

**GENERAL CERTIFICATE OF EDUCATION
(ADVANCED LEVEL)**

PHYSICS
SYLLABUS (REVISITED)

Grade 12 from
&
Grade 13 from



Department of Science, Health and Physical Education
Faculty of Science and Technology
National Institute of Education

1.0 Introduction

This syllabus has been designed to provide a basic background of physics that would be required by those intending to proceed to higher studies as well as by those who would utilize their knowledge of physics gained at the GCE (AL) in various other spheres.

The syllabus comprises 11 units. The major change in this revisited syllabus is the removal of unit 12: “Emerging Scientific Knowledge” from the 2009 syllabus.

2.0 Aims of the Syllabus

1. Acquires sufficient understanding and knowledge to become confident citizens in a technological world.
2. Recognizes the usefulness and limitations of scientific method and to appreciate its applicability in everyday life.
3. Develops abilities and skills that are relevant to the study and practice of Physics in day-to-day life.
4. Develops attitudes relevant to Physics such as concern for accuracy and precision, objectivity, enquiry, initiative and inventiveness.
5. Stimulates interest and care for the environment.
6. Acquires manipulative, observational and experimental skills together with hands-on experience on the equipments used by physicists.

List of topics and allocated number of periods

Topic

Number of periods

Unit 01	Measurement	22
Unit 02	Mechanics	102
Unit 03	Oscillations and Waves	86

Unit 4

Thermal physics

Grade	Term	Competency levels
-------	------	-------------------

46

Unit 05

Gravitational Field 12

Unit 06	Electrostatic Field	30
Unit 07	Current Electricity	34
Unit 08	Electro-magnetism	42
Unit 09	Electronics	30
Unit 10	Mechanical Properties of Matter	32
Unit 11	Matter and Radiation	22

Total = 458

**Proposed term
of the syllabus**

Grade 12	First Term	From 1.1 to 2.5 (Competency levels 11)
	Second Term	From 2.6 to 3.5 (Competency levels 08)
	Third Term	From 3.6 to 4.9 (Competency levels 15)
Grade 13	First Term	From 5.1 to 7.6 (Competency levels 12)
	Second Term	From 8.1 to 10.2 (Competency levels 10)
	Third Term	From 10.3 to 11.6 (Competency levels 07)

wise breakdown

3.0 Syllabus

3.1 - Grade 12

Unit 1 - Measurement

(22 periods)

Competency	Competency Level	Content	No. of Periods
1. Uses experimental and mathematical frames in physics for systematic explorations.	1.1 Inquires the scope of physics and how to use the scientific methodology for explorations.	<ul style="list-style-type: none">• Introduction to physics<ul style="list-style-type: none">• How physics is connected to daily life and nature• How physics contributed to the development of modern society• How physics is used to understand the evolution of the universe• Explaining simply the subject area of physics• Basic concepts in scientific methodology• How experimental results have influenced the new investigations in physics	04
	1.2 Uses units appropriately in scientific work and daily pursuits.	<ul style="list-style-type: none">• Physical quantities and units<ul style="list-style-type: none">• Fundamental physical quantities• International system of units (SI units) - <i>Système International d'Unités</i>• Basic units• Supplementary units (for measuring angles)• Derived physical quantities and derived units• Physical quantities without units• Multiples and sub multiples of units	02

Competency	Competency Level	Content	No. of Periods
	1.3 Investigates physical quantities using dimensions.	<ul style="list-style-type: none"> • Dimensions <ul style="list-style-type: none"> • Dimensions of basic physical quantities used in mechanics <ul style="list-style-type: none"> • Mass • Length • Time • Dimensions of derived physical quantities • Uses of dimensions <ul style="list-style-type: none"> • Testing the correctness of a physical equation • Finding the units and dimensions of a given quantity • Deriving equations 	02
	1.4 Takes measurements accurately by selecting appropriate instruments to minimize the error.	<ul style="list-style-type: none"> • Measuring instruments <ul style="list-style-type: none"> • Principle, least count and zero error of instruments <ul style="list-style-type: none"> • Metre ruler • Vernier calipers • Micrometer screw gauge • Spherometer • Travelling microscope • Triple beam balance/ Electronic balance • Stop watch/ Digital watch • Uses of measuring instruments • Error, fractional error and percentage error of a measurement and their influence on the final result 	08

Competency	Competency Level	Content	No. of Periods
	1.5 Uses vector addition and resolution appropriately.	<ul style="list-style-type: none"> • Scalars and vectors <ul style="list-style-type: none"> • Scalar quantities • Vector quantities <ul style="list-style-type: none"> • Geometrical representation of a vector quantity • Addition and subtraction of vectors <ul style="list-style-type: none"> • Two vectors in the same line and parallel lines • Two inclined vectors <ul style="list-style-type: none"> • Parallelogram method • Triangle method • Resolution of vectors 	04
	1.6 Extracts information correctly by graphical representation of experimental data.	<ul style="list-style-type: none"> • Graphical analysis <ul style="list-style-type: none"> • Plotting the graph • Values from graphs • Interpretation and prediction of the behavior of variables using a graph 	02

Competency	Competency Level	Content	No. of Periods
		Unit 2: Mechanics	(102 periods)
2. Lays a foundation for analyzing motion around us on the basis of principles of physics.	2.1 Analyzes the linear motion, projectiles and relative motion of bodies.	<ul style="list-style-type: none"> • Kinematics <ul style="list-style-type: none"> • Relative motion <ul style="list-style-type: none"> • Motion in the same direction on parallel paths • Motion in opposite directions on parallel paths • Rectilinear motion under constant acceleration <ul style="list-style-type: none"> • Uses of graphs of motion <ul style="list-style-type: none"> • $s-t$ and $v-t$ graphs • Uses of equations of motion <ul style="list-style-type: none"> • Motion on a horizontal plane • Vertical motion under gravity • Motion on a frictionless inclined plane • Projectiles • 	10
	2.2 Uses resultant force and moment of force to control linear motion and rotational motion of a body.	<ul style="list-style-type: none"> • Resultant of forces <ul style="list-style-type: none"> • Resultant of two forces <ul style="list-style-type: none"> • Parallelogram law of forces • Resultant of a system of coplanar forces <ul style="list-style-type: none"> • Force resolution method • Force polygon method • Moment of a force (torque) <ul style="list-style-type: none"> • Moment of a force about a point 	12

