KOTHARI INTERNATIONAL SCHOOL

ACADEMIC PLAN

A LEVEL

SUBJECT: PHYSICS SESSION: 2023-24

NAME OF THE TEACHER: VIPIN KUMAR

MONTH	TOPIC	CONCEPT	LEARNING OBJECTIVES
MARCH (9 DAYS)	CIRCULAR MOTION	Describing circular motion Angles in radians Steady speed, changing velocity Angular speed Centripetal forces Calculating acceleration and force The origins of centripetal forces	In this chapter students will learn how to: Express angular displacement in radians. Solve problems using the concept of angular speed describe motion along a circular path as due to a perpendicular force that causes a centripetal acceleration. Recall and use equations for centripetal acceleration.
APRIL (18 DAYS)	GRAVITATIONAL FIELDS	Representing a gravitational field Gravitational field strength g Energy in a gravitational field Gravitational potential Orbiting under gravity The orbital period Orbiting the Earth	In this chapter you will learn how to: Describe a gravitational field as a field of force and define gravitational field strength g.

			Represent a gravitational field using field lines. **Understand the meaning of centre of mass and use the concept in problems involving uniform spheres.** **Recall and use Newton's law of gravitation.** **Solve problems involving the gravitational field strength of a uniform field and the field of a point mass understand how the gravitational potential energy,of two point masses is a consequence of gravitational potential define and solve problems involving gravitational potential.** **Analyse circular orbits in an inverse square law field, including geostationary orbits.**

	OSCILLATIONS	**Free and forced oscillations** **Observing oscillations** **Describing oscillations** **Simple harmonic motion** **Representing s.h.m. graphically** **Frequency and angular frequency** **Equations of s.h.m.** **Energy changes in s.h.m.** **Damped oscillations** **Resonance**	**In this chapter students will learn how to:** **Give examples of free and forced oscillations.** **Use appropriate terminology to describe oscillations.** **Use the equation $a = -\omega^2 x$ to define simple harmonic motion (s.h.m.).** **Recall and use equations for displacement and velocity in s.h.m.** **Draw and use graphical representations of s.h.m.** **describe energy changes during s.h.m.** **Recall and use , where E is the total energy of a system undergoing simple harmonic motion** **describe the effects of damping on oscillations and draw graphs showing these effects.**

			Understand that resonance involves a maximum amplitude of oscillation. **Understand that resonance occurs when an oscillating system is forced to oscillate at its natural frequency.**
	THERMAL PHYSICS	**Changes of state** **Energy changes** **Internal energy** **The meaning of temperature** **Thermometers** **Calculating energy changes**	**In this chapter students will learn how to:** **Relate a rise in temperature of an object to internal energy, the sum of the random distribution of kinetic and potential energies of the molecules in a system.** **Recall and use the first law of thermodynamics.** **Calculate the work done when the volume of a gas changes at constant pressure.** **Measure temperature using a physical property and state examples of such properties.**

			Use the thermodynamic scale of temperature, and understand that the lowest possible temperature is zero kelvin and that this is known as absolute zero. **Relate transfer of (thermal) energy as being due to a difference in temperature and understand thermal equilibrium.** **Define and use specific heat capacity and specific latent heat, and outline how these quantities can be measured.**
MAY **(18 DAYS)**	**IDEAL GASES**	**Particles of a gas** **Explaining pressure** **Measuring gases** **Boyle's law** **Changing temperature** **Ideal gas equation** **Modelling gases: the kinetic model** **Temperature and molecular kinetic energy**	**In this chapter students will learn how to:** **Measure amounts of a substance in moles and find the number of particles using molar quantities.** **Solve problems using the equation of state pV = nRT for an ideal gas.** **Deduce a relationship between pressure, volume and the microscopic**

			properties of the molecules of a gas, stating the assumptions of the kinetic theory of gases. **Relate the kinetic energy of the molecules of a gas to its temperature and calculate root-mean-square speeds.**
	UNIFORM ELECTRIC FIELDS	**Attraction and repulsion** **The concept of an electric field** **Electric field strength** **Force on a charge**	**In this chapter students will learn how to:** **Show an understanding of the concept of an electric field.** **Define electric field strength draw field lines to represent an electric field.** **Calculate the strength of a uniform electric field calculate the force on a charge in a uniform electric field.** **Describe how charged particles move in a uniform electric field.**

JUNE SUMMER VACATION			
JULY (20 DAYS)	COULOMB'S LAW	Electric fields Coulomb's law Electric field strength for a radial field Electric potential Gravitational and electric fields	In this chapter students will learn how to: Recall and use Coulomb's law. Calculate the field strength for a point charge. Recognise that for the electric field strength for a point outside a spherical conductor, the charge on the sphere may be considered to be a point charge at the centre of the sphere. Define electric potential calculate potential due to a point charge. Relate field strength to the potential gradient compare and contrast electric and gravitational fields.

