BLOW UP SYLLABUS
II PUC PHYSICS - 33
(THEORY)

UNIT-I

Chapter 1: ELECTRIC CHARGES AND FIELDS **(9 hours)**

Electric charges and their properties: Additivity of charges, quantisation of charges and conservation of charges - Coulomb's law: Statement, explanation (only in free space) and expression in vector form - Definition of SI unit of charge - Superposition principle: Statement, application to find the force between multiple charges.

Electric field: Definition of electric field - Mention of expression for electric field due to a point charge -Application of superposition principle to find electric field for a system of charges.

Continuous charge distribution: Definitions of surface, linear and volume charge densities - Mention of expression for electric field due to a continuous charge distribution.

Electric dipole: Definition of electric dipole and dipole moment - Derivation of electric field due to a dipole (a) at any point on its axis (b) at any point on its equatorial plane -Derivation of the torque on an electric dipole in an uniform electric field and expression in vector form.

Electric field lines: Properties and representation - Electric flux: Concept of electric flux - Area element vector, electric flux through an area element - Gauss's Law: Statement and its applications to find electric field due to (a) infinitely long straight charged wire, (b) uniformly charged infinite plane sheet and (c) uniformly charged thin spherical shell (field inside and outside), Numerical Problems.

UNIT-II

Chapter 2: ELECTROSTATIC POTENTIAL AND CAPACITANCE **(9 hours)**

Electric potential: Definition of electric potential at a point - Definition of potential difference - Derivation of electric potential due to a point charge - Mention of expression for electric potential due a short electric dipole at any point - Comparison of the variation of electric potential with distance between a point charge and an electric dipole - Application of superposition principle to find electric potential due to a system of charges.

Equipotential surfaces: Properties - Derivation of the relation between electric field and potential,

Electric potential energy: Definition of electric potential energy of a system of charges - Derivation of electric potential energy of a system of two point charges in the absence of external electric field - Mention of expression for electric potential energy of a system of two point charges in presence of external electric field. Mention of the expression for the electric potential energy of an electric dipole placed in a uniform electric field.

Electrostatics of conductors - Dielectrics and electric polarisation: Polar and non-polar dielectrics and their behavior in the absence and presence of an external electric field.
Capacitors and capacitance - Parallel plate capacitor - Derivation of the capacitance of a capacitor without dielectric medium - Mention of expression for capacitance of a capacitor with dielectric medium - Definition of dielectric constant.
Combination of capacitors: Derivation of effective capacitance of two capacitors (a) in series combination and (b) in parallel combination,
Derivation of energy stored in a capacitor.
Van de Graaff generator: Principle, labeled diagram and use, Numerical Problems.

UNIT-III

Chapter 3: CURRENT ELECTRICITY **(15 hours)**
Definition of electric current - Electric currents in a conductor - Definition of current density - Ohm's law: Statement and explanation - Dependence of electrical resistance on the dimensions of conductor and mention of $R = \rho l/A$ - Electrical resistivity and conductivity - Derivation of the relation $\vec{j} = \sigma\vec{E}$ (equivalent form of Ohm's law) - Limitations of Ohm's law.
Drift of electrons and origin of resistivity: Definitions of drift velocity, relaxation time and mobility - Derivation of expression for conductivity of a material $(\sigma = ne^2\tau/m)$.
Color code of carbon resistors; Temperature dependence of resistivity of metals and semiconductors.
Electrical energy and power: Mention of expression for power loss.
Combination of resistors: Derivation of effective resistance of two resistors (a) in series combination and (b) in parallel combination.
Cells: Definitions of internal resistance of a cell, terminal potential difference and emf of a cell -Derivation of current drawn by external resistance.
Combination of cells: Derivation of expressions for equivalent emf and equivalent internal resistance (a) in series and (b) in parallel combination.
Kirchhoff's rules: Statements and explanation.
Wheatstone bridge: Derivation of balancing condition – Metre Bridge.
Potentiometer: Principle - Mention of applications (a) to compare emf of two cells and (b) to measure internal resistance of a cell, Numerical Problems.

UNIT-IV

Chapter 4: MOVING CHARGES AND MAGNETISM **(10 hours)**
Concept of magnetic field - Oersted's experiment – Force on a moving charge in uniform magnetic and electric fields: Lorentz force - Derivation of magnetic force on a current carrying conductor $\vec{F} = I\,(\vec{l} \times \vec{B})$.
Motion of a charge in a uniform magnetic field: Nature of trajectories - Derivation of radius and angular frequency of circular motion of a charge in uniform magnetic field.

Velocity selector: Crossed electric and magnetic fields serve as velocity selector. Cyclotron: Principle, construction, working and uses.
Biot–Savart law: Statement, explanation and expression in vector form - Derivation of magnetic field on the axis of a circular current loop - Right hand thumb rule to find direction.
Ampere's circuital law: Statement and explanation - Application of Ampere's circuital law to derive the magnetic field due to an infinitely long straight current carrying wire: Solenoid and toroid - Mention of expressions for the magnetic field at a point inside a solenoid and a toroid.
Derivation of the force between two parallel current carrying conductors - Definition of ampere.
Current loop as a magnetic dipole - Qualitative explanation and definition of magnetic dipole moment -Mention of expression for torque experienced by a current loop in a magnetic field - Derivation of magnetic dipole moment of a revolving electron in a hydrogen atom and to obtain the value of Bohr magneton.
Moving coil galvanometer: Mention of expression for angular deflection - Definitions of current sensitivity and voltage sensitivity - Conversion of galvanometer to ammeter and voltmeter, Numerical Problems.

UNIT-V

Chapter 5: MAGNETISM AND MATTER **(8 hours)**

Bar magnet: Properties of magnetic field lines - Bar magnet as an equivalent solenoid with derivation - Dipole in a uniform magnetic field: Mention of expression for time period of oscillation of small compass needle in a uniform magnetic field -Gauss law in magnetism: Statement and explanation.
Earth's magnetic field and its elements: Declination, Dip and Earth's horizontal component B_H and their variation - Definitions of magnetisation (M), magnetic intensity (H), magnetic susceptibility (χ) and permeability (μ, μ_o *and* μ_r).
Magnetic properties of materials: Paramagnetic, diamagnetic and ferromagnetic substances, examples and properties - Curie's law and Curie temperature - Hysteresis, Hysteresis loop, definitions of retentivity and coercivity - Permanent magnets and electromagnets.

Chapter 6: ELECTROMAGNETIC INDUCTION **(7 hours)**

Experiments of Faraday and Henry - Magnetic flux $\phi_B = \vec{B} \cdot \vec{A}$ Faraday's law of electromagnetic induction: Statement and explanation - Lenz's law: Statement, explanation and its significance as conservation of energy.
Motional emf - Derivation of motional emf - Eddy currents -Advantages of eddy currents with common practical applications.
Inductance - Mutual inductance: Mention of expression for mutual inductance of two coaxial solenoids – Mention of expression for induced emf $E = -M \frac{dI}{dt}$.
Self-inductance: Mention of expression for self-inductance of solenoid - Mention of expression for induced emf $E = -L\frac{dI}{dt}$ - Derivation of energy stored in the coil.

