NABTEB PHYSICS SYLLABUS

INTRODUCTION

004 – PHYSICS

This syllabus has been designed from the NBTE Curriculum for the sole purpose of examination. It is designed to portray physics as a core science subject with emphasis on the acquisition of knowledge and skill associated with the concepts of Matter, Position, Time, Energy, Waves, Fields, Atomic and Nuclear Physics and Electronics.

AIMS

The aims of the syllabus are to:

1. ensure that candidates acquire proper understanding of the basic underlying

   principles and applications of Physics.

2. develop scientific knowledge and skills which will be the spring board for further scientific studies and activities.
3. inculcate in students the general scientific processes and phenomena towards the eradication of ignorance and superstition.
4. develop relevant scientific attitudes such as precision, objectivity, initiative and inventiveness for the purpose of technological development.

SCHEME OF EXAMINATION

This subject will be made of two papers: Paper 1 and Paper 2 – and will attract a total of 200 marks.

PAPER 1: will be the theory paper and will consist of two sections, A and B which will last for 2 3⁄4 hours

Section A: will comprise 50 multiple-choice objective questions drawn from all the areas of the syllabus. It will last for 1 1⁄4 hours for 50 marks

Section B: will consist of Five questions out of which candidates will be required to answer Four questions. It will last for 1 1⁄2 hours for 80 marks.

PAPER 2: will be a practical test which will last for 2 3⁄4 hours and will comprise three questions out of which candidates are to answer any two
questions for a total of 70 marks.

NOTE: Test-of-practical paper will be conducted as an alternative paper to real practical for private candidates during the November/December series. It will last for 2 3⁄4 hours for a total of 70 marks and will comprise three questions out of which candidates are requested to answer any two questions.

S/N	Topic/Objectives	Contents	Activities/Remarks
PART 1 - MECHANICS			
1.	Concept of Matter 1.1 Explain the structure of matter: 3 states of matter and use the kinetic theory to explain the 3 states.	1. Structure of matter 2. three states of Matter – Solid, Liquid and Gas . 3. The particle nature of matter using Brownian motion experiment. 4. The Kinetic theory explanation of the three states of matter. 5. Use Kinetic theory to explain evaporation and boiling. 6. Crystaline and amorphous substances – metal and gas.	Arrangement of atoms in crystalline structure is not required.
2.	Fundamental Quantities and Units 1.1 State S.I. units of fundamental quantities and S.I. units of derived quantities. 2. 1.2 Measurement of Length, Mass and Time 3. 1.3 Measurement of Area and Volume of objects.	Fundamental quantities and their S.I. units. Derived quantities and their S.I. units. Measurement instruments for: i. Length ii. Mass iii. Time Areas of regular and irregular objects. Volumes of regular and irregular objects. Dimensions analysis of fundamental and derived quantities.	Examples such as Time, Length and Mass with units as s,m,kg. Also, volume m^3, acceleration ms^{-2} example of derived quantity. Using vernier caliper micrometer screw-guage. The degree of accuracy of measuring instruments should be emphasized. Instruments such as measuring cylinder and overflow-can should be used.

			as
3.	Position, Distance & Displacement 3.1 State the differences between Distance and Displacement.	1. Definition of position Distance and Displacement. 2. Distinction between Distance and Displacement.	Location of position of objects in plane using rectangular coordinate and representation of displacement in a rectangular coordinate system

			should be treated.
4.	Speed, Velocity & Acceleration in one dimension 4.1 Explain Uniformly Accelerated Motion	1. Speed 2. Velocity 3. Acceleration 4. Uniform speed, Velocity and acceleration. 5. Equation of uniformly accelerated motion 6. Motion under gravity 7. Distance/displacement time graph. 8. Velocity – Time graph 9. Calculations using the graphs above.	The use of the equations: $V=u+at$ $S=ut+ 1/2at^2$ $V^2 = u^2 + 2as$ To solve numerical problems.
5.	Motion of Bodies 1.1 Explain motion and its various types. 1.2 Explain angular speed in circular motion.	1. The concept of motion 2. Types of motion with examples. 3. Simple ideas about circular motion and angular speed . 4. Types of Forces 5. Contact and field forces with examples. 6. Contact and field forces with examples. 7. Frictional force. 8. Frictional force and various types. 9. Factors affecting frictional	Different types of motion should be illustrated e.g. random, rectilinear, translational, rotational, circular, orbital, spin, oscillatory with practical examples. Banking of roads should be emphasized. Note the differences between static and dynamic friction. Trainees should be made to roll spherical

