using two sets of spherical sound waves and waves on taut strings - phase difference and path difference - measurement of speed of sound in free air	microwaves, stretched strings and air columns in closed or opened pipes. (iv) Explain the formation of stationary waves using graphs, and identify nodes and antinodes.	
11	**10.0** **WAVE** **PHENOMENA**	**10.3** **Electromagnetic Waves**	- the EM spectrum, method of production, chief properties and uses of the main divisions - characteristics of EM waves - meaning and application of plain polarization	(i) Outline the EM spectrum in terms of increasing wavelength or frequency (ii) State the characteristics of EM waves (iii) List the sources, properties, uses and detectors of each portion of EM spectrum (iv) Explain what is meant by polarization (v) Describe the different means by which polarization is achieved (vi) Explain the different applications of polarization.	
12	**END OF SECOND SEQUENCE HARMONIZED EVALUATIONS**			TEST ACQUISITION OF KNOWLEDGE AND ADJUST TEACHING METHODS / TECHNIQUES	
	THIRD SEQUENCE BEGINS				
13	**10.0** **WAVE** **PHENOMENA**	**10.4** **Superposition of Electromagnetic Waves**	- Meaning of diffraction - Fraunhofer diffraction at a single slit - Fraunhofer diffraction at a circular aperture - Optical transmission grating with normal incidence - multiple slit diffraction - meaning of interference - two- source interference pattern	(i) Explain the meaning of diffraction (ii) Describe experiments that demonstrate diffraction through narrow and wide gaps. (iii) Describe Fraunhofer diffraction pattern at a single slit and circular aperture (iv) Derive the diffraction equation: $n\lambda = d \sin \theta$ (v) Explain the effect of diffraction grating on white light (spectrum production) (vi) Explain the term' interference' (vii) State the conditions for interference of water waves using two slits. (viii) Describe experiments that illustrate double – slit interference in water, light and microwaves (ix) Solve problems using the equation $\lambda = \frac{ax}{D}$	

		10.4 **Superposition of Electromagnetic Waves**	- Young's Double Slit experiment - measurement of wavelength by Young's double slit experiment	(x) Explain coherence state the conditions for its occurrence (xi) Determine wavelength by method of Young's double slit experiment. (xii) State the approximate dimensions of slit size, slit separation and screen distance.	
14	**10.0** **WAVE** **PHENOMENA**	**10.4** **Superposition of Electromagnetic Waves** **10.5** **Geometrical Optics**	- light sources: LASERS and gas discharge lamps - reflection and refraction at plain surfaces - laws of refraction - refractive index - total internal reflection	(i) Explain the meaning of LASERS (ii) Describe the method of production of light by gas discharge lamps and by LASER (iii) Give the advantages of LASERS over the gas discharge tube. (i) Define reflection and refraction (ii) State the laws of reflection (iii) State the laws of refraction (iv) Prove the laws of reflection, refraction and the phenomenon of total internal reflection using Huygens' wave front construction	
15		**10.5** **Geometrical Optics**	- prisms - dispersion -lenses - dioptre - Optical instruments: the microscope the astronomical telescope	(i) Trace the path of a light ray through a prism (ii) Explain what is meant by dispersion (iii) Describe the production of a pure and an impure spectrum (iv) State characteristics of images formed by a concave lens and by a convex lens (v) Use the lens formula to solve problems (vi) Describe the application of lenses in the microscope, telescope and the les camera (vii) Calculate the magnifying power of optical instruments (viii) Explain the defects of lenses e.g. coma, spherical and chromatic aberrations	
	END OF FIRST TERM / END OF THIRD SEQUENCE PART ONE				
	SECOND TERM BEGINS / THIRD SEQUENCE PART TWO CONTINUES				
16	**4.0**		- Temperature and thermometers	(i) State that heat is energy in the process of transfer from hot to cold regions. (ii) Define temperature.	

