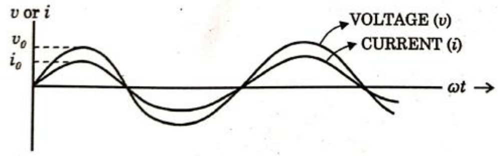
KARNATAKA SCHOOL EXAMINATION AND ASSESSMENT BOARD
II PUC EXAM – 1, MARCH 2025
SUBJECT: 33 - PHYSICS SCHEME OF EVALUATION MAX. MARKS: 70

Q. No.	KEY ANSWER	Marks
	PART – A	
	I. Pick the correct option among the four given options for **ALL** of the following questions: $15 \times 1 = 15$	
1	A point charge q_1 exerts a force F on another point charge q_2 when placed at a fixed distance. If another point charge q_3 is brought near q_2, the force on q_2 due to q_1: (a) increases (b) decreases (c) may increase or increase **(d) does not change** **ANS: (d) does not change**	1
2	Equipotential surfaces for an isolated point charge are ________ in shape. **(a) spherical** (b) planar (c) cylindrical (d) conical **ANS: (a) spherical**	1
3	Resistivity of a metal wire depends on its: (a) area of cross-section (b) length **(c) material** (d) volume **ANS: (c) material**	1
4	The following table lists magnetic fields due to different current configurations. Column I lists the current configurations and column II lists expressions for magnetic fields. Symbols have usual meanings. **Column – I** / **Column – II** (i) At a distance r from an infinitely long straight wire. / (p) $B = \mu_o nI$ (ii) At the centre of a circular current loop of radius r. / (q) $B = \frac{\mu_o I}{2r}$ (iii) At the centre of a current carrying solenoid. / (r) $B = \frac{\mu_o I}{2\pi r}$ Match the current configurations in Column - I with the correct magnetic - field expressions in Column - II. (a) (i) – (p), (ii) – (q), (iii) – (r) **(b) (i) – (r), (ii) – (q), (iii) – (p)** (c) (i) – (r), (ii) – (p), (iii) – (q) (d) (i) – (q), (ii) – (r), (iii) – (p) **ANS: (b) (i) – (r), (ii) – (q), (iii) – (p)**	1
5	'The net magnetic flux through any closed surface is zero'. This law is called (a) Gauss' law in electrostatics **(b) Gauss' law in magnetism** (c) Ampere's circuital law (d) Faraday's law of electromagnetic induction **ANS: (b) Gauss' law in magnetism**	1
6	Consider the following statements: <u>Statement 1:</u> AC generator worked on the principle of electromagnetic induction. <u>Statement 2:</u> In an AC generator, as the armature is rotated in a uniform magnetic field, the magnetic flux linked with the coil changes which induces an emf in the coil. Among the above two statements: **(a) Both statements are true** (b) Both statements are false. (c) Statement 1 is true and statement 2 is false (d) Statement 2 is false and statement 2 is true **ANS: (a) Both statements are true**	1