	Classification of Forces. 1.3 Classify forces into field and contact forces. Friction. 1.4 Explain Frictional Laws. Newtons Law of Motion 1.5 State and explain Newton's Laws of motion.	force. 10. Advantages and disadvantages of frictional force. 11. a) Methods of reducing friction. b) Viscosity, frictional forces 12. Calculations on friction and viscosity. 13. Newton's first law of motion. i) Inertia. ii) Inertia mass and weight. iii) Momentum. iv) The law of conservation of linear momentum. v) Elastic and inelastic collision 14. i) Newton's second law of motion. ii) Calculations involving the second law. 15. I) Newton's third law of law. 16. Consequences of Newtons law of motion (weightlessness, rocket etc) and calculations involving the laws.	objects on a rough, smooth surfaces and report their experiences. μs = F/R OR F =μR Use F = μR for horizontal plane and μ=tan ⊖ for incline plane with ⊖ as an angle of inclination. Use measuring

			cylinder, ball bearing, fluid such as glycerin to illustrate viscosity. Distinction between elastic and inelastic collisions

			Derivation of F = ma is necessary. Solve problems on momentum e.g. recoil of a gun, jet and rocket propulsion.
6.	Scalar and Vector Quantities 6.1. Explain the term scalar and Vector Quantities Addition of Vectors 6.2. Explain the parallelogram and triangle rules of addition of vectors Resolution Vectors 6.3. Resolve vectors into their rectangular components in two dimension.	1. Scalar and vector quantities with examples. 2. representation of vectors graphically in two dimensions. 1. Resultant of two or more vectors 2. Determination of the resultant equilibrium of two or more vectors. 3. The parallelogram rule of the addition of two vectors. 4. The use of triangle rule for vector addition. 1. Component of vectors, 2. Resolution of vectors into rectangular components in two dimensions by drawing and by calculations.	Explain using the force board. Calculations involving components and resultant of vectors (at right angle and obtuse)
7.	Projectile Motion 7.1 Explain projectile motion and its	1. Concept of projectile motion. 2. Definition of i) range.	Applications of projectile in sports, warfare, etc, should

	applications.	ii) maximum height. iii) time of flight 3. Calculations involving projectile 4. Applications of projectile.	be mentioned.
8.	Mass and Weight 8.1 Distinguish between Mass and Weight	1. Definition of mass 2. Definition of weight 3. Distinction between mass and weight. 4. The relationship between mass and weight. 5. Calculation using the relation W = mg.	Measure mass and weight using a chemical balance and spring balance.
9.	Density and Relative Density 9.1 Explain Density and Relative Density	1. Definition of density. 2. Units of density. 3. Definition of relative density. 4. Calculations involving density and relative density.	i. Measurement of density. ii. Measurement of relative density.
10.	Fluid At Rest 1.1 Pressure in fluid at rest. Archimedes Princi ple 2. 1.2 State Archimedes principle. 3. 1.3 Solve problems using Archimedes	1. Definition of pressure, S.I. unit of pressure. 2. The relationship between Pressure P, Force F, and Area A as P = F/A. 3. Calculations involving pressure using P = F/A. 4. Atmospheric pressure 5. Atmospheric pressure in bars. 6. Construction and operation of mercury barometer and manometer 7. Operation of aneroid barometer. 8. Operation of siphon, pump (lift pump,	Set up a simple mercury barometer as in Torricellis Experiment.

		force pump, etc). 9. Hydraulic press. 10. Derivation of an expression for the pressure in fluid P = hpg. 11. Pascal's principle 12. Explanation of the variation of pressure with depth. 13. Pascal's principle. 14. Calculations using P = hpg. 15. Archimedes principle. 16. Forces acting on a body partially or completely immersed in a fluid e.g. water. 17. Problems using Archimedes principle. 18. Determination of relative density of	

	principle. 1.4 Determine relative Density using the principle. Floating 1.5 State the law of Floatation and explain its applications.	solids and liquids using Archimedes principle. 19. Calculation of R.d using Archimedes principle. Law of Floatation Application of the law in hydrometer, balloon, ships (plumb-line) boats, submarines, etc.)	Determine R.d of solids and liquids using Archimedes

11.	Surface Tension 1. 1.1 Define surface tension and state its merits 2. 1.2 Discuss its applications and give the factors affecting tension.	1. Definition of surface tension and derivation of its units. 2. Forces of adhesion and cohesion and relate this to capillarity and wetting of surfaces. Molecular explanation of surface tension. 3. Factors that affect surface tension – temperature impurities, etc. 4. Practical application e.g. capillarity.	
12.	Elastic Properties of Solids 1. 1.1 State Hook's Law 2. 1.2 Calculate problems involving Hooke's Law.	1. Statement of Hooke's Law. Problems involving Hooke's Law. 2. Calculation of work done in stretching or in an elastic body. 3. Definition of tensile stress and tensile strain. 4. Young modulus and its significance	Verification of Hooke's Law and determination of elastic constant. Calculations involving energy stored and young modulus.
13.	Equilibrium of forces 1. 1.1 Define moment of force, couple . 2. 1.2 Solve problems involving moments. 3. 1.3 State the conditions of equilibrium of a	1. Equilibrium of three coplanar forces acting at a point. 2. Definition of moment of a force. 3. Definition of couple. 4. Conditions under which a rigid body is in equilibrium under the action of coplanar forces. 5. Problems involving moments 6. Definition of centre of gravity. 7. Centre of gravity of regular shapes,	Determination of unknown masses using the principle of moment. Construction of a beam of balance using the principle of moment. Verification of the principle of