AC generator: Labeled diagram - Derivation of instantaneous emf in an ac generator, Numerical Problems.

UNIT-VI

Chapter 7: ALTERNATING CURRENT (8 hours)

Mention of expression for instantaneous, peak and rms values of alternating current and voltage.
AC voltage applied to a resistor: Derivation of expression for current, mention of phase relation between voltage and current, phasor representation.
AC voltage applied to an inductor: Derivation of expression for current, mention of phase relation between voltage and current, phasor representation and mention of expression for inductive reactance.
AC voltage applied to a capacitor: Derivation of expression for current, mention of phase relation between voltage and current, phasor representation and mention of expression for capacitive reactance.
AC voltage applied to series LCR circuit: Derivation of expression for impedance, current and phase angle using phasor diagram - Electrical resonance - Derivation of expression for resonant frequency - Mention of expressions for bandwidth and sharpness (quality factor).
Mention of expression for power in ac circuit - Power factor and qualitative discussion in the case of resistive, inductive and capacitive circuit-Meaning of wattless current.
LC oscillations: Qualitative explanation - Mention of expressions for frequency of LC oscillations and total energy of LC circuit.
Transformer: Principle, construction and working - Mention of expression for turns ratio - Sources of energy losses, Numerical Problems.

Chapter 8: ELECTROMAGNETIC WAVES (2 hours)

Displacement current - Mention the need for displacement current (inconsistency of Ampere's circuital law) -Mention of expression for displacement current - Mention of expression for Ampere-Maxwell law.
Electromagnetic waves: Sources and nature of electromagnetic waves – Characteristics - Mention of expression of speed of light.
Electromagnetic spectrum: Wavelength range and their uses.

UNIT-VII

Chapter 9: RAY OPTICS AND OPTICAL INSTRUMENTS (9 hours)

Reflection of light by spherical mirrors: Sign convention (Cartesian rule) - Focal length of spherical mirrors: Derivation of the relation $f = R/2$ in the case of a concave mirror -Mirror equation: Derivation of mirror equation in the case of concave mirror producing a real image - Definition and expression for linear magnification.
Refraction of light: Explanation of phenomenon - Laws of refraction - Consequences.

Total internal reflection: Explanation of phenomenon - Mention of conditions - Definition of critical angle - Mention the relation between n and i_c - Mention of its applications (mirage, total reflecting prisms and optical fibers).
Refraction at spherical surfaces: Derivation of the relation between u, v, n and R.
Refraction by a Lens: Derivation of lens-maker's formula - Mention of thin lens formula - Definition and expression for linear magnification.
Power of a lens and mention of expression for it.
Combination of thin lenses in contact – Derivation of equivalent focal length of two thin lenses in contact.
Refraction of light through a prism: Derivation of refractive index of the material of the prism - Dispersion by prism.
Scattering of light: Rayleigh's scattering law - Blue colour of the sky and reddish appearance of the sun at sunrise and sunset.
Optical instruments: Eye: Accommodation and least distance of distinct vision - Correction of eye defects (myopia and hypermetropia) using lenses.
Simple microscope: Ray diagram for image formation - Mention of expression for the magnifying power - Compound microscope: Ray diagram for image formation - Mention of expressions for the magnifying power when the final image is at (a) least distance of distinct vision and (b) infinity.
Telescope: Ray diagram for image formation - Mention of expression for the magnifying power and length of the telescope ($L = f_o + f_e$) - Schematic ray diagram of reflecting telescope, Numerical Problems.

UNIT-VIII

Chapter 10: WAVE OPTICS **(9 hours)**

Wave front: plane, spherical and cylindrical – Huygens principle - Refraction of plane wave (rarer to denser), derivation of Snell's law - Reflection of a plane wave by a plane surface, derivation of the law of reflection.
Explanation of refraction of a plane wave by (a) a thin prism, (b) by a convex lens and (c) by a concave mirror, using diagrams.
Coherent sources - Theory of interference, (with equal amplitude) arriving at the conditions for constructive and destructive interference.
Young's experiment: Brief description - Derivation of fringe width.
Diffraction: Explanation of the phenomenon - Diffraction due to a single slit -Mention of the conditions for diffraction minima and maxima - Intensity distribution curve.
Resolving power of optical instruments: Mention of expressions for limit of resolution of (a) microscope and (b) telescope - Methods of increasing resolving power of microscope and telescope.
Polarisation: Explanation of the phenomenon - Plane polarised light - Polaroid and its uses - Pass axis – Malus' law - Polarisation by reflection: Brewster's angle - Arriving at Brewster's law - Statement of Brewster's law, Numerical Problems.

UNIT-IX

Chapter 11: DUAL NATURE OF RADIATION AND MATTER **(6 hours)**

Electron emission: Definition of electron volt (eV) - Types of electron emission.
Photoelectric effect: Mention of Hertz's observations - Mention of Hallwachs' and Lenard's observations - Explanation of the phenomenon of Photoelectric effect – Definition of work function, threshold frequency and stopping potential - Experimental setup to study Photoelectric effect: Observations - Mention of effect of (a)intensity of light on photocurrent, (b) potential on photocurrent and (c) frequency of incident radiation on stopping potential.
Einstein's photoelectric equation: Explanation of experimental results.
Particle nature of light: Characteristics of photon.
Wave nature of matter: de-Broglie hypothesis - Mention of de-Broglie relation- Mention of expression for de-Broglie wavelength in terms of kinetic energy and acceleration potential - Davisson and Germer experiment: (No experimental details) Brief explanation of conclusion - wave nature of electrons on the basis of electron diffraction, Numerical Problems.

Chapter 12: Atoms **(5 hours)**
Alpha particle scattering: Schematic diagram of Geiger-Marsden experiment, observations and conclusion - Rutherford's model of an atom - Derivation of total energy of electron in hydrogen atom in terms of orbit radius.
Atomic spectra: Spectral series of hydrogen - Mention of empirical formulae for $1/\lambda$(wave number) of different series.
Bohr model of hydrogen atom: Bohr's postulates - Derivation of Bohr radius - Derivation of energy of electron in stationary states of hydrogen atom - Line spectra of hydrogen atom: Derivation of frequency of emitted radiation - Mention of expression for Rydberg constant - Energy level diagram - de-Broglie's explanation of Bohr's second postulate - Limitations of Bohr model, Numerical Problems.

UNIT-X

Chapter 13: NUCLEI **(7 hours)**
Definition of atomic mass unit (u) - Isotopes, isobars and isotones - Composition, size, mass and density of the nucleus - Einstein's mass energy relation - Nuclear binding energy: Brief explanation of mass defect and binding energy - Binding energy per nucleon -Binding energy curve - Nuclear force and its characteristics.
Nuclear fission and nuclear fusion with examples.
Radioactivity: Law of radioactive decay - Derivation of $N= N_o e^{-\lambda t}$ - Activity (decay rate) and its units - becquerel and curie - Definition and derivation of half-life of radioactive element - Definition of mean life and mention its expression.
Alpha decay, beta decay (negative and positive) and gamma decay with examples - Q value of nuclear reaction, Numerical Problems.