Competency	Competency Level	Content	No. of Periods
		<ul style="list-style-type: none"> • Moment of couple • Resultant of parallel forces and the line of action • Centre of gravity of a body (using the resultant of parallel forces) <ul style="list-style-type: none"> • Centre of gravity of regular shaped bodies • Centre of gravity of regular shaped compound bodies • Centre of mass (concept only) • Determination of weight of a body using the Parallelogram law of forces 	
	2.3 Manipulates the conditions necessary to keep a body in equilibrium.	<ul style="list-style-type: none"> • Equilibrium <ul style="list-style-type: none"> • Conditions for equilibrium • Equilibrium of coplanar forces <ul style="list-style-type: none"> • Three forces in parallel • Three forces inclined • Triangle of forces • Polygon of forces • Principle of moments • States of equilibrium (Identifying states of equilibrium) <ul style="list-style-type: none"> • Stable • Unstable • Neutral • Determination of weight of a body using the principle of moment 	10
	2.4 Uses Newton's laws of motion to control the states of motion of a body.	<ul style="list-style-type: none"> • Force and motion <ul style="list-style-type: none"> • Mass <ul style="list-style-type: none"> • Inertial mass • Gravitational mass • Inertial and non – inertial frames <ul style="list-style-type: none"> • Inertial (Fictitious /Pseudo) forces (Introduction only) and 	16

Competency	Competency Level	Content	No. of Periods
		<p style="text-align: center;">non-inertial forces</p> <ul style="list-style-type: none"> • Newton's first law of motion • Momentum • Newton's second law of motion <ul style="list-style-type: none"> • Obtaining $F = ma$ • Defining the newton • Impulse and impulsive forces • Principle of conservation of linear momentum <ul style="list-style-type: none"> • Elastic collision and inelastic collision • Newton's third law of motion • Self adjusting forces <ul style="list-style-type: none"> • Tension • Thrust / compression • Friction <ul style="list-style-type: none"> • Static friction • Dynamic friction • Free body diagrams • Applications of Newton's laws 	
	2.5 Investigates the concepts related to rotational motion and circular motion.	<ul style="list-style-type: none"> • Rotational motion <ul style="list-style-type: none"> • Angular displacement • Angular velocity • Angular acceleration • Frequency of rotation • Motion with uniform angular acceleration 	16

Competency	Competency Level	Content	No. of Periods
		<ul style="list-style-type: none"> • Uses of equations of rotational motion • Moment of inertia • Angular momentum • Torque • Relationship between torque, moment of inertia and angular acceleration • Principle of conservation of angular momentum • Analogy between linear motion and rotational motion • Uniform circular motion in horizontal plane <ul style="list-style-type: none"> • Frequency • Tangential velocity • Period • Centripetal force • Centripetal acceleration 	
	2.6 Consumes and transforms mechanical energy productively.	<ul style="list-style-type: none"> • Work, energy and power <ul style="list-style-type: none"> • Work <ul style="list-style-type: none"> • Work done in linear motion • Work done in rotational motion • Mechanical energy <ul style="list-style-type: none"> • Kinetic energy <ul style="list-style-type: none"> • Translational kinetic energy • Rotational kinetic energy • Potential energy <ul style="list-style-type: none"> • Gravitational potential energy • Elastic potential energy • Power • Principle of conservation of energy 	16

Competency	Competency Level	Content	No. of Periods
		<ul style="list-style-type: none"> • Principle of conservation of mechanical energy 	
	2.7 Uses the principles and laws related to fluids at rest in scientific work and daily pursuits.	<ul style="list-style-type: none"> • Hydrostatics <ul style="list-style-type: none"> • Hydrostatic pressure • Comparing the relative density of liquids <ul style="list-style-type: none"> • using U- tube • using Hare's apparatus • Transmissibility of pressure <ul style="list-style-type: none"> • Pascal's principle and its applications • Upthrust <ul style="list-style-type: none"> • Archimedes' principle <ul style="list-style-type: none"> • Verification theoretically and practically • Floatation <ul style="list-style-type: none"> • Principle of floatation • Comparing the density of liquids using the Hydrometer 	14
	2.8 Uses the principles and laws related to flowing fluids in scientific work and daily pursuits.	<ul style="list-style-type: none"> • Fluid-dynamics <ul style="list-style-type: none"> • Streamline and turbulent flow • Equation of continuity for a steady, stream line flow • Bernoulli's principle (derivation of the equation is not expected) • Application of Bernoulli's principle • Situations that can be explained by Bernoulli's principle 	08

Competency	Competency Level	Content	No. of Periods
		Unit 3: Oscillations and Waves	(86 periods)
3. Uses the concepts and principles related to waves to broaden the range of sensitivity of human.	3.1 Analyzes oscillations on the basis of physics.	<ul style="list-style-type: none"> • Oscillations <ul style="list-style-type: none"> • Simple harmonic motion • Physical quantities related to simple harmonic motion <ul style="list-style-type: none"> • Amplitude • Frequency • Period • Energy • Characteristic equation of the simple harmonic motion $a = -\omega^2 x$ • Simple harmonic motion as a projection of a circular motion 	10

Competency	Competency Level	Content	No. of Periods
		<ul style="list-style-type: none"> • Phase of vibration • Phase difference • Equation of displacement $y = A \sin \omega t$ • Displacement – time graph corresponding to simple harmonic motion • Small oscillations of a simple pendulum • Determination of gravitational acceleration by using simple pendulum • Oscillations of a mass suspended by a light helical spring • Finding the relationship between the mass and the period of oscillation • Free vibrations • Damped vibrations • Forced vibrations • Resonance • Demonstration by Barton’s pendulums 	
	3.2 Investigates various types of wave – motions and their uses.	<ul style="list-style-type: none"> • Progressive waves <ul style="list-style-type: none"> • Mechanical waves <ul style="list-style-type: none"> • Demonstration of wave motion using slinky/CRO • Transverse waves • Longitudinal waves • Graphical representation of a wave • Points of the same phase and different phase • Physical quantities related to waves 	08