	ENERGETICS **(THERMAL ENERGY)**	**4.1** **Temperature**	- Temperature scales - Mercury–in–glass thermometer - Thermocouple thermometer - The Zeroth Law of thermodynamics	(iii) Explain what is meant by *thermometric substance* and *thermometric property*, giving examples of each. (iv) Name the different types of thermometers, stating their thermometric substances and properties. (v) Compare the relative advantages and disadvantages of resistance and thermocouple thermometers (vi) Discuss the different temperature scales relating to their being used for the calibration of a thermometer. (vii) State that the absolute scale of temperature does not depend on any particular property of a substance (viii) Convert temperatures measured in Kelvin to degree Celsius: $\theta / °C = T / K – 273.15$ (ix) Explain the term thermal equilibrium. (x) State the zeroth law of thermodynamics.	
		4.2 **Energy Transfer**	- Forms of energy - Concepts of energy transfer and energy conversion - Conservation of energy	(i) Name and explain the different forms of energy (ii) Apply the principle of conservation of energy to the forms of energy.	
17		**4.2** **Energy Transfer**	- Internal energy - The First Law of Thermodynamics	(iii) State and explain the concept of internal energy (iv) State that internal energy is the sum of the random distribution of K.E. and P.E of the molecules of the system. (v) Relate a rise in temperature of a body to an increase in its internal energy (vi) Use the concept of efficiency to solve problems involving energy losses in practical devices. (vii) State the First law of thermodynamics and use it in the form $\Delta Q = \Delta U + \Delta W$ to	

		4.3 Heating Matter	- Measurement of Specific Heat Capacity of : a solid a liquid	solve problems (i) Define Heat Capacity and Specific Heat Capacity (ii) Describe exp'ts to measure SHC of solids and liquids	
18		**4.3 Heating Matter** **END OF THIRD SEQUENCE EVALUATION**	- Meaning of latent heat and specific latent heat - Measurement of: SLHF of ice SLHV of water **END OF THIRD SEQUENCE EVALUATION**	(iii) Define SLHF and SLHV (iv) Explain using the kinetic theory, why a) melting and vaporization take place at constant temperature b) the SLHV is higher than SLHF c) a cooling effect accompanies evaporation **END OF THIRD SEQUENCE EVALUATION**	
		FOURTH SEQUENCE BEGINS			
19		**4.4** **Thermal energy transfer**	- conduction - convection - radiation - thermal conductivity - good and poor conductors - Newton's law of cooling	(i) Explain what is meant by conduction, convection and radiation (ii) Describe exp'ts to demonstrate the properties of good and bad conductors of heat, giving examples. (iii) Give a molecular account of the transfer of heat in solids (iv) Relate convection in fluids to density changes (v) Describe exp'ts to illustrate convection (vi) Identify Infra-Red radiation as part of the electromagnetic spectrum. (vii) Describe exp'ts to show the properties of good and bad emitters, and absorbers (viii) State everyday applications / consequences of conduction, convection and radiation	
20			- Gases - Brownian motion in gases	(i) State the basic assumptions of the kinetic	

	9.0 **THERMAL** **PHYSICS –** **THERMO** **DYNAMICS**	**9.1** **The Gas Laws**	- The Gas Laws - The Kinetic Theory of Gases - Assumptions of the kinetic theory of gases - Differences between Real gases and Ideal gases - Pressure exerted by gas molecules on the walls of the container - Absolute zero of temperature and the Kelvin temperature scale - distribution of molecular speeds - P- V diagrams	theory of gases (ii) Use the kinetic theory to explain the pressure exerted by gases (iii) Solve problems using the equation of state for an ideal gas PV = nRT (iv) Derive the relations $P = 1/3\ \rho\ c^2$ and K.E. = 3/2 kT (v) Establish the relationship between pressure and absolute temperature.	
21	**4.0** **ENERGETICS**	**9.3** **The Second Law Of** **Thermodynamics** **4.5** **Solids and Liquids**	- Statement of the law - Degrees of disorder in a system - Reversible and irreversible processes - Entropy change - The kinetic theory of matter - Solids: density forces/separation potential energy/ separation - Stresses and Strains - Elasticity and hysteresis - Hooke's Law and elastic limit	(i) State the second law of thermodynamics (ii) Explain what is meant by entropy (iii) State that entropy is a more natural state than order. (iv) Name and explain some reversible and irreversible processes (i) Describe the simple kinetic model for solids, liquids and gases. (ii) Distinguish between the states of matter in terms of spacing ordering and motion of molecules (iii) Distinguish between the structure of crystalline, polymeric and amorphous solids. (iv) Explain tensile stress and compressive stress (v) Describe the behavior of springs in terms of load, extension, elastic limit, Hooke's law and spring constant (vi) Sketch force-extension graphs for ductile, brittle and polymeric materials.	