Chapter 14: **SEMICONDUCTOR ELECTRONICS** **(12 hours)**

Energy bands in solids: Valance band, conduction band and energy gap - Classification of solids on the basis of energy bands.

Semiconductors: Intrinsic semiconductors - Extrinsic semiconductors (p-type and n-type); p-n junction: p-n junction formation.

Semiconductor diode: Forward and reverse bias - I-V characteristics - Definitions of cut-in-voltage, breakdown voltage and reverse saturation current.

Diode as a rectifier: Circuit diagram, working, input and output waveforms of a) half-wave rectifier and (b) full-wave rectifier.

Zener diode: I-V characteristics - Zener diode as a voltage regulator.

Optoelectronic junction devices: Working principles and mention of applications of photodiode, LED and solar cell.

Junction transistor: Types of transistor - Transistor action - Common emitter characteristics of a transistor: Drawing of input and output characteristics - Definitions of input resistance, output resistance and current amplification factor.

Transistor as a switch: Circuit diagram and working.

Transistor as an amplifier (CE - configuration): Circuit diagram and working - Derivation of current gain and voltage gain.

Transistor as an oscillator: principle and block diagram.

Logic gates: Logic symbol and truth table of NOT, OR, AND, NAND and NOR gates.

Chapter 15: **COMMUNICATION SYSTEMS** **(4 hours)**

Block diagram of generalized communication system - Basic terminology used in electronic communication systems : Transducer, Signal, Noise, Transmitter, Receiver, Attenuation, Amplification, Range, Bandwidth, Modulation, Demodulation, Repeater - Mention of bandwidth of signals for speech, TV and digital data - Mention of bandwidth of transmission medium for coaxial cable, free space and optical fibers - Propagation of electromagnetic waves: Brief explanation of ground wave, sky wave and space wave - Need for modulation - Amplitude modulation: Meaning - Block diagram of AM transmitter and AM receiver.

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SYLLABUS
II PUC PHYSICS - 33
(Practical)

Experiments:

1) To find resistance of a given wire using metre bridge and hence determine the specific resistance of its material.
2) To determine resistance per cm of a given wire by plotting a graph of potential difference versus current.
3) To verify the laws of combination (series/parallel) of resistances using a metre bridge.
4) To compare the emfs of two given primary cells using potentiometer.
5) To determine the internal resistance of given primary cell using potentiometer.
6) To determine resistance of a galvanometer by half-deflection method and to find its figure of merit.
7) To convert the given galvanometer (of known resistance of figure of merit) into an ammeter and voltmeter of desired range and to verify the same.
8) To find the frequency of the ac mains with a sonometer.
9) To find the value of *v* for different values of *u* in case of a concave mirror and to find the focal length.
10) To find the focal length of a convex mirror, using a convex lens.
11) To find the focal length of a convex lens by plotting graphs between *u* and *v* or between 1/*u* and1/*v*.
12) To find the focal length of a concave lens, using a convex lens.
13) To determine angle of minimum deviation for a given prism by plotting a graph between the angle of incidence and the angle of deviation.
14) To determine refractive index of a glass slab using a travelling microscope.
15) To find refractive index of a liquid by using (i) concave mirror, (ii) convex lens and plane mirror.
16) To draw the I-V characteristics curves of a p-n junction in forward bias and reverse bias.
17) To draw the characteristics curve of a Zener diode and to determine its reverse break down voltage.
18) To study the characteristics of a common-emitter npn or pnp transistor and to find out the values of current and voltage gains.

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Design of Question Paper

II PUC PHYSICS (33)

Time: 3 Hours 15 Minutes (*of which 15 minutes for reading the question Paper*).
Max. Marks: 70

The weightage of the distribution of marks over different dimensions of the question paper is as follows:

A. Weightage to Objectives:

Objective	Weightage	Marks
Knowledge	40%	43/105
Understanding	30%	31/105
Application	20%	21/105
Skill	10%	10/105

B. Weightage to content/subject units:

Unit No.	Chapter No.	Topic	No. of Hours	Marks
I	1	Electric Charges and Fields	9	8
II	2	Electrostatic Potential and Capacitance	9	8
III	3	Current Electricity	15	13
IV	4	Moving Charges and Magnetism	10	9
V	5	Magnetism and Matter	8	7
	6	Electromagnetic Induction	7	6
VI	7	Alternating Current	8	7
	8	Electromagnetic Waves	2	2
VII	9	Ray Optics and Optical Instruments	9	8
VIII	10	Wave Optics	9	8
IX	11	Dual Nature of Radiation And Matter	6	5
	12	Atoms	5	5
X	13	Nuclei	7	6
	14	Semiconductor Electronics	12	10
	15	Communication Systems	4	3
TOTAL			**120**	**105**

Note: Variation of 1Mark per chapter is allowed, however the total marks should not exceed 105.

C. Weightage to forms of Questions:

Part	Question Main	Type of questions	Marks	Number of questions to be set	Number of questions to be answered
A	I	Very short answer(VSA)	1	10	10
B	II	Short answer(SA1)	2	8	5
C	III	Short answer(SA2)	3	8	5
D	IV	Long answer(LA)	5	3	2
	V	Long answer(LA)	5	3	2
	VI	Numerical Problems(NP)	5	5	3

Note:

1. ***Questions in IV Main must be set from Unit I to V.***
2. ***Questions in V Main must be set from Unit VI to X.***
3. ***Questions in VI Main must be set such that one Numerical Problem is from every 2 successive units.***

D. Weightage to level of difficulty:

Level	Weightage	Marks
Easy	40%	43/105
Average	40%	42/105
Difficult	20%	20/105

General instructions

- Questions should be clear, unambiguous, understandable and free from grammatical errors.
- Questions which are based on same concept, law, fact etc. and which generate the same answer should not be repeated under different forms (VSA, SA, LA and NP).
- Questions must be set based on the blow up syllabus only.