	rigid body. Centre of Gravity 4. 1.4 Explain the centre of gravity of a body. 5. 1.5 Determine the centre of gravity for some regular and irregular shaped bodies.	e.g. lamina, triangular, etc. 8. Stable, unstable and neutral equilibrium. 9. Factors affecting stability of a body.	moment. Determination of centre of gravity of both regular and irregular shapes, e.g. using the plumbline method.
14.	Simple Harmonic Motion 14.1 Define and explain simple harmonic motion. 14.2 Explain period frequency and amplitude of simple Harmonic Motion (SHM). 14.3 Explain speed and acceleration of SHM. 14.4 Explain the energy of SHM, forced vibration and resonance.	1. Simple Harmonic Motion (SHM) 2. Period, frequency and amplitude of simple harmonic motion. 3. Velocity and acceleration of SHM. 4. Energy of SHM. 5. Forced vibration and resonance.	Illustrate SHM with spiral spring, simple pendulum, loaded test-tube and bifilar suspension. Experimental determination of 'g' using i. Simple pendulum ii. Helical spring iii. Illustrate energy stored graphically.
15.	Energy 15.1 Describe the various forms of	1. Forms of energy. 2. Classification of energy into renewable	Give examples of different forms of energy – mechanical, heat, chemical, electrical and light. Examples of renewable energy sources are solar, wind, tidal,

	energy. 15.2 Identify and classify the sources of energy. 15.3 State the principles of conservation of energy.	and non-renewable. 3. Principles of conservation of energy.	hydro and ocean waves. Example of non

			renewable energy sources are petroleum, coal, nuclear and biomass. Illustrate with simple pendulum, striking of match box.
16.	Concept of Work and Energy Power 16.1 Define work and energy. 2. 16.2 Explain potential energy and kinetic energy and conservation of mechanical energy. 3. 16.3 Explain power.	1. Work (Definition and formula). 2. Energy 3. Types of mechanical energy: potential and kinetic energies 4. Work done in gravitational field. 5. Power. 6. Calculations involving work, energy and power.	Illustrate with the lifting and falling of bodies.
17.	Simple machines 17.1 Define simple machine and	1. Simple machine and types. 2. The force ratio Mechanical Advantage (MA) 3. Velocity Ratio (VR) of different simple	Examples of machines: Levers, pulleys, inclined plane, wedge, screw, wheel and axle, gears. Determine the MA of different simple machines.

	explain the mechanical advantage (MA), velocity ratio (VR) and efficiency e of machine. 17.2 Explain the effects of friction on efficiency.	machines. 4. Efficiency of machines and its relationship with (MA) and (VR). 5. Simple calculations on machine. 6. Effects of Friction on efficiency.	
PART II – HEAT			

18.	Concept of Temperature 18.1 Explain temperature and its measurement.	1. Definition of heat 2. Definition of temperature. 3. Thermometers and types 4. Properties of thermometric substance. 5. Construction and graduation of simple liquid in glass thermometer. 6. Temperature scales and conversion of thermometers. 7. Description of (i) Clinical (ii) minimum and maximum thermometers.	Construction and use of a thermometer.
19.	Effects of Heat 19.1 Describe the effects of heat. 2. 19.2 Explain thermal expansion. 3. 19.3 Describe anomalous	1. Explanation of effect of heat in the following, using kinetic theory. i. Rise in temperature ii. Change of state iii. Expansion iv. Change of resistance.	Demonstration of expansion using ball and ring, bimetallic strip, bar and gauge etc. Determination of linear expansivity of materials (rod) and volume expansivity of liquid.

	expansion of water	2. Consequences and applications of expansion, e.g. in building, bridges, bimetallic strips, thermostat, overhead cables (causing sagging) and in railway lines (causing bucking. 3. Thermal expansion in both solids and liquid. i. Linear expansivity, ą ii. Area expansiveity, ß iii.Volume expansivity, γ iv. Real and apparent cubic expansity. 4. Relationship between ą, ß and ą 5. Anomalous expansion of water and its importance. 6. Numerical problems on thermal expansion.	Discuss Hope's experiment.
20.	Heat Transfer 20.1 Explain modes of heat transfer. 20.2 Compare thermal conductivities of different solids and liquids.	1. Heat transfer. • Conduction. • Convection. • Radiation. 2. Explain conduction and convection using kinetic theory. 3. Examples of good and bad conductors of heat. 4. Comparing thermal conductivities of different metal rods, and various	Comparison of thermal conductivities of metals. Demonstration of water as a conductor of heat.