22	**7.0** **ELECTRICAL** **ENERGY**	**4.5** **Solids and Liquids** **7.1** **Current** **Electricity**	- Young's Modulus of elasticity - Surface tension - Pressure difference in fluids: $P = h\rho g$, manometers, hydrostatic force - Electric current - Potential Difference - Electromotive Force - Current – Potential difference relationships - Ohm's Law	(i) Define and use the terms stress, strain and Young's Modulus (ii) Describe an experiment to determine Young's modulus in the form of a wire. (iii) Distinguish between elastic and plastic deformation of a material (iv) Deduce the strain energy in a deformed material from the area under the force – extension graph (v) Derive and use the equation $P = h\rho g$ (vi) Define surface tension (vii) Determine the pressure difference across a spherical interface. (viii) Describe exp'ts to measure surface tension (i) Express electric current as the rate of flow of charged particles (ii) Define e.m.f. in terms of energy (iii) Distinguish between e.m.f. and p.d. in terms of energy considerations (iv) Sketch and explain the I – V characteristics of conductors, semi-conductor diodes and filament lamp (v) State Ohm's law and use the relationship $V = IR$	
23	**7.0** **ELECTRICAL** **ENERGY**	**7.1** **Current** **Electricity**	- Resistance, resistivity, conductivity and superconductivity - Internal resistance of a cell - Resistor networks - Temperature dependence of resistance - Electrical energy and power - Potential dividers - Combining Cells	(i) Explain the meanings of resistance, resistivity, conductivity and they are related (ii) Explain the meaning of internal resistance (iii) Describe the effects of internal resistance on the terminal P.D. and output power (iv) Calculate the net resistance of a number of resistors in series and in parallel (v) Sketch the temperature characteristics of	

			- Kirchhoff's laws and circuit calculations - The Wheatstone bridge and Meter Bridge - The potentiometer and its applications	a thermistor. (vi) Solve problems using V = WQ, P = IV=I^2R (vii) Explain the use of the potential divider circuit as a source of variable p.d. (viii) Explain the use of thermistors and light dependent resistors in potential dividers to provide a p.d. that is dependent on temperature and illumination respectively (ix) State Kirchhoff's first law and relate it to the conservation of charge (x) State Kirchhoff's second law and relate it to the conservation of energy (xi) Apply Kirchhoff's laws in solving circuit problems (xii) Draw the Wheatstone bridge and use the principle of balance to determine an unknown resistance (xiii) Use the potentiometer to measure the resistance of a given length of wire.	
24	**END OF FOURTH SEQUENCE HARMONIZED EXAMINATIONS**				
	FIFTH SEQUENCE BEGINS				
25	**5.0** **ATOMIC** **AND** **NUCLEAR** **PHYSICS**	**5.1** **Electron Flow in Metals**	- Conduction mechanisms in solids - Current and charge flow - Temperature coefficient of resistance - Experiment to measure the temperature coefficient of a metal wire	(i) Distinguish between conductors and insulators (ii) Derive the relation I = n A v e (iii) Define temperature coefficient of resistance (iv) Sketch graphs to show how the resistances of conductors, semi-conductors and insulators vary with temperature (v) Calculate temperature coefficient of resistance from graphs. (vi) Describe exp't to determine the temperature coefficient of resistance of a wire	

		5.2 + 5.3 **Conduction Mechanisms in Semi- Conductors**	- The Band Theory - Properties of Intrinsic and Extrinsic Semi - conductors	(i) Explain the increased conductivity of semi conductors in terms of more charge carriers; electrons and holes (ii) Describe the conductivity of extrinsic semi conductors in terms of minority and majority charge carriers (iii) Use the band theory to differentiate between insulators, conductors and semi conductors	
26	**5.0** **ATOMIC** **AND** **NUCLEAR** **PHYSICS**	**5.2 + 5.3** **Conduction Mechanisms in Semi- Conductors**	- The n- type and p- type semi conductors - The p – n junction - The p-n junction and the LED - Semi conductor diode: Zener diode	(i) Explain doping in extrinsic semi conductors (ii) Distinguish between p- and n- type extrinsic semi conductors (iii) State the difference between intrinsic and extrinsic semi conductors (iv) Explain the formation of the p- n junction and the meaning of *barrier p.d.* (v) Describe the action of the diode in forward and reverse bias modes (vi) Sketch graphs of current – voltage relations; forward bias, reverse bias and breakdown. (vii) The importance of the p – n junction (viii) Give the functions of a junction diode. (ix) State the applications of LEDS in daily life. (x) Explain the actions of the photodiode, LCD and Zener diodes	
27	**5.0** **ATOMIC** **AND** **NUCLEAR**	**5.4** **Electronic Devices**	- The bipolar transistor - Transistor characteristics - The transistor as a switch in the Common – Emitter mode - The transistor as an LDR switch - The transistor as an alarm	(i) Explain what is meant by a transistor; n – p - n and p-n-p types. (ii) Describe the action of a bipolar n-p-n transistor. (iii) Explain transistor action (iv) State the functions of a transistor as an amplifier and as a switch.	