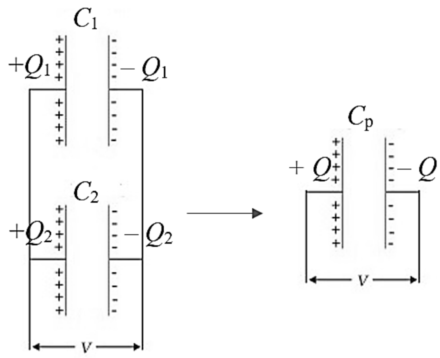
7	The variation of voltage and current through an a.c. circuit with time is as shown in the figure.  Along with the a.c. source, the circuit: (a) has a series combination of resistance and capacitance (b) has only inductance (c) has only capacitance **(d) may have only resistance or may have a suitable series combination of inductance (*L*), capacitance (*C*) and resistance (*R*)** **ANS: (d) may have only resistance or may have a suitable series combination of inductance (*L*), capacitance (*C*) and resistance (*R*)**	1
8	Transformer cores are usually laminated. This is to reduce energy loss due to: (a) flux leakage (b) winding resistance **(c) eddy currents** (d) hysteresis **ANS: (c) eddy currents**	1
9	**'Ampere-Maxwell Law'** is written as (symbols have usual meanings): **(a)** $\oint \vec{B} \cdot d\vec{l} = \mu_o I + \mu_o \varepsilon_o \frac{d\phi_E}{dt}$ (b) $\oint \vec{B} \cdot d\vec{l} = \mu_o I + \varepsilon_o \frac{d\phi_E}{dt}$ (c) $\oint \vec{B} \cdot d\vec{l} = \mu_o I$ (d) $\oint \vec{E} \cdot d\vec{l} = -\frac{d\phi_B}{dt}$ **ANS: (a)** $\oint \vec{B} \cdot d\vec{l} = \mu_o I + \mu_o \varepsilon_o \frac{d\phi_E}{dt}$	1
10	Final image of a real object formed by a compound microscope is _______ with respect to the object. (a) real, inverted and magnified (b) virtual, erect and magnified (c) virtual, erect and diminished **(d) virtual, inverted and magnified** **ANS: (d) virtual, inverted and magnified**	1
11	Which one of the following statements is WRONG about interference of light? **(a) Light waves of same wavelength coming from two independent sources can be coherent and can produce interference.** (b) When the path difference between two interfering waves in $n\lambda$, bright fringe is produced (here n = 0, 1, 2, … and λ is the wavelength of light) (c) When the phase difference between two interfering waves is $(2n + 1)\pi$, dark fringe is produced (here n = 0, 1, 2, …) (d) In Young's double slit experiment, dark and bright fringes are equally spaced. **ANS: (a) Light waves of same wavelength coming from two independent sources can be coherent and can produce interference.**	1
12	A ball is dropped from a certain height and it falls freely under gravity. During the fall, the de Broglie wavelength associated with it: (a) keeps increasing **(b) keeps decreasing** (c) is zero (d) may increase or decrease **ANS: (b) keeps decreasing**	1
13	In Rutherford's α – ray scattering experiment, α – particles of specific energy are projected towards a thin gold foil. If the impact parameter for the a-particles is zero, the angle of scattering is: (a) $\theta = 0°$ (b) $\theta = 90°$ **(c)** $\theta = 180°$ (d) $\theta = 45°$ **ANS: (c)** $\theta = 180°$	1

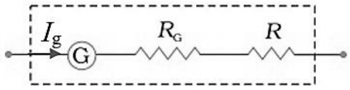
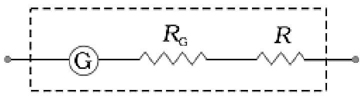
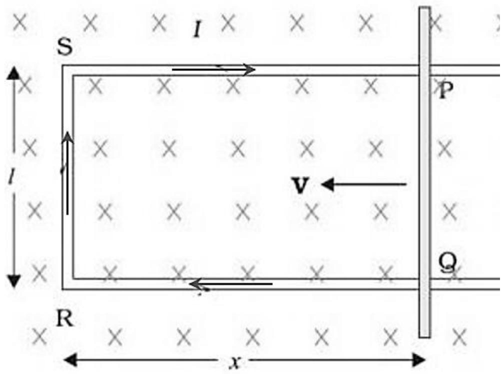
14	Binding energy per nucleon of a nucleus is a measure of its: (a) radius (b) mass (c) volume **(d) stability** **ANS: (d) stability**	1
15	The energy gap for silicon is: (a) 0.72 eV **(b) 1.1 eV** (c) 3 eV (d) 5 eV **ANS: (b) 1.1 eV**	1
II. Fill in the blanks by choosing appropriate answer given in the bracket for **ALL** of the following questions: (*diamagnetic*, *ferromagnetic*, *instantaneous*, *transverse*, *force*, *torque*)		
16	An electric dipole placed in a uniform electric field experiences a net **TORQUE**.	1
17	Water is an example for **DIAMAGNETIC** material.	1
18	When a **FERROMAGNETIC** rod is inserted into a coil, its self- inductance increases	1
19	Polarization of light shows that light is a **TRANSVERSE** wave.	1
20	Photoelectric effect is a/ an **INSTANTANEOUS** effect	1
PART – B III. Answer any **FIVE** of the following questions: $5 \times 2 = 10$		
21	**Define electric potential energy of a system of charges. What happens to the potential energy of a system of two unlike charges when the distance between them is increased (assume there is no external electric field)?** Electric potential energy of a system of charges is the amount of work done to assemble the system of charges bringing each charge from infinity to their respective positions. The potential energy increases.	1 1
22	**List any two limitations of Ohm's law.** (1) V ceases to be proportional to I. (2) Semiconductor diodes do not obey Ohm's law. (3) For some materials like GaAs, the relation between V and I is not unique. (4) Ohm's law is not applicable at very high and very low temperatures. (Any two) (Any other correct limitation should be considered)	1 + 1
23	**Write the expression for Lorentz force and explain the terms.** $\vec{F} = q(\vec{E} + \vec{v} \times \vec{B})$ where q is the charge; $\vec{E}$ is the electric field; $\vec{B}$ is the magnetic field and $\vec{v}$ is the velocity of the charge.	1 1
24	**State Lenz's law. What is its significance?** The polarity of induced emf is such that it tends to produce a current which opposes the change in magnetic flux that produced it. Lenz law gives the polarity of induced emf.	1 1
25	**Give any two uses of microwaves.** (1) They are used in radar systems used in aircraft navigation. (2) They are used in speed guns. (3) They are used in microwave ovens. (Any two) (Any other relevant use should be considered)	1 + 1
26	**How are focal length (*f*) and radius of curvature (*R*) of a spherical mirror related? What is the sign of focal length of a convex mirror?** $f = \frac{R}{2}$ The focal length of a convex mirror is *positive*.	1 1