II P.U.C PHYSICS (33)

Blue print for Model question paper – I

Unit	Chapter	Topic	Teaching Hours	Marks allotted	1 mark (VSA)	2 mark (SA1)	3 mark (SA2)	5 mark (LA)	5 mark (NP)
1	1	Electric Charges and Fields	9	8	✓	✓			✓
2	2	Electrostatic Potential and Capacitance	9	8		✓	✓✓		
3	3	Current Electricity	15	13	✓	✓		✓	✓
4	4	Moving Charges and Magnetism	10	8			✓	✓	
5	5	Magnetism and Matter	8	7		✓		✓	
	6	Electromagnetic Induction	7	6	✓	✓	✓		
6	7	Alternating Current	8	8			✓		✓
	8	Electromagnetic Waves	2	2	✓✓				
7	9	Ray Optics and Optical Instruments	9	8	✓	✓		✓	
8	10	Wave Optics	9	8			✓		✓
9	11	Dual nature of Radiation And Matter	6	5	✓✓		✓		
	12	Atoms	5	5					✓
10	13	Nuclei	7	6	✓			✓	
	14	Semiconductor Electronics	12	10		✓	✓	✓	
	15	Communication Systems	4	3	✓	✓			
TOTAL			**120**	**105**	**10**	**16**	**24**	**30**	**25**

II P.U.C PHYSICS (33)
MODEL QUESTION PAPER-I

Time: 3 hours 15 min. **Max Marks: 70**

General instructions:

1) *All parts are compulsory.*
2) *Answers without relevant diagram/figure/circuit wherever necessary will not carry any marks.*
3) *Direct answers to Numerical problems without detailed solutions will not carry any marks.*

PART A

I Answer the following. **10 × 1 = 10**

1. Draw the electric field lines for a system of two positive point charges.
2. Name the charge carriers in metallic conductors.
3. North Pole of a bar magnet is moved towards a metal ring. What is the direction of induced current in the ring when viewed from magnet side?
4. Write the expression for displacement current.
5. Name the electromagnetic radiations which are produced when high energy electrons are bombarded with metal target.
6. Write the expression for magnifying power of a telescope in terms of focal lengths.
7. What is the outcome of Davisson Germer Experiment?
8. How does nuclear radius of an atom depend on its mass number?
9. A proton and an electron have same kinetic energy. Which one has smaller de-Broglie wavelength?
10. What is demodulation?

PART – B

II Answer any FIVE of the following questions. **5×2=10**

11. Write two properties of an electric charge.
12. What is electrostatic shielding? Mention one application electrostatic shielding.
13. State Kirchhoff's rules for electrical network.
14. Define the terms magnetic Declination and Dip at a place.

15. What are eddy currents? Mention one application of eddy currents.

16. Draw the ray diagram to construct a real inverted image by a concave mirror.

17. Name the semiconductor device that can be used as a voltage regulator. Draw the I –*V* characteristics of this device.

18. Draw the block diagram of a generalized communication system.

PART – C

III Answer any FIVE of the following questions. 5×3=15

19. Write the expression for electric potential at a point due to a short electric dipole. Mention one contrasting feature of electric potential of dipole at a point as compared to that due to a point charge.

20. Obtain the expression for effective capacitance of two capacitors connected in parallel.

21. What is a cyclotron? Draw its schematic labeled diagram.

22. Explain briefly an experiment with a coil and magnet to demonstrate the phenomenon of electromagnetic induction.

23. Show that voltage and current are in phase with each other when an AC voltage is applied across a resistor. Represent this relation in phasor diagram.

24. Derive the law of reflection of light on the basis of Huygens wave theory.

25. Mention three experimental observations of photoelectric effect.

26. Classify metals, semiconductors and insulators on the basis of energy bands.

PART – D

IV Answer any TWO of the following Questions 2×5=10

27. Obtain expressions for effective emf and effective internal resistance when two different cells are connected in parallel.

28. Use Biot-Savart law to derive the expression for magnetic field on the axis of circular current loop.

29. Define magnetic susceptibility of a material. Name two elements, one having positive susceptibility and other having negative susceptibility. State Curie's law and define Curie temperature.

V Answer any TWO of the following questions 2×5=10

30. Derive the expression for the refractive index of the material of a prism in terms of the angle of the prism and angle of minimum deviation.

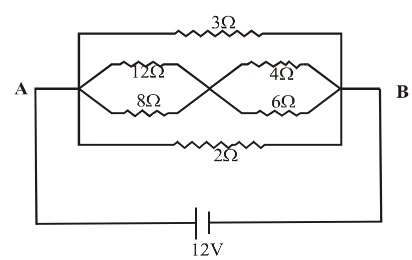
31. State the law of radioactive decay. Show that $N = N_o e^{-\lambda t}$ for a radioactive element.

32. Write the neat circuit diagram of a full wave rectifier and explain its working. Draw the input and output waveforms.

VI Answer any THREE of the following questions. 3×5=15

33. The electrostatic force on a metal sphere of charge 0.4 μC due to another identical metal sphere of charge -0.8 μC in air is 0.2N. Find the distance between the two spheres and also the force between the same two spheres when they are brought into contact and then replaced in their initial positions.

34. In the given circuit, calculate the (i) effective resistance between A and B (ii) current through the circuit and (iii) current through 3 Ω resistor.



35. A resistor, an inductor and a capacitor are connected in series with a 120V, 100Hz ac source. Voltage leads the current by 35° in the circuit. If the resistance of the resistor is 10Ω and the sum of inductive and capacitive reactance is 17Ω, calculate the self-inductance of the inductor.

36.A beam of light consisting of two wavelengths 500 nm and 400 nm is used to obtain interference fringes in Young's double slit experiment. The distance between the slits is 0.3 mm and the distance between the slits and the screen is 1.5 m. Compute the least distance of the point from the central maximum, where the bright fringes due to both the wavelengths coincide.

37.The first member of the Balmer series of hydrogen atom has wavelength of 656.3nm. Calculate the wavelength and frequency of the second member of the same series. Given, c = 3×10^{8} m/s.

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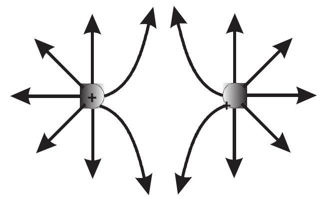
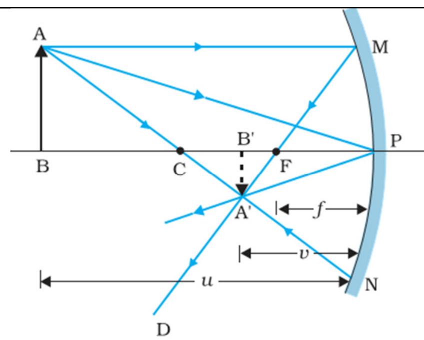
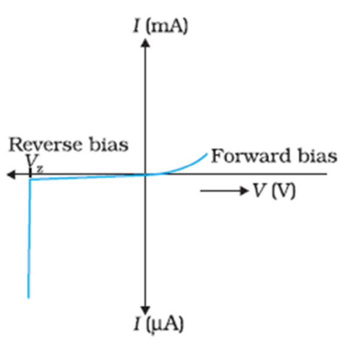
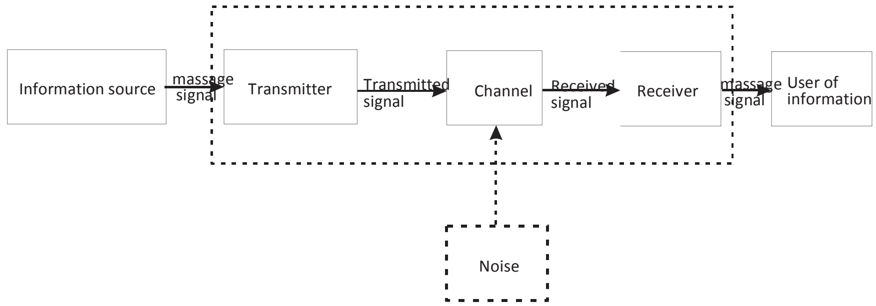
II PU PHYSICS (33)