	PHYSICS		switch	(v) Explain the use of a bipolar transistor in switching circuits.	
28	**5.0 ATOMIC AND NUCLEAR PHYSICS**	**5.4 Electronic Devices**	- The Common- Emitter class a.c. amplifier -The transistor as an amplifier: + the quiescent state + applying the input + voltage amplification + load lines - Integrated circuits - Logic Gates; OR, AND, NOT, NAND and NOR	(i) Calculate current gain (ii) Describe the: a) C- E amplifier b) load line c) thermal runaway d) coupling (iii) State in words and in truth table form, the action of logic gates. (iv) State the symbols of the various logic gates.	
29	**5.0 ATOMIC AND NUCLEAR PHYSICS**	**5.5 The Nucleus**	- Evidence for the existence of atomic nuclei - The nuclear atom - Nuclear binding energy	(i) Describe and explain the results of the alpha – particle scattering exp't. (ii) Describe a simple model for the nuclear atom (iii) Distinguish between nucleon number and atomic number. (iv) Explain the existence of isotopes (v) Use the notation for atomic nuclides. (vi) Define nuclear binding energy and use it to explain the mass-energy equivalence	
END OF SECOND TERM / END OF FIFTH SEQUENCE PART ONE					
THIRD TERM BEGINS / FIFTH SEQUENCE PART TWO CONTINUES					
30	**5.0 ATOMIC AND NUCLEAR PHYSICS**	**5.6 Radioactive Decay**	- Natural and artificial radioactivity - Properties of nuclear radiation - Radioactivity as a random process - Stable and unstable nuclei	(i) Distinguish between natural and artificial radioactivity (ii) Explain the spontaneous and random nature of nuclear decay (iii) Describe nuclear reactions using nuclear equations. (iv)List the properties of α, ß and λ particles (v) State the mass-energy equation $E = c^2 \Delta m$ and use it to solve problems (vi) Sketch the variation of binding energy	

				per nucleon with nucleon number (vii) Explain the relevance of binding energy per nucleon to nuclear fusion and fission. (viii) Define the terms *activity* and *decay constant* (ix) Solve problem using $A = \lambda N$ (x) Plot exponential decay curves and analyze the equation $N = N_o \ell^{-\lambda t}$ to solve problems. (xi) Define half – life (xii) Solve exercises using the relation: $\lambda t_{½} = \ln 2$	
31	**END OF FIFTH SEQUENCE HARMONIZED EXAMINATIONS**				
	SIXTH SEQUENCE BEGINS				
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ADVANCED LEVEL PHYSICS TEACHING SCHEMES
UPPER SIXTH SCIENCE

WEEK	TOPIC	LESSON	CONTENTS	OBJECTIVES	REMARKS/ ACTIVITIES
FIRST TERM week 1 to week 15			**FIRST TERM week 1 to week 15**	**FIRST TERM week 1 to week 15**	
	FIRST SEQUENCE				
1	**6.0** **FIELDS**	**6.1** **Gravitational Fields**	- Newton's law of universal gravitation - Gravitational field strength, g - Qualitative description of the earth's gravitational field - Inverse square law for fields of spherically symmetrical masses - Variation of gravitational field inside and outside earth. - Gravitational potential	(i) State the laws of gravitation (ii) Prove Kepler's laws (iii) Apply Kepler's laws to the movement of the moon and other planets (iv) Apply Newton's law of gravitation $\mathbf{F} = \mathrm{G}\frac{\mathrm{M\,m}}{\mathrm{r}^3}\mathbf{r}$ to solve problems involving orbiting bodies. (v) Define gravitational field strength (vi) Derive g from force of gravity for a uniform field (vii) Draw and interpret graphs showing the variation of g with distance from centre of mass (viii) Sketch graphs showing the variation of V with distance from centre of mass (ix) Apply potential energy to planetary and satellite motions (x) Define potential energy (xi) Derive the equation $V = -\mathrm{G}\frac{\mathrm{m}}{\mathrm{r}}$	
		6.2	- Measurement of charge - Electrostatic phenomena and electric charge	(i) State that electric charge is a fundamental property of matter	