	CAPACITANCE	**Capacitors in use** **Energy stored in a capacitor** **Capacitors in parallel** **Capacitors in series** **Comparing capacitors and resistors** **Capacitor networks** **Charge and discharge of capacitors**	**In this chapter students will learn how to:** **Define capacitance and state its unit, the farad** **solve problems involving charge, voltage and capacitance.** **Deduce the electric potential energy stored in a capacitor from a potential–charge graph.** **Deduce and use formulae for the energy stored by a capacitor.** **Derive and use formulae for capacitances in series and parallel.** **Recognise and use graphs showing variation of potential difference, current and charge as a capacitor discharges.** **Recall and use the time constant for a capacitor–resistor circuit.**

			Use the equation for the discharge of a capacitor through a resistor.
	MAGNETIC FIELDS AND ELECTROMAGNETISM	**Producing and representing magnetic fields** **Magnetic force** **Magnetic flux density** **Measuring magnetic flux density** **Currents crossing fields** **Forces between currents** **Relating SI units** **Comparing forces in magnetic, electric and gravitational fields**	**In this chapter students will learn how to:** **Describe a magnetic field as an example of a field of force caused by moving charges or permanent magnets.** **Use field lines to represent a field and sketch various patterns.** **Determine the size and direction of the force on a current-carrying conductor in a magnetic field.** **Define magnetic flux density and know how it can be measured.** **Explain the origin of the forces between current-carrying conductors and find the direction of these forces.**

AUGUST (19 DAYS)	**MOTION OF CHARGED PARTICLES**	**Observing the force** **Orbiting charged particles** **Electric and magnetic fields** **The Hall effect** **Discovering the electron**	**In this chapter you will learn how to:** **Determine the direction of the force on a charge moving in a magnetic field recall and use F = BQv sinθ.** **Describe the motion of a charged particle moving in a uniform magnetic field perpendicular to the direction of motion of the particle.** **Explain how electric and magnetic fields can be used in velocity selection understand the origin of the Hall voltage and derive and use the expression.** **Understand the use of a Hall probe to measure magnetic flux density.**
	ELECTROMAGNETIC INDUCTION	**Observing induction** **Explaining electromagnetic induction**	**In this chapter you will learn how to:**

		Faraday's law of electromagnetic induction Lenz's law Everyday examples of electromagnetic induction	**Define magnetic flux as the product of the magnetic flux density and the cross-sectional area perpendicular to the direction of the magnetic flux density. Recall and use understand and use the concept of magnetic flux linkage. Understand and explain experiments that demonstrate: that a changing magnetic flux can induce an e.m.f. in a circuit that the direction of the induced e.m.f. opposes the change producing it the factors affecting the magnitude of the induced e.m.f. Recall and use Faraday's and Lenz's laws of electromagnetic induction.**

	ALTERNATING CURRENTS	**Sinusoidal current** **Alternating voltages** **Power and alternating current** **Rectification**	**In this chapter you will learn how to:** **Understand and use the terms period, frequency and peak value as applied to an alternating current or voltage use equations of the form x = x0 sin ωt representing a sinusoidally alternating current or voltage.** **Recall and use the fact that the mean power in a resistive load is half the maximum power for a sinusoidal alternating current.** **Distinguish between root-mean-square (r.m.s.) and peak values and recall and use and for a sinusoidal alternating current.** **Distinguish graphically between half-wave and full-wave rectification explain the use of a single diode for the half-wave rectification of an alternating current.**

			Explain the use of four diodes (bridge rectifier) for the full-wave rectification of an alternating current **Analyse the effect of a single capacitor in smoothing, including the effect of the value of capacitance and the load resistance.**
SEPTEMBER **(22 DAYS)**	**QUANTUM PHYSICS AND** **REVISION**	**Modelling with particles and waves** **Particulate nature of light** **The photoelectric effect** **Threshold frequency and wavelength** **Photons have momentum too** **Line spectra** **Explaining the origin of line spectra** **Photon energies** **The nature of light: waves or particles?** **Electron waves** **Revisiting photons**	**In this chapter you will learn how to:** **Understand that electromagnetic radiation has a particulate nature understand that a photon is a quantum of electromagnetic energy recall and use E = hf.** **Use the electronvolt (eV) as a unit of energy.** **Understand that a photon has momentum and that the momentum is given by understand that photoelectrons may be emitted from a metal**