SCHEME OF EVALUATION OF MODEL QUESTION PAPER-I

Q.NO	ANSWERS	MARKS
I	**PART-A**	
1		**1 mark**
2	Free electrons	**1 mark**
3	Anticlockwise.	**1 mark**
4	$i = E_o \dfrac{d\phi_E}{dt}$	**1 mark**
5	X-rays.	**1 mark**
6	$m = \dfrac{f_o}{f_e}$	**1 mark**
7	It confirms the wave nature of electrons.	**1 mark**
8	$R = R_o A^{1/3}$ or R is directly proportional to A to the power of 1/3	**1 mark**
9	Proton	**1 mark**
10	The process of retrieval of information from the carrier wave at the receiver is called demodulation.	**1 mark**
II	**PART-B**	
11	Any two properties	**1 mark each**
12	The field inside the cavity of a conductor is always zero and it remains shielded from outside electric influence. This is known as electrostatic shielding. Sensitive components of electronic devices are protected	**1 mark** **1mark**

13	(1) **Junction rule:** At any junction, the sum of the currents entering the junction is equal to the sum of the currents leaving the junction. (2) **Loop rule:** The algebraic sum of changes in potential around any closed loop involving resistors and cells is zero.	**1 mark** **1 mark**
14	**Definitions**	**1 mark each**
15	The induced circulating currents produced in a metal due to the change in magnetic flux linked with it are called eddy currents. **Any one application,** 1. Induction furnace. 2. Speedometer. 3. Dead beat galvanometer. 4. Electromagnetic Breaks.	**1 mark** **1 mark**
16	 Ray diagram with arrow marks	**2 mark**
17	Zener Diode. 	**1 mark** **1 mark**

18		**2 marks**
III	**PART-C**	
19	$V = \frac{1}{4\pi\varepsilon_0}\left(\frac{\vec{p}\,.\hat{r}}{r^2}\right)$ For an electric dipole, $V \propto \frac{1}{r^2}$ For a point charge, $V = \frac{1}{4\pi\varepsilon_0}\left(\frac{q}{r}\right) \Rightarrow V \propto \frac{1}{r}$	**1mark** **1mark** **1mark**
20	Circuit diagram $q = q_1 + q_2$ Charge on the capacitor C_1, $q_1 = C_1 V$, Similarly, $q_2 = C_2 V$ Arriving at the final equation	**1mark** **1 mark** **1 mark**
21	It is a device used to accelerate charged particles. Diagram Labeling	**1 mark** **1 mark** **1 mark**
22	Diagram Changing magnetic flux linking the coil induces emf. Induced current is large when the magnet moves faster.	**1 mark** **1 mark** **1 mark**
23	Circuit diagram. To show that I and V are in phase. Phasor representation	**1mark** **1mark** **1mark**

24	Diagram Explaining the construction of wavefronts To show i and r are equal	**1 mark** **1 mark** **1 mark**
25	Any three observations,	**1mark each**
26	Metals- overlapping of CB and VB Semiconductors- small energy gap between CB and VB Insulators -very large energy gap between CB and VB	**1 mark** **1 mark** **1 mark**
IV	**PART-D**	
27	Circuit diagram for two cells Pd across the first cell $V = E_1 - I_1 r_1 \Rightarrow I_1 = \left(\frac{E_1 - V}{r_1}\right)$ similarly pd across second cell $V = E_2 - I_2 r_2 \Rightarrow I_2 = \left(\frac{E_2 - V}{r_2}\right)$ But $I = I_1 + I_2$ $I = \left(\frac{E_1 - V}{r_1}\right) + \left(\frac{E_2 - V}{r_2}\right) = \left(\frac{E_1}{r_1} + \frac{E_2}{r_2}\right) - V\left(\frac{1}{r_1} + \frac{1}{r_2}\right)$ $V = \left(\frac{E_1 r_2 + E_2 r_1}{r_1 + r_2}\right) + I\left(\frac{r_1 r_2}{r_1 + r_2}\right)$ $V_{eq} = E_{eq} - I r_{eq}$ Comparing and arriving at $E_{eq} = \frac{E_1 r_2 + E_2 r_1}{r_1 + r_2}$ $r_{eq} = \frac{r_1 r_2}{r_1 + r_2}$	**1 mark** **1 mark** **1 mark** **1 mark** **1 mark**
28	Diagram Magnetic field due to an element, $dB = \frac{\mu_o}{4\pi} \frac{i\,dl}{(x^2 + r^2)}$ Resolving dB and obtaining dB_x Summation over a loop Final expression	**1 mark** **1 mark** **1 mark** **1 mark** **1 mark**

29	Definition of magnetic susceptibility of a material. Naming element having positive susceptibility Naming element having negative susceptibility. State Curie's law Define Curie temperature.	**1 mark** **1 mark** **1 mark** **1 mark** **1 mark**
V		
30	Ray diagram with necessary arrow marks $d = i_1 + i_2 - A$ At minimum deviation, $d = D$ and $i = i_1 = i_2$, $r_1 = r_2 = r$, The value of r and i Arriving at final expression $n = \frac{sin\left(\frac{A+D}{2}\right)}{sin\left(\frac{A}{2}\right)}$	**1 mark** **1 mark** **1 mark** **1 mark** **1 mark**
31	Decay law statement $\frac{dN}{dt} = -\lambda N$ Arriving at **$\log_e N = -\lambda t + C$** Finding the value of C Arriving at $N = N_0 e^{-\lambda t}$	**1 mark** **1 mark** **1 mark** **1 mark** **1 mark**
32	Circuit Diagram Working Input and output waveforms	**1 mark** **2 marks** **2 marks**
VI		
33	$f = \frac{1}{4\pi\varepsilon_o}\frac{q_1 q_2}{r^2}$ $0.2 = \frac{9\times10^9\ 0.4\times10^{-6}\ 0.8\times10^{-6}}{r^2}$ $r = 0.12m$ after contact $f = \frac{9\times10^9\ 0.2\times10^{-6}\ 0.2\times10^{-6}}{0.12^2} = 0.025N(repulsive)$ Final answer with unit f = 0.025N	**1 mark** **1 mark** **1 mark** **1 mark** **1mark**

