GOVERNMENT OF KARNATAKA
KARNATAKA SCHOOL EXAMINATION AND ASSESSMENT BOARD
II PUC SUPPLEMENTARY EXAMINATION - 2
(AUG/SEP–2023)

Subject: PHYSICS **SCHEME OF EVALUATION** **Subjectcode: 33**

PART – A Only the first written answers will be considered

I. Pick the correct option among the four given options for ALL of the following questions : **15 × 1 = 15**

1.	**The substances which allow electricity to pass through them easily are called** **(a) Conductors (b)Insulators (c) Semiconductors (d) None of these**	
Ans	(a) Conductors	**1**
2.	**The maximum electric field that a dielectric medium can withstand without breakdown is called** **(a) permitivity (b) dielectric constant (c) electric susceptibility (d) dielectric strength**	
Ans	(d) dielectric strength	**1**
3.	**Which of the following is the S I unit of capacitance?** **(a) coulomb (C) (b) farad (F) (c) volt (V) (d) tesla (T)**	
Ans	(b) farad (F)	**1**
4.	**As the temperature of a conductor increases, then its resistance** **(a) increases (b) decreases (c) remains constant (d) both (a) and (b) are correct**	
Ans	(a) increases	**1**
5.	**To convert a galvanometer to an ammeter one should connect** **(a) high resistance in series with galvanometer** **(b) low resistance in series with galvanometer** **(c) low resistance in parallel with galvanometer** **(d) high resistance in parallel with galvanometer**	
Ans	(c) low resistance in parallel with galvanometer	**1**
6.	**An angle between true geographic north and the north shown by a compass needle at a place is called** **(a) magnetic declination (b) magnetic inclination** **(c) Brewster's angle (d) Critical angle**	
Ans	(a) magnetic declination	**1**
7.	**The phenomenon in which an emf is induced in a coil whenever the magnetic flux linked with it changes is known as** **(a) magnetic effect of an electric current (b) mechanical effect of an electric current** **(c) electromagnetic induction (d) photoelectric effect**	
Ans	(c) electromagnetic induction	**1**
8.	**Lenz's law is the consequence of law of conservation of** **(a) mass (b) energy (c) charge (d) momentum**	
Ans	(b) energy	**1**

9.	**Which of the following is independent of the frequency of applied A. C.?** **(a) resistance (b) inductive reactance (c) capacitive reactance (d) impedance**	
Ans	(a) resistance	**1**
10.	**Which of the following are not electromagnetic waves?** **(a) Radio waves (b) β – rays (c) U – V rays (d) X - rays**	
Ans	(b) β – rays	**1**
11.	**Blue colour of sky is due to the phenomenon of Light** **(a) reflection (b) refraction (c) scattering (d) dispersion**	
Ans	(c) scattering	**1**
12.	**Which of the following phenomenon confirms the transverse nature of the light waves?** **(a) interference (b) diffraction (c) polarisation (d) reflection**	
Ans	(c) polarisation	**1**
13.	**The phenomenon of emission of electrons from a metal surface by heating it is called** **(a) field emission (b) thermionic emission** **(c) photoelectric emission (d) secondary emission**	
Ans	(b) thermionic emission	**1**
14.	**Nucleids with same neutron number N but different atomic number Z are called** **(a) isotopes (b) isobars (c) radioactive nuclei (d) isotones**	
Ans	(d) isotones	**1**
15.	**The given truth table is for which logic gate?** **(a) NOT gate (b) OR gate** **(c) AND gate (d) NAND gate** **Input (A) | Output (Y)** **0 | 1** **1 | 0**	
Ans	(a) NOT gate	**1**

II. Fill in the blanks by choosing appropriate answer given in the brackets for ALL the following questions: **5 × 1 = 5**

(Activity, Oil immersion objective, Gold leaf electroscope, intrinsic, Meissner effect)

16.	**_____ in an apparatus used to detect charge on a body.**	
Ans	Gold leaf electroscope	**1**
17.	**The phenomenon of perfect diamagnetism in superconductors is called the _____.**	
Ans	Meissner effect	**1**
18.	**The resolving power of a microscope can be increased by using _____.**	
Ans	Oil immersion objective	**1**
19.	**The number of disintegration OR decay per second of the radioactive substance is named as _____.**	
Ans	Activity	**1**
20.	**An _____ semiconductor will behave like an insulator at temperature T = 0 K.**	
Ans	intrinsic	**1**

PART – B

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

21. **Mention two properties of an equipotential surface.**

Ans

i) Potential at every point on the equipotential surface is same.

ii) For any charge configuration, equipotential surface through a point is normal to the electric field at that point. **OR** Electric field is normal to the equipotential surface at every point.

iii) Work done to move a charge on an equipotential surface is zero.

iv) The equipotential surfaces corresponding to different potentials will be (a) very close in case of strong field and (b) far apart in case of weak field.

v) Potential difference between any two points on the equipotential surface is zero.