27	**Mention the condition for total internal reflection.** (a) The light ray should be travelling from a denser medium to a rarer medium. (b) The angle on incidence should be greater than the critical angle for the pair of media.	 1 1
28	**An intrinsic semiconductor crystal is doped with pentavalent atoms has an electron concentration of 5×10^{22} m^{-3}. If, at thermal equilibrium, the intrinsic concentration n_i = 1.5×10^{16} m^{-3}, find the hole concentration.** Given: $n_e = 5 \times 10^{22}$ m^{-3} and $n_i = 1.5 \times 10^{16}$ m^{-3} $n_e n_h = n_i^2$ $\Rightarrow n_h = \frac{n_i^2}{n_e} = \frac{(1.5 \times 10^{16})^2}{5 \times 10^{22}} = 0.45 \times 10^{10}\ \text{m}^{-3}$ **OR** $n_h = 4.5 \times 10^9\ \text{m}^{-3}$	 1 1

PART – C

IV. Answer any **FIVE** of the following questions: 5 × 3 = 15

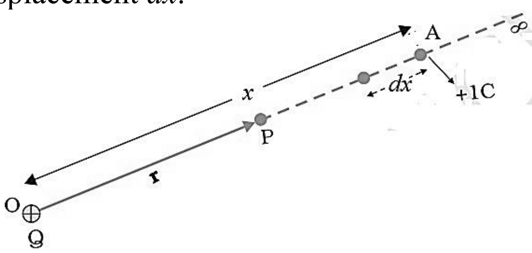
29	**Mention three properties of electric field lines.** (1) Field lines start from positive charges and end at negative charges. (2) In a charge-free region, electric field lines can be taken to be continuous curves without any breaks. (3) Two field lines can never cross each other. (4) Electrostatic field lines do not form any closed loops. (4) A tangent drawn to an electric field line at any point gives the direction of electric field at that point. (5) Density of field lines is a measure of the strength of electric field. (Any three)	1 + 1 + 1
30	**Derive the expression for the equivalent capacitance of two capacitors connected in parallel.** Consider two capacitors C_1 and C_2 connected in parallel across a voltage V. Let C_p be the equivalent capacitance of the combination.  For the first capacitor: $Q_1 = C_1V_1$ and for the second capacitor $Q_2 = C_2V_2$. For the equivalent capacitor, $Q = C_pV$. As the capacitors are in parallel, $Q = Q_1 + Q_2$ $\Rightarrow C_pV = C_1V_1 + C_2V_2$ $\Rightarrow C_p = C_1 + C_2$	1 1 1