2	**6.0** **FIELDS**	**Electric Fields**	- Current as rate of flow of charge - Coulomb's Law - Electric fields - Electric field strength and Gauss's law - Electric Potential -	(ii) Describe how the two types of charges can be obtained. (iii) Apply the qualitative laws of electrostatics. (iv) Use Coulomb's law in the form $\mathbf{F} = k\frac{Q_1 Q_2}{r^2}\ \mathbf{r}$ and use it to solve problems (v) Define electric field strength (vi) Represent an electric field by field lines (vii) Apply E = V/d	
3	**6.0** **FIELDS**	**6. 3** **Capacitors**	- Meaning of capacitance - Measurement of capacitance - Factors affecting the capacitance of a parallel plate capacitor - Permittivity - Capacitor networks	(i) Describe what a capacitor is (ii) State the use of capacitors in simple circuits (iii) Define capacitance and the farad (iv) Describe an exp't to determine the capacitance of a capacitor. (v) State and explain the factors that affect the capacitance of a capacitor (vi) Derive equations for series and parallel arrangements capacitors. (vii) Solve problems involving capacitors in series and in parallel (viii) Solve problems using the equation C=Q/V	
4	**6.0** **FIELDS**	**6. 3** **Capacitors** **6.4** **Magnetic fields**	- Charging and discharging of capacitors; growth and decay curves - The time constant - Energy stored in a charged capacitor - Magnets and magnetic materials - Magnetization and hysteresis - Magnetic flux density; the tesla - Force on a current-carrying conductor in a uniform magnetic field	(ix) Calculate the energy stored in capacitor by calculating the area under a Q versus V graph (x) Analyze exponential growth / decay curves (xi) Use the equation $Q = Q_o\ \ell^{-t/RC}$ to determine the time constant τ (i) Explain the origin of the magnetic field (ii) Distinguish between magnetic, paramagnetic, diamagnetic and non magnetic materials (iii) Describe the processes of magnetization (iv) State that magnetic hysteresis results from the fact that magnetic dipoles are not exactly elastic (v) Define *magnetic flux density* and the tesla	

			- Force between parallel current-carrying conductors; definition of the ampere and permeability μ_o - Magnetic effect of steady currents; Biot - Savart law	(vi) Solve problems using F = BIL sinθ and determine the direction of the force from Fleming's left hand rule (vii) Demonstrate that the force on a current-carrying conductor can be used to measure the flux density of a magnetic field using a current balance (viii) Sketch field patterns due to a long straight wire, flat circular coil and a long solenoid (ix) Determine the nature and direction of the forces between current-carrying conductors (x) Define the ampere and explain permeability (xi) State the Bio- Savart law for a short length of conductor. (xii) State that the Bio – Savart law can be used to derive expressions for the flux density of real conductors	
5	**6.0** **FIELDS**	**6.4** **Magnetic fields**	- Force on a moving charge - Measurement of charge–to-mass ratio; e/m - Couple on a rectangular coil - Magnetic flux density within a long solenoid - Effects of iron core in solenoid - Electromagnets - Magnetic shielding, Lorentz force - Earth's magnetic field	(i) Predict the direction of the force on a charge moving in a magnetic field (ii) Apply the formula F = B Q v sinθ to solve problems involving a moving charge (iii) Describe an exp't to determine the e/m of an electron (iv) Prove that $\frac{e}{m} = \frac{2V}{B^2 r^2}$ (v) Derive the expression for the torque on a rectangular coil in a magnetic field Ƭ = NIBA (vi) Apply the torque to simple dc motors and generators (vii) Draw and describe the magnetic field within a long solenoid (viii) State the different applications of electromagnets (ix) Describe the Earth's magnetic field	
			- Magnetic flux and flux linkage - Electromagnetic induction	(i) Define magnetic flux and the weber (ii) Solve problems using Φ = BA cosθ (iii) Distinguish between magnetic flux and magnetic flux linkage	

6	**11.0** **ELECTRO-** **MAGNETIC** **INDUCTION**	**11.1** **Magnetic Flux** **END OF FIRST SEQUENCE EVALUATION**	- Laws of electromagnetic induction - Induced e.m.f. in a straight conductor - Mutual inductance - Self inductance **END OF FIRST SEQUENCE EVALUATION**	(iv) Describe how the following can cause an emf to be induced in a circuit - changing magnetic flux - relative movement of a magnet and a coil (v) State that the direction of the induced emf opposes the change causing it (vi) State the factors that affect the magnitude of the induced emf (vii) Solve problems involving Faraday's and Len's laws of electromagnetic induction (viii) Name common applications of electro-magnetic induction (ix) Explain what is mutual inductance (x) Describe how mutual induction can be demonstrated (xi) Explain the self inductance and back emf **END OF FIRST SEQUENCE EVALUATION**	
	SECOND SEQUENCE BEGINS				
7	**11.0** **ELECTRO-** **MAGNETIC** **INDUCTION**	**11.2** **Alternating Currents**	- The transformer - The simple DC generator - The AC theory - Root Mean Square values - Relationship between r.m.s. values and peak values for currents and voltages - Energy and power in ac circuits - Rectification and smoothing	(i) Describe the principle of operation of the transformer (ii) Solve problems involving the efficiency of a transformer (iii) Explain the scientific and economic advantages of using transformers to transport ac at high voltages (iv) Describe the action of a simple dc motor (v) Explain the terms: *period*, *frequency*, *peak value* and *r.m.s. value* as applied to alternating current or voltage (vi) Establish that: $I = I_o \sin 2\pi f t$ and r.m.s. value = 0.71 peak value (vii) Deduce that the mean power in a resistive load is half the maximum for a sinusoidal a.c. (viii) Distinguish between r.m.s. and peak values (ix) Solve problems using $V_{rms} = \frac{V_{max}}{\sqrt{2}}$	