	20.3 Compare radiation and absorption of radiant heat by different surfaces.	liquids. 5. Explanation of land and sea breezes. 6. Absorption and radiation of heat,	Leslie's Cube experiment. Experimental illustration of a good and bad conductor of heat, e.g. copper and wood/plastic

		radiant heat by different surfaces. 7. Applications of conduction, convection and radiation of heat in everyday life. 8. Principle and operation of the vaccum flask.	
21.	Gas Laws B21.1 State gas laws and explain the gas laws using the kinetic theory	1. The Gas Laws: – Boyle's Law - Charles' s Law. - Pressure Law - General Gas Law 2. Explanation of the gas laws using kinetic theory. 3. Calculations of gas law	Perform the experiments to verify (i) Boyle's law (ii) Charles's law
22.	Heat Capacity 22.1 Explain heat capacity, specific heat capacity and their determination.	1. Concept of heat capacity. 2. Specific heat capacity. 3. Calculation of quantity of heat. 4. Determination of specific heat capacities of substances. 5. Land and sea breezes in relation to specific heat capacity.	Use of the method of mixtures and the electrical method to determine the specific heat capacities of solids and liquids.
23.	Latent Heat 23.1 Explain the concept of latent of state of matter (melting, vaporisation and sublimation).	1. Definition of latent heat and specific latent heat of fusion and vaporization 2. Calculation involving them. 3. Boiling and melting points and the	Use the method of mixtures and electrical method to determine the specific latent heat of fusion of ice and of vaporization of steam. Determine experimentally the melting point of a solid and the boiling point of a liquid. Demonstration of regulation, e.g. temperature, humidity, surface area, and draught over surface.

		effects of impurities and pressure. 4. Working principles of pressure cooker. 5. Working principle of refrigerator. 6. Boiling and evaporation. 7. Factors affecting boiling and evaporation. 8. Effects of evaporation. 9. Vapour and vapour pressure. 10. Saturated vapour pressure and boiling. 11. Dew point and relative humidity. 12. Humidity, formation of dew, mist, fog and rain.	

			Demonstrate the cooling effect of evaporation using volatile liquid such as methylated spirit. Demonstrate vapour pressure experimentally. Determination of humidity of atmosphere using wet and dry bulb hydrometer.
PART III – WAVES, OPTICS AND SOUND			
24.	Production and Propagation of Waves	1. Definition of waves 2. Generation and propagation of waves. 3. Graphical representation of waves. 4. Definition of amplitude, wavelength,	Demonstrate energy propagation using ripple tank. Note that frequency, f and period T are related by f=1/T.

	24.1 Describe the concept of waves, production and propagation of waves. 24.2 Describe different types of waves. Properties of Waves 24.3 Describe and identify properties of waves. Solve problems involving the equation.	frequency and period of wave. 5. Using the relationship $V = f\lambda$ to solve simple problems. 6. Definitions and examples of: i. Transverse. ii. Longitudinal, and iii. Stationary waves. 7. Stationary wave equation, $Y=A\sin(\omega t + 2\pi)\lambda$ 8. Properties of waves – reflection, refraction, diffraction, interference. 9. Superposition of progressive waves (standing waves). 10. Polarization of transverse waves	Explain all the symbols in the relationship. $Y = A\sin(\omega t + 2\pi)\lambda$
25.	Light Waves 25.1 Explain sources of light and demonstrate rectilinear	1. Sources of light – Luminous and non-luminous objects. 2. Rays and beams 3. Rectilinear propagation of light. • formation of shadows and eclipses. • Pin-hole camera.	Demonstration of rectilinear propagation of light. Construction and

propagation of light.	4. Reflection of light at plain surface, e.g. plain mirror. • Laws of reflection, regular and irregular reflection.	working of pin-hole camera to be treated. Verification of law of reflection.

25.2Explain the reflection of light. Paraxial Beam Focus, Principal focus. 25.3Spherical mirror and Application	• Images in plain mirror – inclined mirror • Effects of rotation of mirrors on the reflected beam. • Application of reflection from plain surfaces – periscope, sextant, etc Virtual and real image. 5. Types - concave and conex etc. Definition of terminologies – principal axis (P.A) Principal focus etc. Formation of images Sign convection & formula – mirror formula 1+1=1 uvf magnification = v = Hi u Ho Solve problems using the above relations Uses – driving mirror, dentist mirror, sharing mirror etc. 6. Concept of refraction. 7. Application of reflection from plain surfaces – periscope, sextant, etc. 8. Laws of refraction; Snell's law. 9. Definition of refractive index. 10. Real and apparent depths. 11. Critical angle and total internal reflection	Formation of images, characteristics of images and use of mirror formula: 1+1=1 uvf v m= u to solve numerical problems. (Derivation of mirror formulae is not required) Experimental determination of the focal length of concave mirror. Applications in search light, parabolic and driving mirrors, car headlamps, etc. Geometrical determination of image positions. Experimental determination of refractive index.