34	$R_p = \frac{R_1 R_2}{R_1 + R_2}$ and V = IR Finding the effective resistance of the circuit Finding current through the circuit I = 11.66A Finding current through 3Ω resistor I = 4A with unit	**1 mark** **2 marks** **1 mark** **1 mark**
35	$\tan\phi = \frac{X_L - X_C}{R}$ or $\cos\phi = \frac{R}{Z}$ and $X_L = 2\pi fL$ $X_L - X_C = 7$ $X_L = 12\Omega$ Calculation of $L = 19mH$ with unit	**1 mark** **1 mark** **1 mark** **2 marks**
36	$X_{n_1} = X_{n_2}$ $\frac{n_1\lambda_1 D}{d} = \frac{n_2\lambda_2 D}{d}$ Substitution and getting the values n_1 and n_2 Calculation of Final answer with unit X_{n_1} = 0.01 m	**1 mark** **1+1 marks** **1+1 marks**
37	$\frac{1}{\lambda} = R\left[\frac{1}{n_1^2} - \frac{1}{n_2^2}\right]$ Identifing transitions Substitution, simplification and λ_2=486.1 nm Using c=fλ, getting the value of f=6.1715×10^{14} Hz (with unit)	**1 mark** **1 mark** **1 mark** **1 mark** **1 mark**

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Blue print for Model question paper – II

Unit	Chapter	Topic	Teaching Hours	Marks allotted	1 mark (VSA)	2 mark (SA1)	3 mark (SA2)	5 mark (LA)	5 mark (NP)
1	1	Electric Charges and Fields	9	8	✓	✓		✓	
2	2	Electrostatic Potential and Capacitance	9	8			✓		✓
3	3	Current Electricity	15	13	✓	✓		✓✓	
4	4	Moving Charges and Magnetism	10	9	✓		✓		✓
5	5	Magnetism and Matter	8	7	✓		✓✓		
	6	Electromagnetic Induction	7	6	✓			✓	
6	7	Alternating Current	8	7		✓			✓
	8	Electromagnetic Waves	2	2		✓			
7	9	Ray Optics and Optical Instruments	9	8			✓		✓
8	10	Wave Optics	9	8	✓	✓		✓	
9	11	Dual nature of Radiation And Matter	6	5					✓
	12	Atoms	5	5		✓	✓		
10	13	Nuclei	7	6	✓	✓	✓		
	14	Semiconductor Electronics	12	10	✓✓		✓	✓	
	15	Communication Systems	4	3	✓	✓			
TOTAL			**120**	**105**	**10**	**16**	**24**	**30**	**25**

II P.U.C PHYSICS (33)
MODEL QUESTION PAPER-II

Time: 3 hours 15 min. **Max Marks: 70**

General instructions:

1) *All parts are compulsory.*
2) *Answers without relevant diagram/figure/circuit wherever necessary will not carry any marks.*
3) *Direct answers to Numerical problems without detailed solutions will not carry any marks.*

PART A

I Answer ALL of the following questions. **$10 \times 1 = 10$**

1. A cube encloses a charge of 1 C. What is the electric flux through the surface of the cube?
2. The color code of a carbon resistor is Brown-Red-Brown-Gold. What is its resistance?
3. State Ampere's circuital law.
4. Define magnetic permeability.
5. Name the law which gives the polarity of induced emf.
6. What type of a wave front is observed from a distant source of light?
7. Give an example for nuclear fusion reaction.
8. Define energy band gap in solids.
9. The output of OR gate is connected to the input of NOT gate. Name the equivalent logic gate.
10. What is the signal bandwidth offered by a coaxial cable?

PART – B

II Answer any FIVE of the following questions. **$5 \times 2 = 10$**

11. State Coulomb's law in electrostatics and explain it in the case of free space.
12. How does the resistivity of the following materials vary with the increase in their temperature (i) metallic conductor and (ii) semiconductor?

13. Mention the principle behind the working of a transformer. Can a transformer be used to step up a dc voltage?

14. Mention two characteristics of electromagnetic waves.

15. Using Huygens principle, draw a diagram to show the refraction of plane wave front incident obliquely on a surface separating two media.

16. Mention two observations of Geiger- Marsden's experiment on scattering of alpha particle.

17. Two nuclei have mass numbers in the ratio 8 : 125 . Calculate the ratio of their nuclear radii.

18. Explain the terms 'range' and 'band-width', used in electronic communication systems.

PART – C

III Answer any FIVE of the following questions. 5×3=15

19. Obtain the expression for capacitance of a parallel plate capacitor without dielectric medium between the plates.

20. Write the expression for the force acting on a charge moving in a uniform magnetic field. Mention the nature of a trajectory of the charged particle which is moving (i) parallel and (ii) perpendicular to the magnetic field.

21. Mention three distinguishing properties of diamagnetic and ferromagnetic materials.

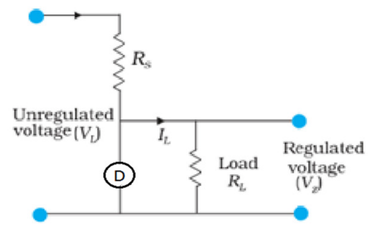
22. Write the expression for time period of oscillation of small compass needle in a uniform magnetic field and explain the terms. In this case if the magnitude of the magnetic field is reduced to 1/4th, how does the time period change?

23. Derive the relation f = R/2 in the case of a concave mirror.

24. State Bohr's postulates of hydrogen atom.

25. Obtain the expression for the half-life of a radioactive element.

26. Name the device 'D' which is used as a voltage regulator in the given circuit. Rewrite the circuit by replacing the device 'D' with proper circuit symbol. Give its working principle.



PART – D

IV Answer any TWO of the following questions. 2×5=10

27. Obtain the expression for the electric field at a point on the equatorial plane of an electric dipole.

28. Define 'relaxation time'. Derive the expression for electrical conductivity of a material in terms of relaxation time.

29. Draw the circuit diagram of Wheatstone bridge. Derive the balancing condition for the same. Name the device which works on the principle of Wheatstone bridge.

V Answer any TWO of the following questions. 2×5=10

30. What is self-inductance of a coil? Write its SI unit. Obtain the expression for energy stored in an inductor.

31. Obtain the expression for fringe width of interference fringes in Young's double slit experiment.

32. With a neat circuit diagram, explain the working of an npn transistor in CE mode as a switch.

VI Answer any THREE of the following questions. 3×5=15

33. Two capacitors of capacitance 600 pF and 900 pF are connected in series across a 200 V supply. Calculate (i) the effective capacitance of the combination, (ii) the pd across each capacitor and (iii) the total charge stored in the system.

34. A straight wire of length π/2 m is bent into a circular shape. O is the center of the circle formed and P is a point on its axis which is at a distance 3 times the radius from O. A current of 1 A is passed through it. Calculate the magnitude of the magnetic field at the point O and P.

35. A series LCR circuit is connected to 220 V ac source of variable frequency. The inductance of the coil is 5 H, capacitance of the capacitor is 5μF and resistance is 40 Ω. At resonance, calculate a) The resonant frequency, b) current in the circuit and c) the inductive reactance.