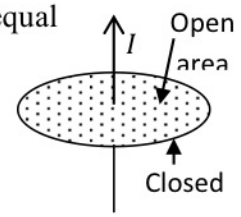
vi) No two equipotential surfaces intersect. **Any 2 properties & 1 mark each**

1 each

22. **State and explain Ampere's circuital law.**

Ans

Statement: The line integral, $\oint \vec{B} . \vec{dl}$ for a closed curve enclosing an area is equal to μ_0 times the net current I through the area bounded by the curve.



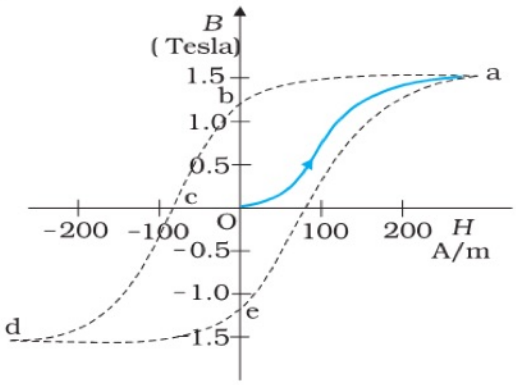
Explanation: Closed curve is split into number of small line elements of length, dl. B is magnetic field due to current at the line element, then $\oint \vec{B} . \vec{dl} = \mu_0 I$ **OR** $\oint B\, dl \cos\theta = \mu_0 I$, where μ_0 – permeability of free space, θ – angle between $\vec{B}$ and $\vec{dl}$.

1

1

23. **Draw the magnetic hysteresis loop (B – H curve) for a ferromagnetic material.**

Ans



2

24. **What are eddy currents? Mention one of its uses.**

Ans

Induced circulating currents in a bulk conductor, when it is placed in a varying magnetic field are called eddy currents.

Uses: i) Magnetic braking systems in trains, ii) Induction furnace, iii) Electric power meters, iv) Electromagnetic damping in galvanometer, v) Induction stove. **Any ONE**

1

1

25. **What is resonant frequency of series L C R circuit? Write the expression for it.**

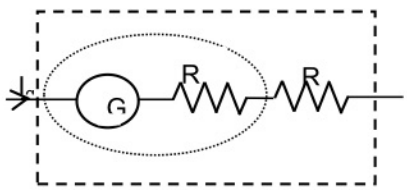
Ans

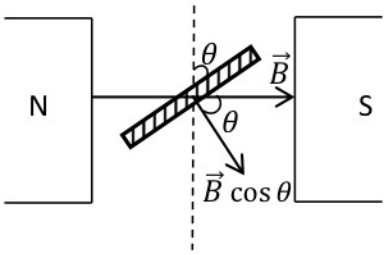
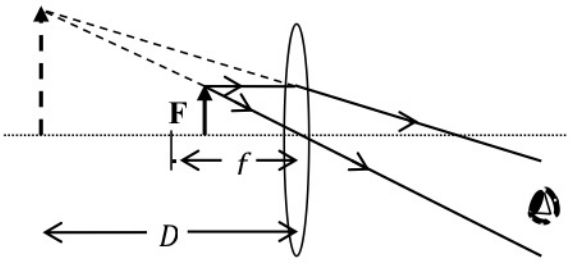
The frequency of applied A C for which inductive reactance is equal to capacitive reactance in series LCR circuit is called resonant frequency. **OR** The frequency of applied A C for which current amplitude in the series L C R circuit is maximum is resonant frequency. **OR** The frequency of applied A C for which voltage across inductor is equal to voltage across capacitor in series LCR circuit is resonant frequency.

Resonant angular frequency, $\omega_0 = \frac{1}{\sqrt{LC}}$ **OR** Resonant frequency, $\nu_0 = \frac{1}{2\pi\sqrt{LC}}$.