				(x) Explain what is rectification (xi) Distinguish between half wave rectification and full wave rectification (xii) Explain the use of a single diode for half wave rectification of alternating current (xiii) Explain the use of a bridge rectifier for full wave rectification of alternating current (xiv) Analyze the role of a capacitor in smoothing	
8	**11.0** **ELECTRO-** **MAGNETIC** **INDUCTION**	**11.3** **Electrical Oscillations**	- Current in an Inductive circuit - Inductive reactance - Current in a pure capacitor - Capacitive reactance - Current in an R- C - L series circuit - Phase diagrams and impedance - Electrical resonance in R- C - L series circuits	(i) Establish the relationship between applied e.m.f. and inductance (ii) State that the induced current lags behind the applied p.d. in a purely inductive circuit. (iii) Calculate the inductive reactance from $X_L = 2\pi f L$ (iv) State that the applied current leads the applied p.d. in a purely capacitive circuit (v) Calculate capacitive reactance using $X_C = \frac{1}{2\pi fC}$ (vi) Explain that current does not flow through a capacitor but to and from the plates only. (vii) Establish a relationship between R, C and L (viii) Draw diagrams showing input and output singles as applied to the various circuits (ix) Explain the use of the circuits as high / low pass filters (x) Calculate impedance $Z = \sqrt{R^2 + (X_L - X_C)}$ (xi) Determine resonance point and its uses (xii) Calculate quality factor	
9	**12.0** **QUANTUM** **PHYSICS**	**12.1** **Photons and Energy Levels**	- Conservation of energy for waves in free space - Inverse square law - Wave – particle duality	(i) Explain that the energy of a wave is conserved in vacuum but it gradually degrades when travelling through a medium (ii) Define intensity and use it to explain the inverse square law	

		12.1 **Photons and** **Energy Levels**	- The photoelectric effect - The Quantum Theory of Radiation - Einstein's photoelectric equation - Stopping Potential	(iii) Explain the dual nature of light (iv) Give evidences to both the particle theory and wave theory of light (v) State that all physical entities can be described as waves or particles and that these aspects are linked by E = hf, $\lambda = \frac{h}{P}$ (vi) Explain what is meant by the photoelectric effect (vii) State the results of the photoelectric effect (viii) Explain how the classical theory fails to explain the photoelectric effect (ix) Explain the quantum theory of radiation (x) Explain the photoelectric effect in terms of photon energy and work function (xi) Use Einstein's photoelectric equation $E = \Phi + K.E$ to solve problems (xii) State the significance of the threshold frequency (xiii) Sketch and interpret graphs of how the kinetic energies of emitted electrons vary with frequency of the incident radiation (xiv) describe and interpret qualitatively the evidence provided by electron diffraction for wave nature of particles (xv) Use the relation for the de Broglie wavelength $\lambda = \frac{h}{P}$	
10		**12.1** **Photons And Energy Levels**	- Atomic structure - Energy levels - The electron volt - Excitation and ionization energies - Line spectra: emission and absorption	(i) State the results of Rutherford's alpha – particle scattering experiment (ii) Describe the Bohr model of the atom (iii) Explain the meaning of *energy level, stationary state, ground state* and *excited state* (iv) Distinguish between *ionization energy* and *excitation energy*, *ionization potential* and *excitation potential* (v) Calculate the energy involved in electron	