	12. Applications of refraction and total internal reflection. 13. Refraction through triangular prism. 14. Calculation of refractive index. $\mu = \text{Sin } 1/2 (A + D_{min}) \text{ Sin O A N}$ 2 15. i lateral displacement and angle of deviation. ii. Refractive index and angle of minimum deviation. 16 Distinguish between	

Refraction of Light 25.4 Explain the refraction of light at plane surfaces, rectangular glass prism (block) and triangular prism. 25.5 Explain the refraction of light on curved surfaces: convex, concave lenses.	converging and diverging lenses. 17. Definition of terms e.g. * Principal axis * Principal focus. * Optical centre * Focal length Aperture of converging lenses. 18. Formation of images on lens 19. Use of ray diagrams to illustrate formation of images by lenses. 1 + 1 = 1 and m=v uvfu 20. Use the above relation to solve problems	Examples of Applications include: image fish-eye-view periscope, optical fibres and binoculars Determination of focal length of the lens (approximate method etc).

		i) Simple microscope ii) Compound microscope iii) Astronomical telescope 21. Operational principle of optical projector. 22. Human eye and camera. 23. Eye defects: myopia, hypermyopia, astigmatism and presbyopia. 24. Correction of eye defects. 25. Concept of dispersion. 26. Dispersion and deviation. 27. Description of rainbow. 28. Pure and impure spectrum. 29. Production of pure spectrum. 30. Effects of coloured light. 31. Mixing of colour and mixing pigments. 32. Distinction between primary and secondary colours. 33. Components of electromagnetic spectrum.	

	Optical Instruments 25.6 Describe optical instruments I.E. (applications of refraction). Dispersal of Light		Construction of simple microscope. Draw ray diagram for formation of images by a compound microscope. Demonstrate splitting of white light into different colours by a prism.

	25.7 Explain the dispersion of white light and production of colours.		
26.	Electromagnetic Waves 26.1 Explain the principles of electromagnetic waves and identify its properties.	1. Definition of electromagnetic waves. 2. Distinction between electromagnetic waves and mechanical waves. 3. Electromagnetic spectrum. 4. Uses of various types of radiations. 5. Properties of various radiations in the electromagnetic spectrum.	Draw electromagnetic spectrum.
27.	Sound Waves 27.1 Explain the production of sound waves and description of their properties. 27.2 Explain the production of echoes and applications of echo sounding. 27.3 Explain musical instruments and its operations. 27.4 Explain forced	1. Sources of sound. 2. Transmission of sound. 3. Speed of sound in solids, liquids, and 4. gasses. Factors affection velocity of sound in 5. air. 6. Production of echoes. Application of echoes: i. ii. Determination of sea depth using echo. Determination of velocity of sound, time and distance using echo.	Demonstrate that a material medium is required to transmit sound. Examples of factors affecting velocity of sound are: temperature, pressure, wind, etc. Measurement of velocity of sound by echo method. Use sonometer to demonstrate the dependence of frequency (f) on

		7. 8. Characteristics of sound e.g. pitch, Distinction between musical note and noise.	

	loudness, quality, etc. 9. Vibrations in strings. 10. Explanation of the phenomena of beats. 11. Concepts of forced vibration. 12. Resonance. 13. Harmonics and overtones. 14. Musical tones. 15. Air column 16. Vibration in closed pipes. 17. Vibration in open pipes. 18. Resonance tube experiment for determination of the velocity of sound in air. 19. Applications of vibration of air in pipes and wind instrument.	length (L) tension (T) and linear density (m) of string i.e. F=1 L /T M Use the above formula involving simple problems. Mention string instruments such as guitar, piano, harp, violin, etc. Use resonance tube and sonometer to illustrate forced vibrations. Perform experiment on acoustical resonance using resonance tube. Mention applications in percussion instrument e.g. drum, bell, cymbals, etc. Show that the fundamental frequency of a closed pipe is $F_o = v$ 4L, hence, to = V 2λ S how that the possible harmonics of a close pipe are fo, 3fo, 5fo, 7fo... The fundamental frequency in this case, is fo. Hence, the
vibrations. 27.5 Explain vibrations in pipes – and closed of air open pipes.		