Competency	Competency Level	Content	No. of Periods
		<ul style="list-style-type: none"> • Speed of waves – v • Wavelength - λ • Frequency – f • Relationship between frequency, wavelength and speed $v = f\lambda$ 	
	3.3 Investigates the uses of waves on the basis of their properties.	<ul style="list-style-type: none"> • Properties of waves <ul style="list-style-type: none"> • Demonstration of properties of waves by ripple tank • Reflection <ul style="list-style-type: none"> • Rigid reflection • Soft reflection • Refraction • Wavelength and speed of waves in different media • Diffraction (qualitatively) • Polarization (qualitatively) • Principle of superposition of waves (graphical representation) <ul style="list-style-type: none"> • Interference • Stationary waves • Beats <ul style="list-style-type: none"> • $f_b = f_1 - f_2$ and uses (derivation is not necessary) • Comparison of stationary waves and progressive waves 	10
	3.4 Uses the modes of vibration of strings and rods by manipulating variables.	<ul style="list-style-type: none"> • Waves in strings and rods • Stationary waves in a stretched string <ul style="list-style-type: none"> • Speed of transverse waves $v = \sqrt{\frac{T}{m}}$ • Modes of vibrations in a stretched string 	12

Competency	Competency Level	Content	No. of Periods
		<ul style="list-style-type: none"> • Fundamental tone $f_o = \frac{1}{2l} \sqrt{\frac{T}{m}}$ • Overtones and harmonics • Sonometer <ul style="list-style-type: none"> • Finding the frequency of a tuning fork • Finding the relationship between vibrating length and frequency • Longitudinal waves in a rod <ul style="list-style-type: none"> • Speed of longitudinal waves $v = \sqrt{\frac{E}{\rho}}$ • Fundamental vibration <ul style="list-style-type: none"> • Vibration with one end clamped • Vibration with clamping in the middle • Seismic waves, Richter scale and Tsunami (qualitatively) 	
	3.5 Uses the vibrations in air columns by manipulating the variables.	<ul style="list-style-type: none"> • Waves in gases <ul style="list-style-type: none"> • Speed of sound in air $v = \sqrt{\frac{\gamma P}{\rho}}$ • $v = \sqrt{\frac{\gamma RT}{M}}$ • Factors affecting the speed of sound in air • Modes of vibrations in air column 	10

Competency	Competency Level	Content	No. of Periods
		<ul style="list-style-type: none"> • Closed tube • Open tube • Determination of the speed of sound in air using a closed tube <ul style="list-style-type: none"> • by one tuning fork • by a set of tuning forks (graphical method) 	
	3.6 Inquires about the uses of Doppler effect.	<ul style="list-style-type: none"> • Doppler effect <ul style="list-style-type: none"> • Equations for apparent frequency <ul style="list-style-type: none"> • Only the observer is moving • Only the source is moving • Both observer and source are moving along the same line • Applications and explanations of phenomena using Doppler effect • Sonic boom (qualitatively; equations are not necessary) 	04
	3.7 Produces and propagates sound by considering characteristics of sound.	<ul style="list-style-type: none"> • Nature of sound <ul style="list-style-type: none"> • Characteristics of sound <ul style="list-style-type: none"> • Pitch • Loudness • Quality of sound • Intensity and intensity level of sound (decibel) • Graph of intensity level versus the frequency for human ear <ul style="list-style-type: none"> • Limits of hearing 	08

Competency	Competency Level	Content	No. of Periods
		<ul style="list-style-type: none"> • Threshold of hearing • Threshold of pain • Ultrasonic and infrasonic (qualitatively) 	
	3.8 Inquires about electromagnetic waves.	<ul style="list-style-type: none"> • Electromagnetic waves <ul style="list-style-type: none"> • Electromagnetic spectrum • Properties of electromagnetic waves • Speed of electromagnetic waves • Uses of electromagnetic waves • LASER beams (production methods are not necessary) <ul style="list-style-type: none"> • Properties • Uses 	04
	3.9 Applies the principles of refraction of light for daily pursuits.	<ul style="list-style-type: none"> • Geometrical optics <ul style="list-style-type: none"> • Refraction <ul style="list-style-type: none"> • Laws of refraction • Refractive index • Relationships between refractive indices • Real depth and apparent depth 	12

Competency	Competency Level	Content	No. of Periods
		<ul style="list-style-type: none"> • Apparent displacement $d = t(1 - \frac{1}{n})$ • Finding refractive index using travelling microscope • Critical angle • Relationship between the critical angle and the refractive index $n = \frac{1}{\sin c}$ • Total internal reflection • Refraction through a prism • Experimental investigation of deviation through prism <ul style="list-style-type: none"> • Deviation • $d - i$ graph • minimum deviation • Derivation of $n = \frac{\sin(A+D)/2}{\sin A/2}$ for minimum deviation • Finding the refractive index of the prism material by critical angle method • Spectrometer <ul style="list-style-type: none"> • Main adjustments of the spectrometer • Finding the angle of prism • Finding the angle of minimum deviation • Refraction through lenses <ul style="list-style-type: none"> • Location of real and virtual images and determination of focal lengths of lenses <ul style="list-style-type: none"> • Experimental method • Ray diagrams • Lens formula 	

Competency	Competency Level	Content	No. of Periods
		<ul style="list-style-type: none"> • Sign convention • Derivation by geometrical method • Linear magnification • Power of a lens (+ converging, - diverging) • Combinations of thin lenses in contact 	
	3.10 Applies the knowledge of images formed by lenses for the correction of defects of vision appropriately.	<ul style="list-style-type: none"> • Human eye <ul style="list-style-type: none"> • Formation of an image • Defects of vision and correction <ul style="list-style-type: none"> • Short sight (myopia) • Long sight (hypermetropia) • Presbyopia 	04
	3.11 Applies the knowledge of the images formed by lenses in using the optical instruments appropriately.	<ul style="list-style-type: none"> • Optical instruments <ul style="list-style-type: none"> • Simple microscope <ul style="list-style-type: none"> • Normal adjustment • Magnifying power (Angular magnification) • Compound microscope <ul style="list-style-type: none"> • Normal adjustment • Magnifying power (Angular magnification) 	04
Unit 4: Thermal Physics			(46 periods)
		<ul style="list-style-type: none"> • Normal adjustment • Magnifying power (Angular magnification) • Instances where microscope and telescopes are not in normal adjustment (only the ray diagram) 	
4. Uses the knowledge of heat to fulfil human needs	4.1 Measures temperature correctly by selecting appropriate	<ul style="list-style-type: none"> • Temperature <ul style="list-style-type: none"> • Thermal equilibrium • Zeroth law of thermodynamics • Thermometric properties 	04