		12.1 **Photons And Energy Levels**		transitions from one energy level to another (vi) Explain the meaning / significance of the electron volt (eV) (*v*ii) Explain that the wavelengths of the radiations emitted by the various transitions are different and consist of lines. (viii) Explain and distinguish between *line emission spectra and line absorption spectra*	
11		**12.2** **Atomic Spectra**	- Schrodinger model of the Hydrogen atom - Heisenberg uncertainty principle: + position - momentum + time - energy		
12	**END OF SECOND SEQUENCE HARMONIZED EVALUATIONS**			TEST ACQUISITION OF KNOWLEDGE AND ADJUST TEACHING METHODS / TECHNIQUES	
	THIRD SEQUENCE BEGINS				
13	**OPTION 1:** **ENERGY RESOURCES AND ENVIRONMENTAL PHYSICS**	**Energy Resources**	- Primary and Secondary energy - Finite and renewable resources -Patterns of energy consumption in Cameroon - Energy Reserves and their sources: + Estimates of fossil fuels and uranium resources + Solar power + Energy of winds, waves and tides	(i) Distinguish between primary and secondary sources of energy (ii) List renewable and non- renewable sources of energy (iii) Define fossil fuels and give the use of fossil fuels, fossil materials and biofuels as stores of energy (iv) State and describe locations of *geothermal energy, solar energy, tidal energy, wind energy, biomass, biofuel* and *wave energy* in Cameroon (v) Distinguish between directly usable energy sources and indirect (convertible) energy sources (vi) Discuss the non- uniform distribution of worldwide energy sources (vii) Use the solar constant in simple calculations on kinetic energy of wind, potential energy of stored water	

				(viii) Give a description of deep water waves	
14		**Energy Conversion**	- Hydroelectric power + Efficiency of the power station - Fission reactor as a boiler - Alternative Sources of electric energy + solar cells and solar power stations, wind turbines, Fusion reactor	Describe the processes by which energy is converted from one form to another with reference to: (i) Compare the relative advantages and cost of using natural gas, gas oil and Heavy Fuel Oil (HFO) for electricity generation and in car consumption. (ii) Hydroelectric generation and transmission, with emphasis on mechanical energy involved. (iii) Solar energy and solar cells: designing of solar cells and solar panels, performing simple calculations. (iv) Nuclear energy (v) Geothermal energy (vi) Wind energy (vii) Biomass / biofuel : a) Showing daily and seasonal variations in demand b) Solving problems of storage of electrical energy c) Distinguish between fission and fusion in terms of energy release d) Qualitative description of the fission reactor: chain reaction, moderator, coolant and control rods e) Calculate the efficiency of the energy conversion in terms of the energy converted w.r.t. to energy input	
15			- Radiation hazard and its consequences to human health and the environment - Geophysical hazard and its consequences to human and the	(i) Explain the radiation hazard between humans and their natural environment (ii) Describe the destruction of the ionosphere its consequences (iii) Appreciate the energy waste in the	

		Climate Change	environment - Global warming - Greenhouse effect: efforts to reduce greenhouse effect or mitigation method	destruction of the forest (iv) Appreciate and advise on detection and prevention of destruction caused by seismic waves (tsunami and volcanoes)	
	END OF FIRST TERM / END OF THIRD SEQUENCE PART ONE				
	SECOND TERM BEGINS / THIRD SEQUENCE PART TWO CONTINUES				
16	**OPTION 1:** **ENERGY RESOURCES AND ENVIRONMENTAL PHYSICS** (Continued)	**Space Weather**	- Effects of air navigation - Satellites and Power stations - Information on collection of satellite data - Ground armature means of tracking data from different satellites	(i) Discuss the movement of air over the earth's surface due to cosmic radiation (ii) Detection of air movement by satellite (iii) Describe methods of measuring humidity (iv) State and discuss simple methods of weather forecast (v) Describe the variation and the consequences of rainfall in Cameroon (vi) Explain the use of satellites in collecting weather parameters	
17	**OPTION 2:** **COMMUNICATION**	**Radio Systems**	- Simple A.M. radio transmitter and Receiver - Differences between FM and AM transmissions - Sidebands and bandwidth - Attenuation - Tuning circuits - Parallel-tuned LC circuits and the dependence of f_r on LC - Principles of modulation - Different modes of transmission	(i) Draw block diagrams for a simple radio transmitter and receiver. (ii) Use tuning circuit to explain the principle of a radio receiver. (iii) Describe super heterodyne system (iv) Distinguish between AM and FM (v) Explain the term modulation and use it to distinguish between FM and AM (vi) Give the relative advantages of AM and FM (vii) Explain that a carrier wave amplitude modulated by a single audio frequency is equivalent to the carrier wave frequency together with two sideband frequencies (viii) Define the term bandwidth (ix) State the advantages of the transmission of data in digital form (x) Explain that the digital transmission of	