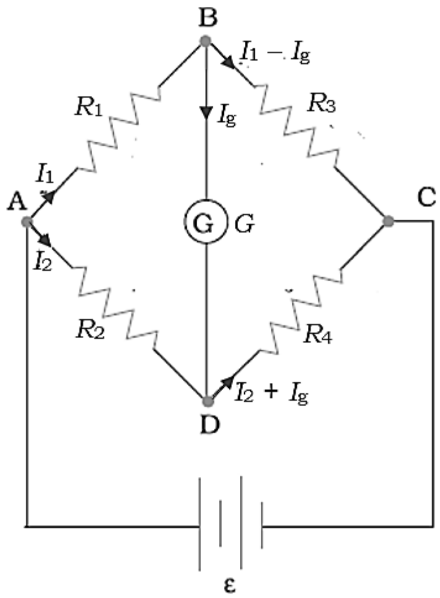
31	**Explain with a circuit diagram, how a galvanometer can be converted into voltmeter.** A galvanometer can be converted into a voltmeter by connecting a suitable high resistance in series with it.  Voltmeter The value of high resistance is: $$R = \frac{V}{I_g} - R_G$$ Where, V is the voltage to be measured, R_G is the resistance of the galvanometer and I_g is the maximum galvanometer current. **OR** As a voltmeter is connected in parallel with that section of the circuit it must draw a very small current.  Voltmeter Therefore, to convert a galvanometer into a voltmeter, a large resistance R is connected in series with it.	1 1 1 **OR** 1 1 1
32	**Define the terms: a) Magnetization b) Magnetic permeability and c) Magnetic susceptibility.** (a) The net magnetic moment per unit volume is called magnetization. (b) Magnetic permeability is the ratio between magnetic field and magnetic intensity. (c) Magnetic susceptibility is the ratio between magnetization and magnetic intensity.	1 1 1
33	**Derive the expression for motional emf induced in a rod moving in a uniform magnetic field.** Consider a rod PQ of length l moving perpendicular to a uniform magnetic field B with a speed v as shown in the figure.  Magnetic flux for the surface PQRS, $\phi_B = B\,A\cos\theta = Blx$ Induced emf in the rod: $$\varepsilon = -\frac{d\phi_B}{dt}$$ $$\varepsilon = -\frac{d(Blx)}{dt} = Blv$$	1 1 1

34	**When a light radiation of energy 3 eV falls on a metal surface, photoelectrons with a maximum kinetic energy 1 eV are emitted from the surface. Find the threshold frequency for the metal surface.** **(Given: Planck's constant, $h = 6.63 \times 10^{-34}$ J s; Charge on the electron $e = 1.6 \times 10^{-19}$ C).** Given: $h\nu = 3$ eV and $K_{max} = 1$ eV. From Einstein's photoelectric equation: $\phi_o = h\nu - K_{\text{max}} = 3\text{ eV} - 1\text{ eV} = 2\text{ eV}$ $\nu_o = \frac{\phi_o}{h}$ $= \frac{2 \times 1.6 \times 10^{-19}}{6.63 \times 10^{-34}} = 4.83 \times 10^{14}$ Hz	1 1 1
35	**State the postulates of Bohr's hydrogen atom model.** (1) An electron in an atom could revolve in certain stable orbits without the emission of radiant energy. These are called the stationary states of the atom. (2) The electron revolves around the nucleus only in those orbits for which the angular momentum is some integral multiple of $h/2\pi$ where h is the Planck's constant. OR The angular momentum of the electron in an orbit is quantized in terms of $h/2\pi$ where h is the Planck's constant. (3) An electron might make a transition from one of its orbits to another of lower energy. When it does so, a photon is emitted having energy equal to the energy difference between the initial and final states. OR When an electron makes a transition from a higher energy E_2 to a lower energy E_1, a photon is emitted whose frequency is given by: $\nu = \frac{E_2 - E_1}{h}$	1 1 1
36	**Write any three properties of nuclear force.** (1) It is a very strong force. (2) It is a short-range force. (3) It is charge independent. (4) It shows saturation property. (5) The force is attractive for distances larger than 0.8 *f*m and repulsive if they are separated by distances less than 0.8 *f*m. (Any three) (Any other correct answer should be considered)	1 + 1 + 1

PART – D

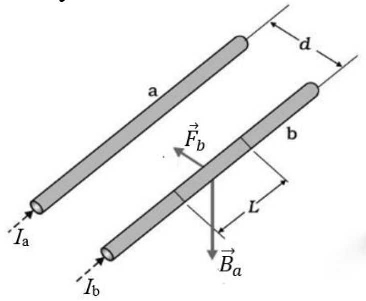
V. Answer any **<u>THREE</u>** of the following questions: $3 \times 5 = 15$

37	**Derive the expression for the electric potential at a point due to a point charge.** Let us calculate the potential due to this charge at a point P at a distance r from Q. Suppose a unit positive charge is brought radially from infinity to P. Consider an intermediate point A at a distance x from the charge. Let the unit positive charge be displaced by a small displacement dx.  	1