Competency	Competency Level	Content	No. of Periods
<p>and for scientific work productively.</p>	<p>thermometer according to the need.</p>	<ul style="list-style-type: none"> • Thermometric substances • Expression for temperature based on two fixed points $\theta = \frac{x_{\theta} - x_L}{x_H - x_L} (\theta_H - \theta_L) + \theta_L$ • Celsius scale • Absolute scale (Thermodynamic scale) • Triple point of water • Expression for absolute temperature based on triple point of water $T = \frac{X_T}{X_{tr}} \times 273.16$ • Absolute zero • Relationship between Celsius and absolute scale $T = \theta + 273.15$ • Thermometers <ul style="list-style-type: none"> • Liquid - glass thermometers <ul style="list-style-type: none"> • Mercury-glass thermometer • Thermocouple • Thermistors (Introduction as a temperature sensor) 	

Competency	Competency Level	Content	No. of Periods
	4.2 Inquires about the instances where the expansion of solids and liquids are used.	<ul style="list-style-type: none"> • Thermal expansion <ul style="list-style-type: none"> • Expansion of solids <ul style="list-style-type: none"> • Linear expansion • Area expansion • Volume expansion • Relationship between linear, area and volume expansivities • Expansion of liquids <ul style="list-style-type: none"> • Real expansion • Apparent expansion • $\gamma_{absolute} = \gamma_{apparent} + 3\alpha$ • Variation of density with temperature • Anomalous expansion of water • Uses of expansion of solids and liquids 	06
	4.3 Investigates the behavior of gases using gas laws.	<ul style="list-style-type: none"> • Gas laws <ul style="list-style-type: none"> • Boyle's law <ul style="list-style-type: none"> • Finding atmospheric pressure using quill tube • Charles's law <ul style="list-style-type: none"> • Investigation of relationship between gas volume and temperature at constant pressure • Pressure law <ul style="list-style-type: none"> • Investigation of relationship between gas pressure and temperature at constant volume • Ideal gas equation • Dalton's law of partial pressure 	08

Competency	Competency Level	Content	No. of Periods
	4.4 Inquires about the pressure exerted by a gas on its container using kinetic theory of gases.	<ul style="list-style-type: none"> • Kinetic theory of gases <ul style="list-style-type: none"> • Elementary assumptions of the kinetic theory • Explanation of the pressure exerted by a gas • Equation of kinetic theory, $PV = \frac{1}{3}Nm\overline{c^2}$ (Derivation is not necessary) • Distribution of molecular speeds at different temperatures (graphical representation) • Expression for mean translational kinetic energy of air Molecule, $E = \frac{3}{2}kT$ 	04
	4.5 Quantifies the amount of heat exchange among the objects using the specific heat capacity of substances.	<ul style="list-style-type: none"> • Heat exchange <ul style="list-style-type: none"> • Heat capacity • Specific heat capacity of solids and liquids • Molar heat capacity of gases • Determination of specific heat capacities of solids and liquids by the method of mixtures • Newton's law of cooling • Comparison of specific heat capacities of liquids by the method of cooling 	06

Competency	Competency Level	Content	No. of Periods
	4.6 Inquires about the productive use of the heat exchange during the change in state of matter.	<ul style="list-style-type: none"> • Changes of state <ul style="list-style-type: none"> • State of matter <ul style="list-style-type: none"> • Qualitative molecular account of the difference between solids, liquids and gases • Simple explanation of the molecular processes in fusion and evaporation • Fusion <ul style="list-style-type: none"> • State changing curve • Specific latent heat of fusion • Determination of specific latent heat of fusion of ice (method of mixtures) • Vapourization <ul style="list-style-type: none"> • State changing curve • Specific latent heat of vapourization • Determination of specific latent heat of vapourization of water (method of mixtures) • Effect of pressure on boiling point and melting point 	06
	4.7 Relates the effect of water vapour on weather.	<ul style="list-style-type: none"> • Vapour and humidity <ul style="list-style-type: none"> • Evaporation • Comparison of evaporation and vapourization • Vapour pressure and saturated vapour pressure • Variation of vapour pressure with temperature(graphical representation) • Variation of vapour pressure with volume (graphical representation) • Boiling point and saturated vapour pressure 	04

Competency	Competency Level	Content	No. of Periods
		<ul style="list-style-type: none"> • Dew point • Absolute humidity • Relative humidity <ul style="list-style-type: none"> • Determination of relative humidity using polished calorimeter 	
	4.8 Uses laws of thermodynamics to analyze the various thermodynamic processes.	<ul style="list-style-type: none"> • Thermodynamics <ul style="list-style-type: none"> • Explanation of heat as a state of transfer of energy • Internal energy • First law of thermodynamics $\Delta Q = \Delta U + \Delta W$ • Special instances where the first law of thermodynamics is applicable <ul style="list-style-type: none"> • Isothermal processes • Adiabatic processes • Constant volume processes • Constant pressure processes • Pressure – volume curves for an ideal gas • Cyclic processes 	04
	4.9 Designs daily and scientific work by considering the methods and amount of transfer of heat.	<ul style="list-style-type: none"> • Transfer of heat <ul style="list-style-type: none"> • Conduction <ul style="list-style-type: none"> • Thermal conductivity • Equation for the rate of conduction of heat • Determination of thermal conductivity <ul style="list-style-type: none"> • Searle's method (for a metal) • Convection (qualitatively) • Radiation (qualitatively) 	04