36. A small bulb is placed at the bottom of a tank containing water to a depth of 1m. Find the critical angle for water air interface; also calculate the diameter of the circular bright patch of light formed on the surface of water? [R.I of water = 4/3].

37. The threshold wavelength of a photosensitive metal is 662.5 nm. If this metal is irradiated with a radiation of wavelength 331.3 nm, find the maximum kinetic energy of the photoelectrons. If the wavelength of radiation is increased to 496.5nm, calculate the change in maximum kinetic energy of the photoelectrons. (Planck's constant $h=6.625 \times 10^{-34}$Js and speed of light in vacuum$=3 \times 10^{8}ms^{-1}$)

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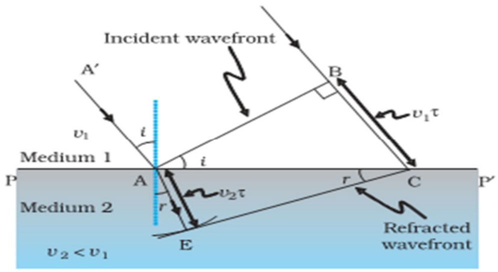
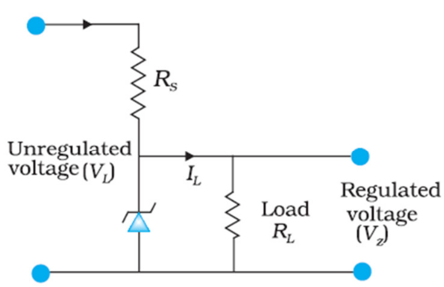
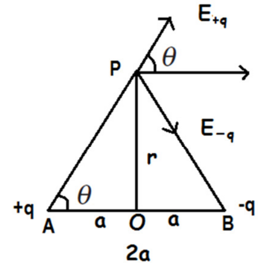
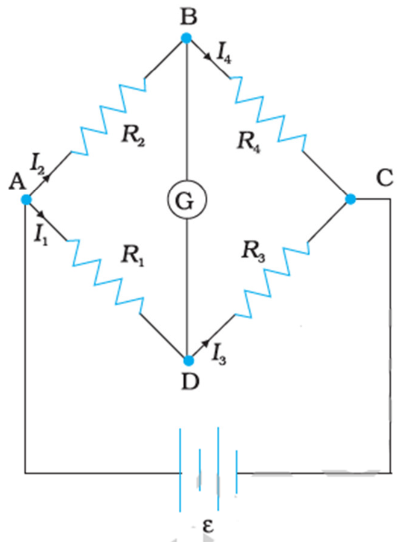
II PU PHYSICS (33)
SCHEME OF EVALUATION OF MODEL QUESTIONPAPER-II

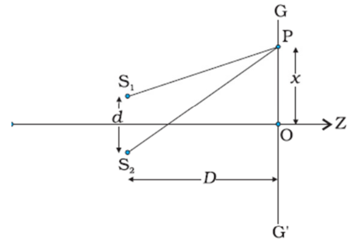
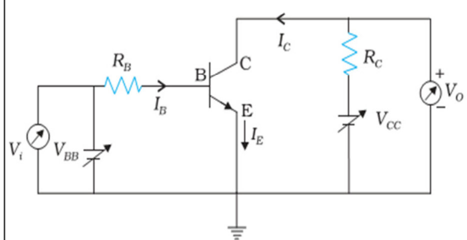
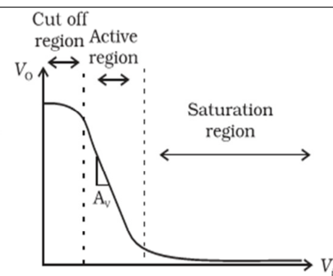
Q.NO	ANSWERS	MARKS
I	PART A	
1	0.113×10^{12}Vm	1
2	$120\ \Omega \pm 5\%$	1
3	Statement	1
4	μ = B / H	1
5	Lenz's law	1
6	Plane wave front	1
7	Any one example.	1
8	The energy difference (gap) between the top of the valence band and the bottom of the conduction band.	1
9	NOR gate	1
10	750 MHz	1
II	PART-B	
11	Statement Explanation, $F \propto q_1 q_2 and \quad F \propto \frac{1}{d^2}$ $Therefore \quad F = \frac{1}{4\pi\epsilon_0}\frac{q_1 q_2}{d^2}$	1 1
12	Metallic conductor : Resistivity increases with increase in temperature Semiconductor : Resistivity decreases with increase in temperature	1 1
13	Mutual induction No	1 1

14	Any two characteristics (one mark each)	2
15		diagram 1 mark labeling 1 mark
16	Most of the alpha particles pass through the foil without any collisions. About 0.14% of alpha particles scatter by more than 1°. About 1/8000 of alpha particles scatter by more than 90°. (any two)	1 each
17	Formula $R = R_0A^{1/3}$ 2 : 5	1 +1
18	Range: Largest distance between a source and destination up to which signal is received with sufficient strength. Band-width: The frequency range with in which an equipment operates OR The portion of the spectrum occupied by the signal	1 1
III	PART-C	
19	Figure $E\ out = \sigma/2\varepsilon_o - \sigma/2\varepsilon_o = 0$ $E\ in = \sigma/2\varepsilon_o + \sigma/2\varepsilon_o = \sigma/\varepsilon_o = Q/\varepsilon_o A$ Taking $V = E\ d$ and arriving at $C = Q/V = \varepsilon_o A/d$	1 1 1
20	$F = q\ (v \times B)$ i) If v is parallel to B, trajectory is a straight line ii) If v is perpendicular to B, trajectory is circular	1 1 1

21	Any three distinguishing properties. (one mark each)	3
22	$$T = 2\pi\sqrt{\frac{I}{mB}}$$ Explanation of the terms When B becomes B/4, T is doubled.	1 1 1
23	Ray diagram Comparing the two triangles Arriving at f = R/2	1 1 1
24	State three postulates (one mark each)	3
25	After one half-life $$t = T_{1/2} \Rightarrow N = No/2$$ using the relation $N = Noe^{-\lambda t}$ $\Rightarrow No/2 = Noe^{-\lambda T_{1/2}}$ $1/2 = e^{-\lambda T_{1/2}} \lambda T_{1/2} = log_n 2 \Rightarrow \lambda T_{1/2} = 0.693$ Arriving at $T_{1/2} = \frac{0.693}{\lambda}$	1 1 1
26	Zener diode.  Principle; Zener diode is operated in the reverse breakdown region, the voltage across it remain constant equal to the breakdown voltage for large change in reverse current.	1 1 1