	The force at this point is given by: $$F = \frac{1}{4\pi\varepsilon_0}\frac{Q \times 1}{x^2}$$ The work done to move the unit positive charge through a distance *dx* is: $$dW = F\,dx\cos\theta = -\frac{1}{4\pi\varepsilon_0}\frac{Q}{x^2}dx$$ Therefore, the total work done which is equal to the potential at the point is given by: $$W = \int dW = \int_{\infty}^{r} -\frac{1}{4\pi\varepsilon_0}\frac{Q}{x^2}dx = -\frac{Q}{4\pi\varepsilon_0}\int_{\infty}^{r}\frac{1}{x^2}dx$$ $$\Rightarrow W = \frac{Q}{4\pi\varepsilon_0}\left[\frac{1}{r} - \frac{1}{\infty}\right] = \frac{1}{4\pi\varepsilon_0}\frac{Q}{r}$$ This is the work done to move the unit positive charge from infinity to point P. By definition, it is equal to the electric potential at P. $$W = V$$ $$\therefore \quad V = \frac{1}{4\pi\varepsilon_0}\frac{Q}{r}$$	1 1 1 1
38	**Arrive at the condition for balance of a Wheatstone's network using Kirchhoff's rules.** The following circuit show a Wheatstone's network  Applying KVL to loop ABDA, $$-I_1R_1 - I_gG + I_2R_2 = 0$$ Applying KVL to loop BCDB, $$-(I_1 - I_g)R_3 + (I_2 + I_g)R_4 + I_gG = 0$$ When the network is balanced, the current through the galvanometer is zero (or $I_g = 0$). Then, we have: $$-I_1R_1 + I_2R_2 = 0 \Rightarrow I_1R_1 = I_2R_2$$ $$-I_1R_3 + I_2R_4 = 0 \Rightarrow I_1R_3 = I_2R_4$$ Dividing one question by another, we get: $$\frac{R_1}{R_3} = \frac{R_2}{R_4} \quad \left(OR\ \frac{R_1}{R_2} = \frac{R_3}{R_4}\right)$$	1 1 1 1 1

39 **Obtain the expression for the force per unit length between two infinitely long straight parallel current carrying conductors placed in vacuum. Hence define the unit 'ampere'.**

Consider two infinitely long straight parallel conductors a and b separated by a distance d. The current through them respectively are I_a and I_b. Let us consider a section L of the wire b.



1

The magnetic field due to wire a at the position of wire b is:

$$B_a = \frac{\mu_o I_a}{2\pi d}$$

The force on the section of wire b due to wire a is:

$$F_b = I_b L B_a \sin\theta = \frac{\mu_o I_a I_b}{2\pi d} L$$ 1

towards wire a.

We can see that a similar section of wire a experiences an equal and opposite force due to wire b. Therefore, $F_a = F_b = F$, the force between the wires. 1

Hence, force per unit length between the wires is:

$$f = \frac{F}{L} = \frac{\mu_o I_a I_b}{2\pi d}$$ 1

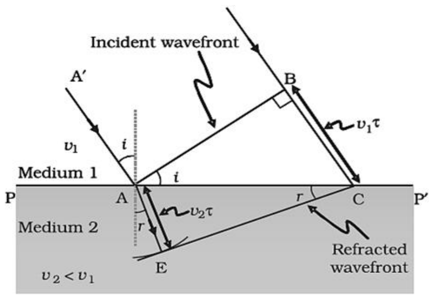
The ampere is the value of that steady current which, when maintained in each of the two very long, straight, parallel conductors of negligible cross-section, and placed one metre apart in vacuum, would produce on each of these conductors a force equal to 2×10^{-7} *newtons per metre of length.* 1

40 **a) State Huygen's principle**

Every point on a primary wavefront act as a source of secondary disturbance and it produces spherical secondary wavelets. A tangent surface drawn to all these secondary wavelets gives the new wavefront. 1

b) Prove Snell's law of refraction using Huygen's principle by considering refraction of a plane wave by a surface.

Consider a plane wavefront incident AB on the interface of two media PP' as shown in the figure. The angle of incidence is i. EC is the refracted wavefront, and r is the angle of refraction.