Competency	Competency Level	Content	No. of Periods
3.2 - Grade 13			
		Unit 5: Gravitational Field	(12 periods)
5. Uses laws and principles of gravitational field to be productive in daily pursuits and scientific work.	5.1 Analyses the effect of gravitational field on objects using Newton's law of gravitation.	<ul style="list-style-type: none"> • Gravitational force field <ul style="list-style-type: none"> • Action of a force on a mass in the gravitational field • Gravitational field intensity • Newton's law of gravitation • Field intensity at a point away from a point mass • Field intensity at a point outside a spherical mass • Graphical representation of the variation of field intensity • Gravitational potential • Expression for gravitational potential at a point distance r from a mass $m, V = -\frac{Gm}{r}$ (derivation is not necessary) • Potential energy of a mass in a gravitational field • Graphical representation of the variation of potential with distance • Expression for the energy of a mass m moving on a circular path of radius r taking centre as the centre of a spherical mass M (Energy equation) 	06

Competency	Competency Level	Content	No. of Periods
	5.2 Inquires about the instances of using the knowledge on earth's gravitational field to fulfil human activities.	<ul style="list-style-type: none"> • Earth's gravitational field <ul style="list-style-type: none"> • Gravitational field intensity near the earth surface • Relationship between the acceleration due to gravity and gravitational field intensity • Earth satellites • Geostationary satellites • Escape velocity <p style="text-align: center;">Unit 6: Electrostatic Field</p>	06 (30 periods)
6. Uses laws and principles of electrostatic field for scientific work and daily pursuits effectively.	6.1 Uses the laws related to electrostatic field appropriately to find the distribution and magnitude of electrostatic field produced by various charged objects.	<ul style="list-style-type: none"> • Electrostatic force <ul style="list-style-type: none"> • Investigation of behavior of charges using the gold leaf electroscope • Lines of force in various electric fields <ul style="list-style-type: none"> • Around a point charge • Around two point charges • Between two charged parallel plates • Force on a charge in an electrostatic field • Electric field intensity • Coulomb's law • Field intensity of a point at some distance from a point charge • Graphical representation of the variation of field intensity 	08
	6.2 Quantifies the electrostatic field using the flux model.	<ul style="list-style-type: none"> • Flux model <ul style="list-style-type: none"> • Electric flux and lines of flux • Gauss's theorem • Finding electrostatic field intensities using Gauss's theorem <ul style="list-style-type: none"> • Around a point charge 	08

Competency	Competency Level	Content	No. of Periods
		<ul style="list-style-type: none"> • Near an infinite charge plate • Around a charged conducting sphere <ul style="list-style-type: none"> • Outside the sphere • On the surface of the sphere • Inside the sphere • Around a non-conducting uniformly charged sphere <ul style="list-style-type: none"> • Outside the sphere • On the surface of the sphere • Inside the sphere • Graphical representation of the variation of field intensity with the distance from the centre of the sphere • Field intensity at a distance r from an infinite long charged thin wire 	
	6.3 Quantifies the potential energy of charges placed in an electrostatic field.	<ul style="list-style-type: none"> • Electric potential <ul style="list-style-type: none"> • Definition of potential at a point in an electrostatic field • Potential at a point due to a point charge, $V = \frac{1}{4\pi\epsilon} \frac{Q}{r}$ (derivation is not necessary) • Potential at a point due to distribution of point charges • Potential difference between two points • Potential energy of a charge in an electric field • Potential energy of a system with charge distribution • Work done in moving a charge across a potential difference • Equipotential surfaces <ul style="list-style-type: none"> • Equipotential surfaces in different fields <ul style="list-style-type: none"> • Near a point charge • Near like point charges • Near unlike point charges 	08

Competency	Competency Level	Content	No. of Periods
		<ul style="list-style-type: none"> • Potential gradient • Relationship between potential gradient and electric field intensity 	
	6.4 Uses capacitors appropriately in electrical circuits.	<ul style="list-style-type: none"> • Electric capacity (capacitance) <ul style="list-style-type: none"> • Definition of capacity • Parallel plate capacitors • Derivation of the equation $c = \frac{k\epsilon_0 A}{d}$ • Capacitance of a spherical conductor (spherical capacitors are not included) • Combination of capacitors <ul style="list-style-type: none"> • Series combination • Parallel combination 	06

Competency	Competency Level	Content	No. of Periods
		<ul style="list-style-type: none"> • Energy stored in a charged capacitor • Derivation of expression for energy • Distribution of charges on conductors having different shapes <ul style="list-style-type: none"> • Point discharge (corona discharge) • Action of lightning conductor (Action of points related to lightning strikes only) <p style="text-align: center;">Unit 7: Current Electricity</p> <p style="text-align: right;">(42 periods)</p>	
<p>7. Uses the laws principles and effects of current electricity productively and appropriately.</p>	<p>7.1 Manipulates the physical quantities related to current electricity wherever appropriate.</p>	<ul style="list-style-type: none"> • Fundamental concepts <ul style="list-style-type: none"> • Electric charges and electric current $I = \frac{Q}{t}$ • Mechanism of conduction of electricity through a metallic conductor • Expression for the drift velocity • Current density • Potential difference • Resistance and resistivity $R = \rho \frac{l}{A}$ • Conductivity • Variation of resistance with temperature (temperature coefficient of resistance) • Superconductivity 	08

Competency	Competency Level	Content	No. of Periods
		<ul style="list-style-type: none"> • Behavior of superconductors • Super conducting materials • Properties of superconductors • Uses of superconductors • Combination of resistors <ul style="list-style-type: none"> • Series connection • Parallel connection • Equivalent resistance of simple networks • Potential divider circuit • Ohm's law <ul style="list-style-type: none"> • Conditions for validity of Ohm's law • V-I curves • Ohmic conductors • Non-ohmic conductors 	
	7.2 Quantifies the energy and power in direct current (dc) circuits.	<ul style="list-style-type: none"> • Energy and power <ul style="list-style-type: none"> • Expression for energy dissipated due to flow of charges $W = QV$ and $W = VI t$ • Expression for rate of dissipation of energy $P = VI$ • Obtaining $P = I^2 R$, $P = \frac{V^2}{R}$ and 	04