			harmonics present in an open pipe are fo, 2fo, 3fo, 4fo... End correction is necessary and use the relationship $V = f\lambda$ in silving numerical problems. Mention examples – organ, flute, trumpet, horn, clarinet, saxophone, etc.
PART IV – FIELDS			
28.	Concept of Fields 28.1 Explain gravitational, electric and magnetic fields and state their properties.	1. Definition of fields: i. Gravitational field. ii. Electric field. iii. Magnetic field. 2. Properties of force field.	Use compass needle and iron fillings to show magnetic field lines.
29.	Gravitational field 29.1 Explain the concept of gravitational field, gravitational field, gravitational potential and escape velocity.	1. Gravitational force between two masses e.g. proton, electronics and planets – Newton's Law of Gravitation. 2. Gravitational field intensity – acceleration due to gravity. 3. Relationship between universal gravitational constant (G) ad acceleration due to gravity (g). 4. Effect of latitude, altitude and the rotation of the earth on acceleration due to gravity. 5. Gravitational potential. 6. Escape velocity. 7. Calculation of escape velocity of a rocket and, gravitational intensity and potential.	

30.	Electric Field 30.1 Explain static electricity. Describe various ways of producing charges and the force between two	1. Concept of charge. 2. Definition of static electricity. 3. Conductors and insulators. 4. Production of charges – friction and induction. 5. The gold leaf electroscope and its use. 6. Distribution of charges on a conductor. 7. Electric lines of force and electric force	Ways of producing negative and positive charges such as contact, friction and induction should be treated. Application of the

charges. 30.2 Explain the concept of electric field. 30.3 Explain the concept of capacitance, arrangement of capacitors and their applications. Capacitor and capacitance 30.3 Explain the concept of capacitance, arrangement of capacitors and their applications.	between point charges. 8. Coulomb's Law e.g." $F=Kq^1q^2 R^2$ F = qE 9. Electric field intensity or potential gradient. 10. Force on a charge in an electric field: 11. Electric potential and electric potential energy. 12. Capacitors. 13. Definition of capacitance. 14. Factors affecting capacitance.	Gold Lead. Application of lighting conductor. Note: Permitivity of a material medium between point charges. Calculation involving electric field, electric field intensity and electric potential is necessary. Note Farad (F) as unit of capacitance. Use C = εA d to compute capacitance where ε is permitivity of medium. Derivation of formula for energy stored in charged capacitor, Example: 2 E = 1⁄2 CV or E = 1⁄2 QV or E = 1⁄2 Q^2/C Uses examples in radio, TV, prurification of metals etc (Derivation of

	15. Series and parallel arrangement of capacitors 16. Energy stored in a charged capacitor 17. Applications of capacitors.	

		formulae for capacitance is not required).
Current Electricity 30.4 Current electricity. Explain the production of electric current from cells. 30.5 Explain potential difference and electric current using an electric circuit. Electric Energy and Power 30.6 Explain electric energy and power.	18. Simple cells 19. Defects of primary cell and its remedies. 20. Leclanche wet and dry cells – Daniel etc. 21. Secondary cell: (Lead-acid- accumulator). 22. Structure of a secondary cell. 23. Maintenance of accumulator. 24. Simple electric circuit. 25. Current, emf and potential difference. 26. Ohm's law and resistance. 27. Ohmic and non-Ohmic conductors. 28. Series and parallel arrangement of cells	Give example of secondary cells as lead-aicd-accumulator, alkaline cadmium cell. Draw a well labeled diagram of lead- acid-accmulator. Rechargeability. Noe the unot of potential difference as volt (V), ampere (A) for current and Ohm (Ω) for resistance. Experimental verification of Ohm's Law. Solve problems r=E-V I Give examples of Ohmic and non- Ohmic conductors and factors affecting Ohmic conductors. Examples of applications are: Electric motor, ring boiler, electric kettle. Explain kilowatt- hour in commercial electricity as the Board of trade unit.

		and resistors. 29. Determination of effective emf and effective resistance for series and parallel arrangement. 30. Lost volt and internal resistance of cells and batteries. 31. Definition of electrical energy and power. 32. Heating effect of electrical energy and its applications. 33. Numerical problems on heating effects of electrical energy using the relation mcΘ = 1vt or = 1^2Rt or $=V^2 t$ R or 1^2Rt or V^2t R Where mcΘ = heat energy and 1vt = electrical energy 34. Galvanometer 35. Conversion of galvanometer t voltmeter using multiplier.	