1

From the figure:

$$\sin i = \frac{BC}{AC} = \frac{v_1\tau}{AC} \quad \text{and} \quad \sin r = \frac{AE}{AC} = \frac{v_2\tau}{AC}$$ 1

$$\Rightarrow \frac{\sin i}{\sin r} = \frac{v_1}{v_2}$$ 1

But $\frac{v_1}{v_2} = \frac{n_2}{n_1}$

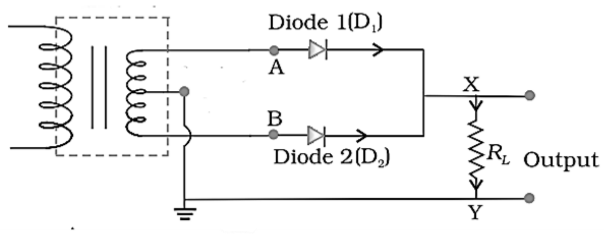
$$\Rightarrow \frac{\sin i}{\sin r} = \frac{n_2}{n_1}$$ 1

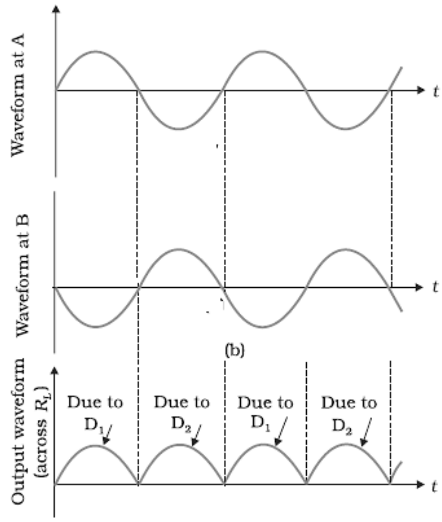
41 **a) What is a rectifier?**

A rectifier is a device (or circuit) which converts AC into DC. 1

b) With the help of a circuit diagram, input and output waveforms, explain the working of a full wave rectifier.

The circuit for a full wave rectifier is constructed as shown in the figure.





1 + 1

WORKING: During positive half-cycle of AC, A becomes positive and B becomes negative. Then diode D_1 is forward biased and it conducts; diode D_2 is reverse biased and it does not conduct. The output due to D_1 appears across R_L. 1

During negative half-cycle of AC, A becomes negative and B becomes positive. Then diode D_2 is forward biased and it conducts; diode D_1 is reverse biased and it does not conduct. The output due to D_2 appears across R_L. 1

VI. Answer any **TWO** of the following questions: $2 \times 5 = 10$

42 **A uniformly charged spherical shell of radius 10 cm has a surface charge density of 16 μC m^{-2}. Find the electric field due to the shell at a distance of**

a) 20 cm from the centre of the shell. **b) 5 cm from the centre of the shell.**

Given: $\sigma = 16\ \mu\text{C m}^{-2} = 16 \times 10^{-6}\ \text{C m}^{-2}, R = 10\ \text{cm} = 0.1\ \text{m}$

Charge on the spherical shell, $Q = \sigma \times 4\pi R^2$

$$= (16 \times 10^{-6}) \times (4 \times 3.14 \times (0.1)^2) = 2 \times 10^{-6}\text{C}$$ 1

(a) The electric field at a distance of 20 cm is:

$$E = \frac{1}{4\pi\varepsilon_o}\frac{Q}{r^2}$$ 1

$$\Rightarrow E = (9 \times 10^9) \times \frac{2 \times 10^{-6}}{0.2^2}$$ 1

$$= 4.5 \times 10^5\ \text{N C}^{-1}$$ 1

Alternate Method:

$$\text{Electric field: } E = \frac{\sigma}{\varepsilon_o}\frac{R^2}{r^2} = \frac{16\times10^{-6}}{8.854\times10^{-12}}\left(\frac{10}{20}\right)^2 = 0.452\times10^6\,\text{NC}^{-1}$$