				speech or music involves analogue- to – digital conversion (ADC) on transmission and digital – to- analogue conversion (DAC) on reception	
18		**The Mobile Phone** **END OF THIRD SEQUENCE EVALUATION**	- Structure and Functions of a Mobile Phone - **END OF THIRD SEQUENCE EVALUATION**	(i) Discuss the relative advantages and disadvantages of channels of communication in terms of available bandwidth, noise, cross-linking, security, signal attenuation, repeaters and regeneration, cost and convenience (ii) Describe the use of satellites in communication (iii) Analyze the phone as a transmitter and as a receiver. (iv) Explain the link between the base stations (via a cellular exchange) and the public switched telephone network (PSTN) in a mobile phone system. (v) Explain the need for an area to be divided into a number of cells in the satellite station, each cell served by a based station (vi) Explain the role of the base station and the cellular exchange during the making of a call from a mobile phone handset. (vii) Draw a simplified block diagram of a mobile phone handset, giving the function of each block **END OF THIRD SEQUENCE EVALUATION**	
	FOURTH SEQUENCE BEGINS				
19	REVISION	REVISION	REVISION	REVISION	
20	REVISION	REVISION	REVISION	REVISION	
21	REVISION	REVISION	REVISION	REVISION	
22	REVISION	REVISION	REVISION	REVISION	
23	REVISION	REVISION	REVISION	REVISION	
24	END OF FOURTH SEQUENCE HARMONIZED EXAMINATIONS				
25	REVISION	REVISION	REVISION	REVISION	

26	REVISION	REVISION	REVISION	REVISION	
27	MOCK EXAMS	MOCK EXAMS	MOCK EXAMS	MOCK EXAMS	
28	MOCK EXAMS	MOCK EXAMS	MOCK EXAMS	MOCK EXAMS	
	SECOND TERM HOLIDAYS				
29	REVISION	REVISION	REVISION	REVISION	
30	**END OF FIFTH SEQUENCE**				
31	REVISION	REVISION	REVISION	REVISION	
32	REVISION	REVISION	REVISION	REVISION	
33					
34					
35					
36					

	THIRD SEQUENCE BEGINS				
13	**OPTION 3:** **ELECTRONICS** **ELECTRONICS**	**Electronics**	- Thermionic emission - Action and use of circuit components - Colour code - Therevin law - CR and LR circuits - Transformers - Centre taped transformer in rectification	(i) Explain the emission of electrons by a hot metal filament (ii) Explain that to cause a continuous flow of emitted electrons requires high positive potential and very low gas pressure (iii) Identify and list the components found in the electrical circuit (iv) Give the values of some components such as resistors, capacitors and inductors found in such circuits (v) Explain how the values of resistors are chosen according to the colour code and why widely different values are needed in different types of circuits (vi) State and apply Therevin law (vii) Discuss the need to choose components with suitable power ratings (viii) Display an understanding of the charging and discharging a: - capacitor time constant - capacitor coupling (ix) Explain the effect of an inductor in a circuit (ix) Draw phasor diagrams (x) Calculate the reactance X and the impedance Z in an oscillatory system (xi) Identify a transformer in a circuit for rectification	
14	**ELECCTRONICS**	**Heat and Light Sensors** **Relays and Reed switches**	- Thermistor and LDR - Relay - Reed switch	(i) Describe the action of heat and light dependent resistors and describe use as input sensors (ii) Describe and explain the use of reed / relays in switching circuits (iii) Explain the use of reed / relays in switching circuits	

15		**Binary Systems and OPAMP**	- Bistable and astable		
	END OF FIRST TERM / END OF THIRD SEQUENCE PART ONE				
	SECOND TERM BEGINS / THIRD SEQUENCE PART TWO CONTINUES				
16					
17	**OPTION 4**				
18		**END OF THIRD SEQUENCE EVALUATION**	**END OF THIRD SEQUENCE EVALUATION**	**END OF THIRD SEQUENCE EVALUATION**	
	FOURTH SEQUENCE BEGINS				
19	REVISION	REVISION	REVISION	REVISION	
20	REVISION	REVISION	REVISION	REVISION	

21	REVISION	REVISION	REVISION	REVISION	
22	REVISION	REVISION	REVISION	REVISION	
23	REVISION	REVISION	REVISION	REVISION	
24	END OF FOURTH SEQUENCE HARMONIZED EXAMINATIONS				
25	REVISION	REVISION	REVISION	REVISION	
26	REVISION	REVISION	REVISION	REVISION	
27	MOCK EXAMS	MOCK EXAMS	MOCK EXAMS	MOCK EXAMS	
28	MOCK EXAMS	MOCK EXAMS	MOCK EXAMS	MOCK EXAMS	
	SECOND TERM HOLIDAYS				
29	REVISION	REVISION	REVISION	REVISION	
30	**END OF FIFTH SEQUENCE**				
31	REVISION	REVISION	REVISION	REVISION	
32	REVISION	REVISION	REVISION	REVISION	
33					
34					
35					
36					