	30.7 Describe the operations of shunt and multiplier		Calculation involving the conversion of galvanometer to ammeter and to voltmeter is necessary.
	30.8 Define resistivity and conductivity of a material and enumerate the factors affecting electrical resista nce of a material. 30.9 Explain the measurement of electric current, potential difference, resistance emf and internal resistance of a cell.	36. Factors affecting the electrical resistance of a material 37. Definition and S.1. unit of resistivity. Definition of conductivity and its unit. 38. Solve simple problems using $R = \rho \frac{L}{A}$ 39. Principle of operation and the use of: i. Ammeter. ii. Voltmeter. iii. Potentiometer. iv. Metre bridge. v. Wheatsone bridge.	Note : S.I. unit of resistivity as (Ωm) and that of conductivity as $((\Omega m)^{-1}$. Also the relationship between resistivity (ρ) and conductivity (σ) as $i = \sigma$ e Mention factors as resistivity, length, cross-sectional area (radius), temperature. Perform experiment using potentiometer determine and compare emf, p.d of cells. By using metre bridge, determine the unknown resistance in a circuit.
30.	Electrical Condu ction Through Liquids 30.1 Explain	1. Definition of electrolysis 2. Electrolytes and non-electrolysis. 3. Charge carriers in electrolytes: anions and cations. 4. Conduction of charge carriers through	Give examples of electrolytes and non-electrolytes.

	electrolysis and its applications.	electrolyte. 5. Simple copper voltmeter. 6. Uses of electrolysis 7. Faraday's laws of electrolysis and the applications of electrolysis.	Mention examples of applications as electroplating, extraction of metals e.g. aluminum and purification of metals.
31.	Electrical Condition Through Gasses 31.1 Explain discharge through gasses, hot cathode emissions and their applications.	1. Discharge through gasses. 2. Hot cathode emission. 3. Applications of discharge through gasses and hot cathode emission.	Example in neon signs, fluorescent tubes, etc.
32.	Magnetism 32.1 Explain the properties of magnets and concepts of magnetization.	1. Magnetic materials. 2. Processes of magnetization and demagnetization. 3. Distinction between permanent and temporary magnets. 4. The earth's magnetism. 5. Angles of dip and declination. 6. Description and application of the marine compass. 7. Magnetic field – due	List examples of magnetic materials: soft iron, nickel, cobalt, etc. Explain magnetic flux and density, magnetic field around a permanent magnet, a current-carrying conductor. Plot lines of force to locate neutral points using compass needle, iron fillings. Note units of magnetic flux and magnetic flux density as weber (Wb) and tesla (T) respectively. Compare the use of iron and steel as magnetic materials. Ilustrate with stroking and electrical method, also heating for de-

		to bar magnet. 8. Interaction of fields of: i. Two bar magnets. ii. Bar magnets and earth's field. 9. Field due to current carrying conductor and a solenoid. 10. Force on a current-carrying conductor. 11. Applications of force on current- carrying conductor e.g. electric motor, moving-coil galvanometer. 12. Force on two parallel conductors carrying current. 13. Principle and operations of electromagnets. 14. Applications of electromagnets e.g. electric bell, telephone earpiece. 15. Magnetic force on a moving charged	

		particle. 16. Problems involving the motion of charged particle in a magnetic field.	magnetization only. Illustrate the direction of the movement of the conductor using Fleming's left-hand rule. Solve problem using F = BIL sinθ Use right grip rule or corkscrew rule to

			illustrate the direction of magnetic field. Use electric bell in your laboratory to illustrate the principle of operation of electromagnet.
33.	Electromagnetic Induction 33.1 Explain the concept of electro- magnetic induction. 33.2 Explain electromagnetic induction and its applications. 33.3 Explain the concept of inductance. 33.4 Explain Eddy current, power transmission and distribution.	1. Concept of electromagnetic induction. 2. Electromagnetic induction: Faraday's Law, Lenz's Law. 3. Experiment to verify Faraday's law and Lenz's law. 4. Induced emf in a conductor moving in a magnetic field. 5. Generators (d.c. and a.c.); E = Eo sin ω t. induction coil. Transformer. Inductance (only self inductance). Energy stored in an inductor. 6. 7. 8. 9. 10. Applications of inductors e.g. radio, TV and transformer. 11. Eddy current. 12. Reducing Eddy current losses and applications of Eddy current. 13. Power transmission and distribution.	Determination of direction of current using Fleming's right rule. The principle underlying the operations of direct and alternating currents should be treated. Note also that in equation E = Eo sin wt. Where E = induced emf, Eo = peak emf, w = angular velocity and t = time. Note unit of inductance as Henry (H). Use $E = 1/2\ LI^2$ to solve simple problems

		14. Reduction of power losses in high- tension transmission lines. 15. Household wiring system.	

			(Note derivation of formula is not necessary). Method of reducing Eddy current and the application of Eddy current losses in induction furnace, speedometer etc. Example of reduction of power losses process is to transmit power at low current and high volage. Fuses, electrical installations: Line (L), Neutral (N) and Earth (E) should be discussed.
34.	Simple A.C. Circuit 34.1 Explain the graphical representation of variation of e.m.f. and current in an a.c. circuit, peak and r.m.s values of a.c. circuits. 34.2 Analyse series circuit containing	1. Graphical representation of variation of current in an ac circuit. 2. Peak and r.m.d. values for a.c. circuit. 3. Phase relationship between voltage and current in the circuit's elements; resistors, inductor and capacitor. 4. Resistance, inductance and capacitance.	Treat the graph equation I = Io sin ωt for current and E = Eo sin ωt for e.m.f. Lo = √2 1rms Note the relationship between the peak and r.m.s. values. Eo = √2 Erms Use $Z = \sqrt{R^2+(X_L-Xc)^2}$ To solve simple problems. (Deirvation of the formulae is not required). Differentiate between reactance and resistance.