Competency	Competency Level	Content	No. of Periods
		$W = I^2 R t, W = \frac{V^2}{R} t$ <ul style="list-style-type: none"> • Application of $P = VI$ and $W = VI t$ for any electrical appliance • Application of $P = I^2 R, P = \frac{V^2}{R}, W = I^2 R t$ and $W = \frac{V^2}{R} t$ for appliances producing heat only (Joule heating) 	
	7.3 Inquires the power supply of an electric circuit quantitatively.	<ul style="list-style-type: none"> • Electromotive force <ul style="list-style-type: none"> • Formation of potential difference between plates of a simple cell • Direction of conventional electric current • Transformation of different forms of energy in various sources of electromotive force • Definition of electro motive force • Introduction of internal resistance • Application of the law of conservation of energy to a circuit • having a source of electromotive force • Expression $V = E - Ir$ for the potential difference between the terminals of a cell in a closed circuit • Determination of e.m.f. and internal resistance of a cell (graphical method) • Combination of sources of electromotive force <ul style="list-style-type: none"> • Series connection • Parallel connection of identical sources • Graphical representation between resistance and power • Condition for maximum power transfer (derivation is not necessary) 	06

Competency	Competency Level	Content	No. of Periods
	7.4 Uses the laws and principles related to current electricity for designing circuits.	<ul style="list-style-type: none"> • Electric circuits <ul style="list-style-type: none"> • Kirchoff's laws <ul style="list-style-type: none"> • First law (conservation of charges) • Second law (conservation of energy) • Wheatstone bridge <ul style="list-style-type: none"> • Relationship among resistances for balance conditions • Metre bridge <ul style="list-style-type: none"> • Facts to be considered in using meter bridge • Comparison of resistances • Finding temperature coefficient of resistance 	10
	7.5 Selects suitable instruments according to the quantity to be measured and uses electrical measuring instruments accurately and protectively.	<ul style="list-style-type: none"> • Electrical measuring instruments based on moving coil galvanometer <ul style="list-style-type: none"> • Ammeter <ul style="list-style-type: none"> • Arrangement • Properties of an ideal ammeter • Changing the range of an ammeter • Voltmeter <ul style="list-style-type: none"> • Arrangement • Properties of an ideal voltmeter • Changing the range of a voltmeter • Ohm – meter <ul style="list-style-type: none"> • Arrangement • Multi-meter 	04
	7.6 Uses potentiometer by setting up the circuit appropriately.	<ul style="list-style-type: none"> • Potentiometer <ul style="list-style-type: none"> • Principle of potentiometer • Calibration of potentiometer • Facts to be considered in using potentiometer • Uses of potentiometer 	

Competency	Competency Level	Content	No. of Periods
		<ul style="list-style-type: none"> • Comparison of electromotive forces • Comparison of resistances • Determination of internal resistance of a cell • Determination of very small electromotive forces • Advantages and disadvantage of using potentiometer 	10
8. Uses the effects of inter-		<p style="text-align: center;">Unit 8: Electromagnetism</p> <ul style="list-style-type: none"> • Magnetic force • Force acting on a current carrying conductor placed in a 	10

(34 periods)

Competency	Competency Level	Content	No. of Periods
relationships between electricity and magnetism for scientific work and daily pursuits.	the force acting on a current carrying conductor and moving charge placed in a magnetic field.	magnetic field <ul style="list-style-type: none"> • Demonstrating the nature of electromagnetic force using current balance • Expression for the magnitude of force • Magnetic flux density • Fleming's left hand rule • Force acting on a charge moving in a magnetic field <ul style="list-style-type: none"> • Magnitude of the force • Direction of the force • Hall effect <ul style="list-style-type: none"> • Qualitative explanation • Derivation an expression for Hall voltage • Applications of Hall effect 	
	8.2 Constructs magnetic fields by manipulating variables for the needs.	<ul style="list-style-type: none"> • Magnetic force field <ul style="list-style-type: none"> • Biot –Savart law • Magnetic flux density near a current carrying infinitely long straight conductor (derivation is not necessary) • Magnetic flux density at the centre of a current carrying circular coil • Magnetic flux density near the axis of a current carrying long solenoid (derivation is not necessary) • Magnitude of the force between two current carrying 	06

Competency	Competency Level	Content	No. of Periods
		infinitely long parallel conductors <ul style="list-style-type: none"> • Definition of Ampere 	
	8.3 Inquires the rotational effect due to the inter-relationship of electricity and magnetism.	<ul style="list-style-type: none"> • Torque acting on a current loop <ul style="list-style-type: none"> • Rectangular coil placed in a uniform magnetic field • Rectangular coil placed in a radial magnetic field • Moving coil galvanometer <ul style="list-style-type: none"> • Expression for deflection • Factors affecting the current sensitivity • Direct current motor 	06
	8.4 Uses the laws and rules in electromagnetic induction for technical needs.	<ul style="list-style-type: none"> • Electromagnetic induction <ul style="list-style-type: none"> • Laws of electromagnetic induction <ul style="list-style-type: none"> • Faraday's law • Lenz's law • Demonstrating the laws of electromagnetic induction • Electromotive force induced in a straight rod moving in a magnetic field <ul style="list-style-type: none"> • Expression for induced electromotive force • Fleming's right hand rule • Electromotive force induced in a rod rotating in a magnetic field • Electromotive force induced in a disc rotating in a magnetic field • Electromotive force induced in a rectangular coil rotating in a magnetic field and expression for maximum value • Alternating current generator <ul style="list-style-type: none"> • Arrangement • Graphical representation of the variation of electromotive force with time • Direct current generator <ul style="list-style-type: none"> • Arrangement • Graphical representation of the variation of electromotive force with 	12