1

1

26.	**What is displacement current? Write the expression for it.**	
Ans	The current due to time varying electric field/flux is called displacement current. **OR** A time varying electric field between the plates of a capacitor produces a current. This current is called as displacement current. Displacement current, $i_d = \varepsilon_0 \frac{d\phi_E}{dt}$	1 1
27.	**State Huygens principles of wavefront.**	
Ans	i. Each point on a wave front is a source of secondary waves. ii. Forward common tangent to all secondary wavelets give a new wave front at that time.	1 1
28.	**What is an impact parameter? When is it minimum?**	
Ans	The perpendicular distance of the initial velocity vector of the α – particle from the centre of the nucleus is called impact parameter. When α – particles are deflected through 180° (OR for head on collision), then impact parameter is minimum.	1 1
29.	**Define binding energy of a nucleus? What is its significance?**	
Ans	Binding energy of a nucleus is defined as the minimum energy required to break the nucleus into its constituent nucleons. Binding energy is the measure of stability of a nucleus. **OR** More the binding energy nucleus is more stable and lesser the binding energy nucleus is less stable.	1 1
	PART – C	
	IV. Answer any FIVE of the following questions: 5 × 3 = 15	
30.	**Mention three properties of electric field lines.**	
Ans	i. Field lines start from positive charges and end at negative charges. ii. Two electric field lines can never intersect since a vector cannot have two directions at a point. iii. Electric filed lines do not form any closed loops. iv. Electric field lines are crowded in region of greater electric field. v. Tangent drawn to the electric field lines at any point gives the direction of electric field. vi. In the region of uniform electric field, the electric field lines are uniformly spaced parallel straight lines. **Any 3 properties**	**1** **1** **1**
31.	**Mention three limitations of Ohm's law.**	
Ans	i. Relation between V and I is nonlinear for large current. ii. Relation between V and I depends on sign of V in rectifier. iii. The relation between V and I is non – unique in the case of GaAs (Gallium Arsenide).	**1** **1** **1**
32.	**With a circuit diagram, explain how a galvanometer can be converted into a voltmeter**	
Ans	A moving coil galvanometer can be converted into voltmeter by connecting a **high resistance in series** with it. **Explanation**: When high resistance is introduced, equivalent resistance of voltmeter becomes $R_G + R$. R – High resistance and R_G is resistance of galvanometer **OR** High resistance: $R = \frac{V}{I_g} - R_G$ V – maximum voltage to be measured (range of voltmeter) I_g – maximum current through the galvanometer. 	1 1 Diagram 1

33.	**Define the terms: (i) magnetisation, (ii) magnetic intensity and (iii) magnetic susceptibility.**	
Ans	(i) Magnetisation is net magnetic dipole moment per unit volume. (ii) Magnetic intensity of a material is the ratio of external magnetic field to the permeability of free space. **OR** The degree to which a magnetic field can magnetise a material is called magnetic intensity. (iii) The ratio of magnetisation to the magnetic intensity is called magnetic susceptibility.	1 1 1
34.	**Derive an expression for instantaneous emf induced in A. C. generator.**	
Ans	Let a rectangular coil of N turns and area A rotates in a uniform magnetic field B with uniform angular velocity ω. Let at the time zero the coil is perpendicular to the field. Let it rotates through an angle θ in time t such that $\omega = \theta / t$.  The flux at any time t is, $\emptyset_B = BA\cos\theta = BA\cos\omega t$. By Faraday's law, the induced emf for the rotating coil of N turns is given by, $\varepsilon = -N\frac{d\emptyset_B}{dt} = -NBA\frac{d}{dt}\cos\omega t$. The instantaneous value of the emf is, $\varepsilon = NBA\omega\sin\omega t = \varepsilon_0\sin\omega t$, where $NBA\omega = \varepsilon_0$, peak value of emf and $\omega = 2\pi\nu$ (ν– the frequency of rotation of coil)	1 1 1
35.	**Draw a ray diagram for the formation of image at the near point by a simple microscope. Write the expression for magnification produced by it.**	
Ans	 Magnification, $m = 1 + \frac{D}{f}$. **Note: Deduct ONE mark for the diagram without arrow mark**	2 (diagram) 1 (expression)
36.	**Write Bohr's postulates for the hydrogen atom model.**	
Ans	**i)** In hydrogen atom, an electron revolves in stationary orbits without emission of radiant energy. **ii)** The stationary orbits are those for which the angular momentum, $L = \frac{nh}{2\pi}$, where n is an integer called quantum number and h Planck's constant. **iii)** When electron makes a transition from a stationary orbit to another stationary orbit of lower energy, a photon is emitted. Energy of photon, $h\nu = E_i - E_f$, where ν - frequency of emitted photon.	1 1 1
37.	**A radioactive isotope has a half – life of T years. How long will it take the activity to reduce to 3.125%?**	
Ans	Given half life – T years. Activity after n – half lives, $R = \frac{R_0}{2^n}$ $\frac{R}{R_0} = \frac{3.125}{100} = \frac{1}{2^n}$ $\frac{1}{32} = \frac{1}{2^n} \Rightarrow 2^n = 32$ OR n=5 Total time taken, t = nT = 5T years.	1 1 1