			surface when it is illuminated by electromagnetic radiation. **Understand and use the terms threshold frequency and threshold wavelength explain photoelectric emission in terms of photon energy and work function energy.** **Recall and use explain why the maximum kinetic energy of photoelectrons is independent of intensity, whereas the photoelectric current is proportional to intensity understand that the photoelectric effect provides evidence for a particulate nature of electromagnetic radiation, while phenomena such as interference and diffraction provide evidence for a wave nature.** **Describe and interpret qualitatively the evidence**

			provided by electron diffraction for the wave nature of particles understand the de Broglie wavelength as the wavelength associated with a moving particle. Recall and use understand that there are discrete electron energy levels in isolated atoms (such as atomic hydrogen). Understand the appearance and formation of emission and absorption line spectra.
OCTOBER (13 DAYS)	NUCLEAR PHYSICS	Balanced equations Mass and energy Energy released in radioactive decay Binding energy and stability Randomness and radioactive decay The mathematics of radioactive decay Decay graphs and equations Decay constant λ and half-life t1⁄2	In this chapter you will learn how to: Understand the equivalence between energy and mass as represented by $E = mc^2$ and recall and use this equation. Represent simple nuclear reactions by nuclear equations.

			Define and use the terms mass defect and binding energy. **Sketch the variation of binding energy per nucleon with nucleon number explain what is meant by nuclear fusion and nuclear fission.** **Explain the relevance of binding energy per nucleon to nuclear reactions, including nuclear fusion and nuclear fission calculate the energy released in nuclear reactions using $E = \Delta mc^2$.** **Understand that fluctuations in count rate provide evidence for the random nature of radioactive decay.** **Understand that radioactive decay is both spontaneous and random.** **Define activity and decay constant, and recall and use $A = \lambda N$.**

			Define half-life . **Understand the exponential nature of radioactive decay, and sketch and use the relationship $x = x_0e^{-\lambda\tau}$, where x could represent activity, number of undecayed nuclei or received count rate.**
	MEDICAL IMAGING	**The nature and production of X-rays** **X-ray attenuation** **Improving X-ray images** **Computerised axial tomography** **Using ultrasound in medicine** **Echo sounding** **Ultrasound scanning** **Positron Emission Tomography**	**In this chapter you will learn how to:** **Explain how X-ray beams are produced and controlled** **Explain how ultrasound is produced and detected explain how ultrasound images are produced, revealing internal structures** **Describe how conventional and CT scan X-ray images are produced.** **Explain the principles of positron emission tomography.**

NOVEMBER (21 DAYS)	**ASTRONOMY AND COSMOLOGY**	**Standard candles** **Luminosity and radiant flux intensity** **Stellar radii** **The expanding Universe**	**In this chapter you will learn how to:** **Understand the term luminosity as the total power of radiation emitted by a star.** **Recall and use the inverse square law for radiant flux intensity F in terms of the luminosity L of the source.** **Understand that an object of known luminosity is called a standard candle.** **Understand the use of standard candles to determine distances to galaxies.** **Recall and use Wien's displacement law to estimate the peak surface temperature of a star.** **Use the Stefan-Boltzmann law $L = 4\pi\sigma r2T^4$.** **Use Wien's displacement law and the Stefan-**

			Boltzmann law to estimate the radius of a star **understand that the lines in the emission spectra from distant objects show an increase in wavelength from their known values** **use for the redshift of electromagnetic radiation from a source moving relative to an observer.** **Explain why redshift leads to the idea that the Universe is expanding.** **Recall and use Hubble's Law $v \approx H_0 d$ and explain how this leads to the Big Bang theory.**
	PRACTICAL SKILLS AT A LEVEL	**Planning and analysis** **Planning** **Analysis of the data** **Treatment of uncertainties** **Conclusions and evaluation of results**	**In this chapter you will learn how to:** **Develop a systematic approach to carrying out experiments, including planning, setting up apparatus, investigating and recording results, analysing**

		PRACTICE QUESTIONS FROM PAST PAPERS FOR PLANNING AND ANALYSIS COMPONENT	data and writing conclusions. Plan an investigation to test a relationship or investigate a problem, identifying the dependent,independent and control variables. Use logarithms and logarithmic graphs combine uncertainties, extending work from Practical Skills at AS Level. Plot error bars on graphs and find uncertainties in gradients and intercepts.
DECEMBER (21 DAYS)		REVISION AND DOUBT SESSION	
JANUARY (15 DAYS)		REVISION AND DOUBT SESSION	

MOCK TEST OCTOBER NOVEMBER SERIES			
FEBRUARY (20 DAYS)		**REVISION AND DOUBT SESSION**	