	resistance, inductance and capacitance abd explain reactance, impedance, vector diagrams, resonance and power in an a.c.	5. Reactance and impedance. 6. Phase diagrams. 7. Resonance in an ac series circuit. 8. Power in an ac circuit	

	circuit.		Application of resonance on TV and radio should be discussed.
PART V – ATOMIC AND NUCLEAR PHYSICS			
1.	Structure of Atom 35.1 Describe the models of the atom and the limitation of each. 35.2 Explain energy quantization. 35.3 Explain photoelectric effect. 35.4 Explain thermionic	1. Models of the atom. • Thomson. • Rutherford. • Bohr, and • Electron – cloud. 2. Limitations of each model. 3. Quantization of angular momentum (Bohr.) 4. Definition of energy quantization. 5. Energy levels in the atom	 $hv = Eo + KE_{max}$ Discuss applications in TV, camera etc Illustrate the production of X-ray using a well- labelled diagram of X-ray tube.

	emission and X- rays: production, characteristics and applications.	6. Absorption spectra and spectra of discharge lamps. 7. Line spectra, bond, continuous from hot bodies. 8. Concept of photoelectric effect. 9. Definition of work function and threshold frequency. 10. Einstein's photoelectric equation. 11. Calculations involving Einstein's equation. 12. Application of photoelectric effect. 13. wave-particle duality of light 14. Thermionic emission and its application. 15. Production of X-rays. 16. Types, characteristics and properties of X-rays. 17. Application of X-rays. 18. Hazards of X-rays and the safety precautions.	
36.	Structure of the	1. Composition of the nucleus of an atom:	Deine the term:

nucleus 36.1 Explain the composition of the nucleus. 36.2 Explain radioactivity. Identify the types and give examples of radioactive elements. 36.3 List radioactive emissions, describe their properties, uses and ways of detecting them. 36.4 Explain radioactive decay, half life, transformation of elements by radioactivity and the applications of radioactivity.	• Protons. • Neutrons. 2. Isotpes. 3. Concept of radioactivity. 4. Natural and artificial radioactivities 5. Radioactive elements. 6. Radioactive emissions. 7. Properties and uses of radioactive emissions. 8. Detecting radioactive emissions. 9. Radioactive decay, half-life and decay constant. 10. Transmutation of elements by radioactivity. 11. Applications of radioactivity.	nucleon number (A), proton number Z, neutron number (N) and state the equation A= Z+N. Treat also nuclides and their notations. Give examples as Uranium, Thorium, etc. Give examples of the emissions as alpha particles, beta particles and gamma rays. Mention the methods used to detect emissions e.g. G.M. counter, photographic plates. Use the formula: $T1/2 = (\log_e 2)$ $\lambda = 0.693$ λ to solve simple problems.
36.5 Explain nuclear reactions – fusion and fission.	12. Types of nuclear reactions: • Fusion, and • Fission 13. Binding energy, mass defect and energyequation: $E= MC^2$	Give examples of aplications as in agriculture, industry, medicine, archeology, etc.

	14. Principle of nuclear reactors and atomic bomb. 15. Radiation hazards and safety precautions. 16. Peaceful uses of nuclear reactions.	
PART VI – BASIC ELECTRONICS		
Basic Concepts in Electronics	1. Distinction between conductors, semi- conductors and insulators using	

47.1 Distinguish between conductors, semi- conductors and insulators in terms of conduction. 37.2 Explain doping of semi-conductors p- and n- type semi- conductors, majority and minority carriers. 37.3Explain I – V characteristics of p– n junction diode and rectification. 37.4 Explain modes of operation of transistors and single stage amplifier.	conductivity and modes of conduction. 2. Intrinsic conduction. 3. Valance, conduction and forbidden energy bands and their effects on conductivity of material. 4. Doping of semi-conductors. 5. Extrinsic conduction p- and n- type semi-conductors. 6. Majority and minority carriers 7. I – V characteristics of p – n junction diode. 8. Half and full wave rectification.	Draw and label the circuit for a single stage amplifier and use it to explain its operations. You are only required to mention integrated circuits.

	9. Smoothening of rectified waveforms using capacitors. 10. Modes of operation of p-n-p and n-p-n transistors. 11. Operations of a single stage amplifier. 12. Integrated circuits.	