38. **Write any three differences between intrinsic and extrinsic semiconductors.**

Ans

Intrinsic semiconductors	Extrinsic semiconductors
i) It is a pure semiconductor.	i) It is an impure semiconductor.
ii) Number of holes and electrons will be equal.	ii) Number of holes and electrons will be unequal.
iii) Conductivity is zero at very low temperatures.	iii) Conductivity is not zero even at low temperatures.
iv) Conductivity depends only on temperature	iv) Conductivity depends on temperature and doping concentration.
v) Conductivity is relatively less	v) Conductivity is relatively more.

Any THREE differences — **1 each**

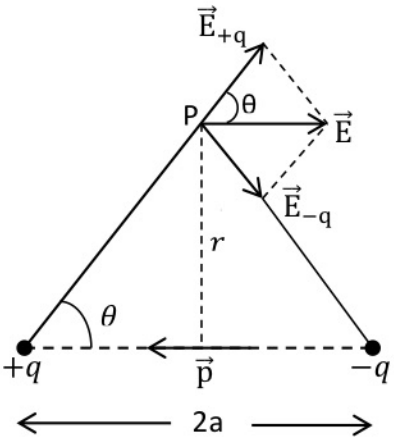
PART – D

V. Answer any THREE of the following questions: $3 \times 5 = 15$

39. **Derive the expression for the electric field at a pointon the equatorial line of an electric dipole.**

Ans

Let P be a point at a distance r from the center of electric dipole along the equatorial line of electric dipole.



1 diagram

Magnitude of electric field at P due to charge $+q$ and $-q$ are $E_{+q} = \frac{1}{4\pi\varepsilon_0}\frac{q}{(r^2+a^2)}$ and $E_{-q} = \frac{1}{4\pi\varepsilon_0}\frac{q}{(r^2+a^2)}$ respectively. **1**

The field at P due to charges is resolved. The components along equatorial line cancel each other. The components along dipole axis added up.

Therefore, $\vec{E} = -(E_{+q} + E_{-q})\cos\theta\,\hat{p}$ (negative sign indicates that both components are opposite to $\vec{p}$) **1**

$$\vec{E} = -\frac{1}{4\pi\varepsilon_0}\frac{2q}{(r^2+a^2)}\cos\theta\,\hat{p}$$ **1**

From the figure, $\cos\theta = \frac{a}{\sqrt{r^2+a^2}}$.

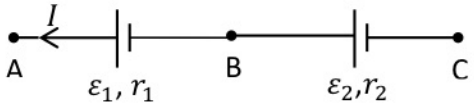
Therefore, $\vec{E} = -\frac{2qa}{4\pi\varepsilon_0(r^2+a^2)^{3/2}}\hat{p}$ **OR** $\vec{E} = -\frac{\vec{p}}{4\pi\varepsilon_0(r^2+a^2)^{3/2}}$. Since $\vec{p} = q2a\,\hat{p}$ **1**

Note: Diagram without proper direction of field, deduct ONE mark.

40. **Two cells of different emfs and different internal resistance are connected in series. Obtain the expression for equivalent emf and equivalent internal resistance of the combination.**

Ans

Let the two cells of emf's ε_1 and ε_2 are connected in series. Let r_1 and r_2 be their internal resistances.