Competency	Competency Level	Content	No. of Periods
		<p style="text-align: center;">time</p> <ul style="list-style-type: none"> • Eddy currents and uses • Back e.m.f. of an electric motor • Effect of the back e.m.f. on the armature current • Controlling the initial current – starter switch • Transformers <ul style="list-style-type: none"> • Structure • Relationship between the number of turns and the voltages of primary and secondary • Step-down and step-up transformers • The product VI, as input / output power of a transformer • Energy loss in a transformer <ul style="list-style-type: none"> • Loss due to Joule heating • Loss due to eddy current • Uses of transformers • Transmission of electric power • Elements of alternating current <ul style="list-style-type: none"> • Sinusoidal voltage and current wave forms from an ac source • Peak value and rms value • Average power in watts in a resistive circuit <p style="text-align: center;">Unit 9: Electronics</p> <p style="text-align: right;">(30 periods)</p>	
9. Uses electronic	9.1 Inquires about the	<ul style="list-style-type: none"> • Junction diode 	06

Competency	Competency Level	Content	No. of Periods
<p>circuits to fulfil human needs efficiently.</p>	<p>principle of action of semiconductor diode.</p>	<ul style="list-style-type: none"> • Intrinsic semiconductors • Extrinsic semiconductors <ul style="list-style-type: none"> • <i>n</i> – type • <i>p</i>- type • <i>p-n</i> junction <ul style="list-style-type: none"> • Depletion layer • Forward bias • Reverse bias • Characteristic of a diode <ul style="list-style-type: none"> • <i>I-V</i> curve of ideal diode • <i>I-V</i> curve of practical diode • Uses of diode as a rectifier <ul style="list-style-type: none"> • Half wave rectification • Full wave rectification • Smoothing • Demonstration of rectification using CRO • Diode as a switch • Other types of diodes <ul style="list-style-type: none"> • Zener diode <ul style="list-style-type: none"> • Voltage regulation of Zener diode • Light emitting diode(LED) • Photo diode 	

Competency	Competency Level	Content	No. of Periods
	9.2 Uses the action of transistor for practical needs.	<ul style="list-style-type: none"> • Transistor <ul style="list-style-type: none"> • Bipolar transistor <ul style="list-style-type: none"> • Structure and circuit symbol of <i>npn</i> and <i>pnp</i> transistors • <i>npn</i> transistor circuits <ul style="list-style-type: none"> • Action of a transistor • Circuit configuration <ul style="list-style-type: none"> • Common – base • Common – emitter • Common – collector • Investigating the characteristics of common emitter configuration of a transistor <ul style="list-style-type: none"> • Input characteristic • Output characteristic • Transfer characteristic • Biasing a transistor • Common emitter transistor amplifier <ul style="list-style-type: none"> • Current amplification • Voltage amplification • Common emitter transistor switch • Unipolar transistors <ul style="list-style-type: none"> • Field effect transistor (FET) <ul style="list-style-type: none"> • Structure and circuit symbol of <i>n</i>-channel and <i>p</i>-channel FETs 	12

Competency	Competency Level	Content	No. of Periods
		<ul style="list-style-type: none"> Action of an <i>n</i>-channel FET <ul style="list-style-type: none"> Characteristics Voltage amplification using an FET (qualitatively) 	
	9.3 Investigates on the uses of operational amplifier.	<ul style="list-style-type: none"> Operational amplifier <ul style="list-style-type: none"> Operational amplifier as an integrated circuit (IC) Identification of pins Action of operational amplifier Characteristics of the open loop state Uses of operational amplifier as a voltage amplifier <ul style="list-style-type: none"> Close loop state (negative feedback) Golden rules I and II Inverting amplifier Non-inverting amplifier Uses of operational amplifier as a voltage comparator 	06
	9.4 Uses logic gates to control the action of digital circuits.	<ul style="list-style-type: none"> Digital electronics <ul style="list-style-type: none"> Boolean expressions and truth tables of logic gates <ul style="list-style-type: none"> AND gate OR gate NOT gate NAND gate NOR gate EXOR gate EXNOR gate Investigating the truth tables of basic logic gates Logic expressions for simple digital circuits (maximum of three) 	06

Unit 10: Mechanical Properties of Matter

Competency	Competency Level	Content	No. of Periods
		inputs) <ul style="list-style-type: none"> • Converting a given logic expression to a logic gate circuit • Logic expression for a truth table • Designing simple logic circuits • Electronic memory <ul style="list-style-type: none"> • Single memory element with NAND/NOR gates <ul style="list-style-type: none"> • Basic SR flip-flop (Bistable) 	(32 periods)
10 Applies the knowledge on mechanical properties of matter quantitatively in scientific activities and daily pursuits.	10.1 Selects relevant materials for day – today needs in life using the knowledge about elasticity.	<ul style="list-style-type: none"> • Elasticity of solids <ul style="list-style-type: none"> • Tension and extension • Load-extension graph • Hooke's Law • Tensile stress • Tensile strain • Young's modulus • Determination of Young's modulus of a metal using a wire • Stress-strain graph • Energy stored in a stretched string 	10

Competency	Competency Level	Content	No. of Periods
	10.2 Uses the knowledge on viscosity in scientific work and daily pursuits.	<ul style="list-style-type: none"> • Viscosity <ul style="list-style-type: none"> • Viscous force <ul style="list-style-type: none"> • Factors affecting viscous force • Velocity gradient • Tangential stress (F/A) • Coefficient of viscosity • Poiseuille's formula for a fluid flow <ul style="list-style-type: none"> • Conditions of validity • Correctness of the formula through dimensional analysis • Determination of coefficient of viscosity by using Poiseuille's formula • Motion of an object through viscous media <ul style="list-style-type: none"> • Forces acting on an object • Terminal velocity using $v-t$ graph • Stokes' law 	10

Competency	Competency Level	Content	No. of Periods
		<ul style="list-style-type: none"> • Condition of validity • Correctness of formula through dimensional analysis • Derivation of expressions for terminal velocity <ul style="list-style-type: none"> • Object moving upwards • Object moving downwards • Comparison of coefficient of viscosity for different fluids • Variation of viscosity with temperature • Uses of viscosity 	
	<p>10.3 Uses the knowledge on surface tension to explain the natural phenomena and to fulfil the daily pursuits.</p>	<ul style="list-style-type: none"> • Surface tension <ul style="list-style-type: none"> • Demonstrating the nature of the free surface of a liquid with examples • Explaining the behavior of free surface of a liquid using inter-molecular forces • Definition of surface tension • Angle of contact • Relationship between nature of the liquid meniscus and the angle of contact • Free surface energy • Expression for the work done in increasing the surface area of a liquid film isothermally • Relationship between surface energy and surface tension • Expression for pressure difference across a spherical meniscus • Capillary rise 	12