	OR Given: $\sigma = 16\ \mu\text{C cm}^{-2} = 16 \times 10^{-2}\ \text{C m}^{-2}, R = 10\ \text{cm} = 0.1\ \text{m}$ Charge on the spherical shell, $Q = \sigma \times 4\pi R^2$ $= (16 \times 10^{-2}) \times (4 \times 3.14 \times (0.1)^2) = 2 \times 10^{-2}\text{C}$ (a) The electric field at a distance of 20 cm is: $E = \frac{1}{4\pi\varepsilon_o}\frac{Q}{r^2}$ $\Rightarrow E = (9 \times 10^9) \times \frac{2 \times 10^{-2}}{0.2^2}$ $= 4.5 \times 10^9\ \text{N C}^{-1}$ **Alternate Method:** Electric field: $\text{E} = \frac{\sigma}{\varepsilon_o}\frac{\text{R}^2}{\text{r}^2} = \frac{16 \times 10^{-2}}{8.854 \times 10^{-12}}\left(\frac{10}{20}\right)^2 = 0.452 \times 10^{10}\ \text{NC}^{-1}$ (b) A point 5cm from the centre lies within the spherical conductor. Hence **electric field is zero.**	**OR** 1 1 1 1 1
43	**Two identical cells each of emf 15 V either connected in series or connected in parallel across an external resistance of 5 Ω produce the same current through the resistor.** **a) Calculate the value of internal resistance of the cell.** **b) Find the current through the external resistor in either case.** Given: $\varepsilon_1 = \varepsilon_2 = 15\ V; R = 5\ \Omega; r_1 = r_2 = r; I_s = I_p$ (a) $\varepsilon_s = \varepsilon_1 + \varepsilon_2 = 30\ V; \varepsilon_P = \frac{\varepsilon_1 r_2 + \varepsilon_2 r_1}{r_1 + r_2} = 15\ V$ $r_s = r_1 + r_2 = 2r; r_p = \frac{r_1 r_2}{r_1 + r_2} = \frac{r}{2}$ $I = \frac{\varepsilon}{R + r}$ $I_s = I_p \Rightarrow \frac{30}{5 + 2r} = \frac{15}{5 + r/2}$ $\Rightarrow r = 5\ \Omega$ (b) $I = I_s = \frac{30}{5+2r} = \frac{30}{5+2\times5} = 2\ A$ (Any other alternative method should be considered)	1 1 1 1 1
44	**A series *LCR* circuit with *L* = 0.5 H and *R* = 100 Ω is connected to a 200 V, 50 Hz a.c. supply.** **a) Calculate the value of capacitance of the capacitor that drives the circuit into resonance. b) Find the value of voltage across the inductor at resonance.** Given: $L = 0.5$ H; $R = 100\ \Omega$; $V = 200$ V; $f = f_o = 50$ Hz (a) $f_o = \frac{1}{2\pi\sqrt{LC}}$ $\Rightarrow C = \frac{1}{4\pi^2 f_o^2 L} = \frac{1}{4 \times (3.14)^2 \times (50)^2 \times 0.5} = 20.2 \times 10^{-6}\ \text{F}$ (b) Current through the circuit, $I = \frac{V}{R} = \frac{200}{100} = 2\ \text{A}$ Inductive reactance, $X_L = 2\pi f L = 2 \times 3.14 \times 50 \times 0.5 = 157\ \Omega$ Voltage across inductor, $V_L = IX_L = 2 \times 157 = 314\ \text{V}$ (Any other alternative method should be considered)	1 1 1 1 1

45	**An object of height 1 mm is kept perpendicular to the axis of a thin convex lens of power + 10 D. The distance between the object and the lens is 15 cm. Find the position and height of the image formed.** Given: $P = +10$ D; $u = -15$ cm; $h_i = 1$ mm Focal length of the lens, $f = \frac{1}{P} = \frac{1}{10} = 0.1$ m $= 10$ cm Thin lens formula: $-\frac{1}{u} + \frac{1}{v} = \frac{1}{f}$ $$\Rightarrow v = \frac{uf}{u+f} = \frac{(-15)\times(10)}{(-15)+(10)} = 30 \text{ cm}$$ Height of the image, $h_i = m \times h_o = \frac{v}{u} \times h_o$ $$h_i = \frac{v}{u} \times h_o = \frac{30}{-15} \times 1 = -2 \text{ mm}$$ **OR** Height of the image is 2 mm. (Any other alternative method should be considered)	1 1 1 1 1
	PART – E	
7	When a.c. is passed through an a.c. circuit, it is observed that the voltage and the current are in phase. Along with the a.c. source, the circuit: (a) has a series combination of resistance and capacitance. (b) has only inductance. (c) has only capacitance. **(d) may have only resistance or may have a suitable series combination of inductance (*L*), capacitance (*C*) and resistance (*R*).** **Ans: (d) may have only resistance or may have a suitable series combination of inductance (*L*), capacitance (*C*) and resistance (*R*).**	1