IV	PART-D	
27	 The electric field at P due to $+q$ $\vec{E}_{+q} = \frac{1}{4\pi\varepsilon_o}\frac{q}{(r^2+a^2)}$ $along\ AP$ Then electric field at P due to $-q$ $\vec{E}_{-q} = \frac{1}{4\pi\varepsilon_o}\frac{q}{(r^2+a^2)}$ $along\ PB$ Directions of $\vec{E}_{+q}$ and $\vec{E}_{-q}$ are shown. Components normal to the dipole axis cancel away. Components along the dipole axis add up Therefore, total field $\vec{E} = -\ \frac{1}{4\pi\varepsilon_o}\frac{2q\ cos\theta}{(r^2+a^2)}\hat{p}$ $\vec{E} = -\ \frac{1}{4\pi\varepsilon_o}\frac{q\ (2a)\hat{p}}{(r^2+a^2)^{3/2}}$ $\vec{E} = -\ \frac{(2qa)\hat{p}}{4\pi\varepsilon_o(r^2+a^2)^{3/2}}$ Or in terms of dipole moment $\vec{p} = \ q\ (2a)\hat{p}$ $\vec{E} = -\ \frac{1}{4\pi\varepsilon_o}\frac{\vec{p}}{(r^2+a^2)^{3/2}}$	1 1 1 1 1
28	Relaxation time is defined as the average time between two successive collisions of free electrons. Assuming the expression for drift velocity $v_d = -\frac{eE}{m}\tau$ $I\Delta t = neav_d\Delta t$ Arriving at $\|\mathbf{j}\| = \frac{ne^2}{m}\tau\|\mathbf{E}\|$ Comparing with $j = \sigma\ E$ and obtaining $\sigma\ = \frac{ne^2}{m}\tau$	1 1 1 1 1

29	 $I_g = 0$ Kirchhoff's loop rule to ADBA $-I_1R_1 + 0 + I_2R_2 = 0$ Kirchhoff's loop rule to CBDC $I_2R_4 + 0 - I_1R_3 = 0$ Arriving at $\frac{R_2}{R_1} = \frac{R_4}{R_3}$ Meter bridge	1 1 1 1 1
30	Meaning "henry" (H) Work done against back emf E $\frac{dW}{dt} = -\|E\|I$ $Induced\ emf\ E = -L\frac{di}{dt}$ $\frac{dW}{dt} = LI\frac{di}{dt}$ Arriving at $W = \int dW = \int_0^I LIdI = \frac{1}{2}LI^2$	1 1 1 1 1

31	 $S_2P - S_1P = n\lambda$; n = 0, 1, 2, 3…. $(S_2P)^2 - (S_1P)^2 = 2xd$ $S_2P - S_1P = xd/D$ Arriving at $x_n = \dfrac{n\lambda D}{d}$ $\beta = (x_n - x_{n-1}) = \dfrac{\lambda D}{d}$ (Or any other method)	1 1 1 1 1
32	  Arriving at $V_i = i_B R_B + V_{BE}$ and $V_o = V_{cc} - i_c R_c$ Explaining the variation of Vo as Vi increases from zero. Explaining the off state Explaining the on state	1 1 1 1 1
V		
33	$C_S = \dfrac{C_1 C_2}{C_1 + C_2}$ i)substitution ⇒ Cs = 360pF ii) Q= $C_S V$ = 360 x 200 = 72 nC iii) $V_1 = Q/C_1$ = 120V iv) $V_2 = Q/C_2$ = 80V	1 1 1 1 1

34	Circumference $$C = \frac{\pi}{2} m \quad \Rightarrow 2\pi r = \frac{\pi}{2} \Rightarrow r = \frac{1}{4} m = 0.25m$$ $$i = 1\,A, \quad n = 1\,,$$ $$B = \frac{\mu_0}{4\pi} \frac{2\,\pi\,n\,i\,r^2}{(r^2 + x^2)^{3/2}}$$ $At\ \ O, \quad x = 0$ $$B = 2.5 \times 10^{-6}\,T$$ $At\ P\,, x = 3r = \frac{3}{4} m = 0.75m$ $$B = 0.079 \times 10^{-6}\,T$$	1 1 1 1 1
35	$f_0 = \frac{1}{2\pi\sqrt{LC}} = \frac{1000}{31.4} = 31.8\text{Hz}$ I =V/R = 230/40 = 5.75 A $X_L = 2\pi fL = 998.5\Omega$	1+1 1 1 +1
36	Diagram Sin C = 1/n Calculating the critical angle C = 48°35′ tan C = 1.134=r/h ⇒ r = h × tan C = 1 ×1.134 = 1.134 m. Diameter = 2.268m	1 1 1 1 1
37	$KE = \frac{hc}{\lambda} - \frac{hc}{\lambda_o} = hc\left[\frac{1}{\lambda} - \frac{1}{\lambda_o}\right]$ Substituting for $\lambda = \lambda_1 = 331.$ nm and $\lambda_o = 662.5$ nm We get $KE_1 = 3\times10^{-19}$J $$KE_2 - KE_1 = hc\left[\frac{1}{\lambda_1} - \frac{1}{\lambda_2}\right]$$ $\lambda_1 = 331.3$ nm and $\lambda_2 = 496.5$ nm $KE_2 - KE_1 = 2\times10^{-19}$J	1 1 1 1+1

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II PUC PRACTICAL EXAMINATION
PHYSICS (33)

General instructions:

- Duration of practical examination: 2 hours.
- Maximum marks allotted: 30 marks.
- At least TEN (10) different experiments have to be set in the practical Examination.

<u>Scheme of Evaluation</u>

A. Weightage of marks

Sl. No.	Particulars	Marks
I	Performing the Experiment	20
II	Viva - Voce	04
III	Practical Record	06
TOTAL		**30**

B. Distribution of marks

I. Performing the Experiment

Sl. No.	Particulars	Marks
1	Writing the principle of the experiment	2
2	Writing the formula and explaining the terms	2
3	Writing the diagram / figure / circuit with labeling (At least two parts)	2
4	Writing the tabular column/ observation pattern	2
5	Constructing the experimental set up/ circuit	3
6	Performing the experiment and entering the readings into the tabular column / Observation pattern	4
7	Substitution and calculation/plotting the graph and calculation	3
8	Result with unit	2
Total		**20**

NOTE FOR SL.NO. 6:

- At least three (3) trials have to be taken in case of finding mean value.
- At least six (6) readings have to be taken in case of plotting the graph.

II. Viva- voce

1. Four questions must be asked and each question carries 1 mark.
2. The questions in the *viva- voce* should be simple, direct and related to the experiment being performed by the student.

III. Practical Record

Sl. No.	Particulars	**Marks**
1	If the student has performed and recorded 13 experiments or more (91% to 100% of the experiments prescribed for the practical examination or more)	**6**
2	If the student has performed and recorded 11 or 12 experiments. (81% to 90% of the experiments prescribed for the practical examination)	**5**
3	If the student has performed and recorded 10 experiments. (71% to 80% of the experiments prescribed for the practical examination)	**4**
4	If the student has performed and recorded below 10 and above 5 experiments. (41% to 70% of the experiments prescribed for the practical examination)	**3**
5	If the student has performed and recorded 5 or less than 5 experiments. (40% & below 40% Of the experiments prescribed for the practical examination)	**0**

NOTE: At least FOURTEEN (14) experiments have to be conducted in the practical classes.

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