Competency	Competency Level	Content	No. of Periods
		<ul style="list-style-type: none"> • Expression for capillary rise • Determination of surface tension <ul style="list-style-type: none"> • using a microscope slide • using a soap film on a frame • capillary rise method • Jaegar's method <p style="text-align: center;">Unit 11: Matter and Radiation</p>	(22 periods)
11 Inquires the modern theories in physics.	11.1 Applies the quantum theories to explain the intensity distribution of black body radiation.	<ul style="list-style-type: none"> • Quantum nature of radiation <ul style="list-style-type: none"> • Black body radiation <ul style="list-style-type: none"> • Stefan's law • Modification of the Stefan's law for non-black bodies • Graphs between intensity of radiation and wavelength <ul style="list-style-type: none"> • Wien's displacement law • Failure of the classical physics to explain the distribution of intensity of radiation • Planck's hypotheses • Explaining the black body radiation considering energy quanta and energy levels 	04
	11.2 Applies the quantum theories to explain	<ul style="list-style-type: none"> • Photoelectric effect <ul style="list-style-type: none"> • Threshold frequency 	04

Competency	Competency Level	Content	No. of Periods
	the photoelectric effect.	<ul style="list-style-type: none"> • I-V graph • Stopping potential • Graph of frequency against stopping potential • Graphs for different metals • Failure of the classical physics to explain photoelectric effect • Hypotheses put forward by Einstein to explain the photoelectric effect • Explaining photoelectric effect considering energy quanta (photon) • Einstein's photoelectric effect equation • Work function • Maximum kinetic energy • Relationship between work function and threshold frequency • Relationship between stopping potential and maximum kinetic energy 	
	11.3 Inquires about wave - particle duality.	<ul style="list-style-type: none"> • Wave nature of matter • Evidences about wave nature of matter • de Broglie wave length for matter waves • Principle of electron microscope 	02
	11.4 Uses X – rays to fulfil human needs.	<ul style="list-style-type: none"> • X – rays • Production of X – rays • Properties of X – rays • Uses of X – rays 	02
	11.5 Inquires about radioactivity to fulfil	<ul style="list-style-type: none"> • Radioactivity • Natural radioactive decay 	06

Competency	Competency Level	Content	No. of Periods
	human needs.	<ul style="list-style-type: none"> • Emission of α particles • Emission of β particles • Emission of γ rays • Radioactive disintegration law <ul style="list-style-type: none"> • Graphical representation • Decay constant • Activity • Half life • Uses of radioactivity <ul style="list-style-type: none"> • Radioactive dating • In medicine, engineering and agriculture • Health hazards of radiation and safety precautions <ul style="list-style-type: none"> • Measurement of quantity of radiation <ul style="list-style-type: none"> • Radiation dose (Gy) • <i>RBE</i> (Relative Biological Effective) / Quality (<i>Q</i>) factor and Effective dose (Sv) • Health hazards <ul style="list-style-type: none"> • Nature of radiation • Area of the body which exposed to radiation • Effective dose • Safety precautions 	
	11.6 Inquires about the nuclear energy and its uses.	<ul style="list-style-type: none"> • Atomic nucleus <ul style="list-style-type: none"> • Stability of nucleus • Unified atomic mass unit • Mass defect • Einstein's mass – energy equation • Binding energy • Graphical representation between atomic number and binding energy of a nucleon 	04

Competency	Competency Level	Content	No. of Periods
		<ul style="list-style-type: none"> • Comparison of energy released in chemical reaction and nuclear reaction • Nuclear energy <ul style="list-style-type: none"> • Nuclear fission <ul style="list-style-type: none"> • Action of an atomic bomb • Action of a nuclear power station • Nuclear fusion <ul style="list-style-type: none"> • Conditions necessary for fusion reaction • Fusion reaction inside the sun • Attempt of using fusion reaction for producing energy 	

4.0 Learning-Teaching Strategies

Global trend in present day education is to introduce competency based curricula which promote collaborative learning through student centered activities where learning predominates over teaching. It is intended for the students to actively participate in activities which enhance the development of individual social and mental skills. Emphasis is made on the following aspects.

- It is advised to cover the content through 5E- model activities as far as possible.
- The teacher is advised to mention technological applications relevant to each topic.
- Allow the students to acquire hands on experience.

- Direct students to acquire knowledge and information through reliable sources wherever necessary.

5.0 School policy and programmes

- 1 The teacher has the liberty to follow any suitable teaching learning method to achieve the relevant learning outcomes.
- 2 It is expected that the theoretical components of each unit will be dealt with the relevant practical components, which are given in bold face letters.
- 3 Capacity of students should be enhanced through extra curricular activities, extensive use of supplementary reading materials and learning teaching aids including CAL (Computer Aided Learning) software.
- 4 With a view to extend learning beyond the class room work and to highlight the students' special abilities, it is expected to

involve students in co-curricular activities such as

- setting up school societies or clubs to pursue various aspects of Physics.
- field trips to industries and places where principles of Physics are used.
- organising school exhibitions and competitions.
- organising guest lectures on relevant topic by resource persons such as experts or professionals.
- producing school publications.
- organising events such as debates, science days etc.

- 5 School management is responsible in providing services within the school and from outside resources.
- 6 In order to develop school policy and programmes, in relation to Physics, it would be desirable to form a committee comprising of suitable teachers and students.
- 7 Most importantly, the school should serve as the role model to be followed by the students.
- 8 The school will develop its annual programmes, consisting of a variety of activities for achieving policy goals. In determining the activities to be undertaken during a particular year, the school will need to identify priorities and consider feasibility in relation to time and resource constraints.

6.0 Assessment and Evaluation

It is intended to implement this syllabus in schools with the School Based Assessment (SBA) process. Teachers will prepare creative teaching - learning instruments on the basis of school terms.

The details together with the format and the nature of questions will be introduced by the Department of Examination.