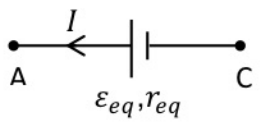
1

Potential difference between A and B, $V_{AB} = \varepsilon_1 - Ir_1$. **1**

Potential difference between B and C, $V_{BC} = \varepsilon_2 - Ir_2$. **1**

Potential difference between A and C,

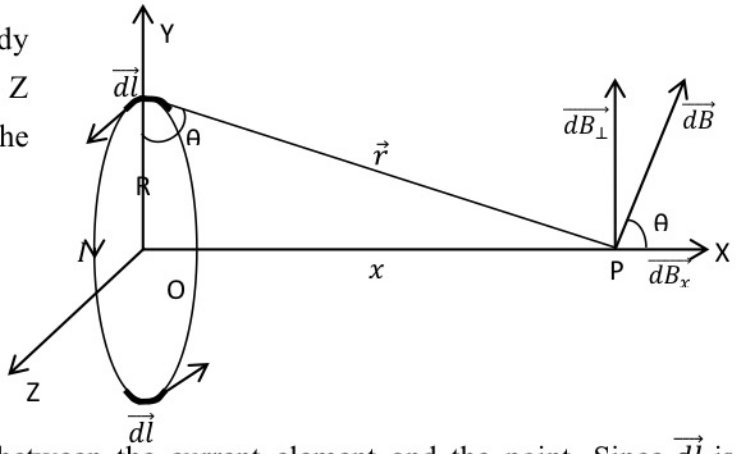
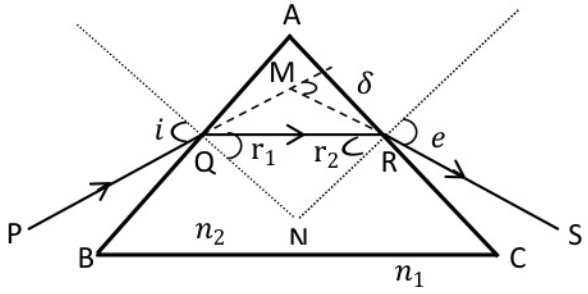
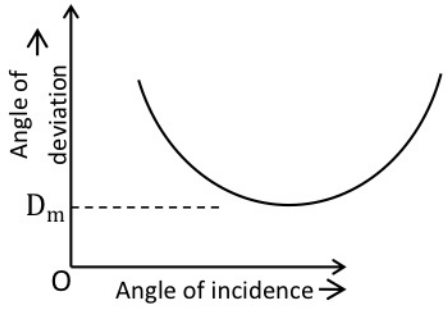
$V_{AC} = \varepsilon_1 + \varepsilon_2 - I(r_1 + r_2)$ -------- (1) **1**

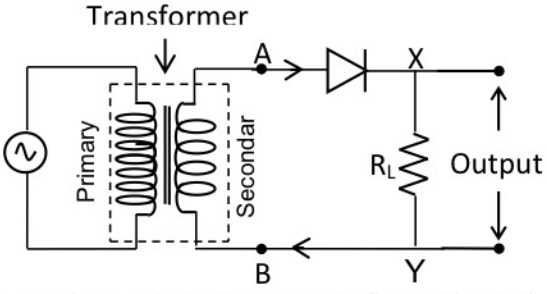


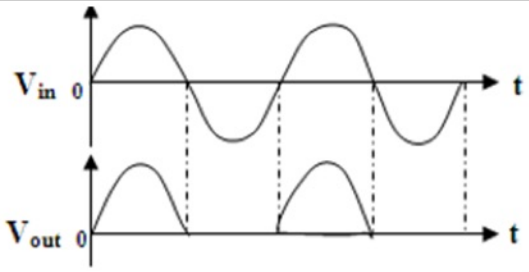
If we replace this combination of cells by a single cell of emf ε_{eq} and internal resistance r_{eq} between A and C, then **1**

$V_{AC} = \varepsilon_{eq} - Ir_{eq}$ -------- (2)

Comparing, (1) and (2),we get $\varepsilon_{eq} = \varepsilon_1 + \varepsilon_2$ and $r_{eq} = r_1 + r_2$. **1**

	Note: Diagram without proper direction of current, deduct ONE mark.	
41.	**Derivean expression for the magnetic field at any point on the axis of a circular current loop**	
Ans	Consider a circular loop carrying steady current I, having radius R placed in Y – Z plane. P is a point at a distance x from the center O of circular loop.  According to Biot – Savart's law the magnitude dB of magnetic field due to $\overrightarrow{dl}$ is given by, $\overrightarrow{dB} = \frac{\mu_0}{4\pi}\frac{I(\vec{dl}\times\vec{r})}{r^3}$, where $r^2 = x^2 + R^2$, r is the distance between the current element and the point. Since $\vec{dl}$ is always perpendicular to $\vec{r}$, $\left\|\vec{dl}\times\vec{r}\right\| = rdl$. Therefore, $dB = \frac{\mu_0}{4\pi}\frac{Idl}{(x^2+R^2)}$. $\overrightarrow{dB}$ is perpendicular to $\vec{dl}$ and $\vec{r}$. $\overrightarrow{dB}$ is resolved into x – component $\overrightarrow{dB_x}$ and perpendicular component $\overrightarrow{dB_\perp}$. $\overrightarrow{dB_\perp}$ components due to diametrically opposite $\vec{dl}$ elements cancel each other. $dB_x = dB\ \cos\theta$, where $cos\,\theta = \frac{R}{(x^2+R^2)^{½}}$. Therefore, $dB_x = \frac{\mu_0}{4\pi}\frac{IdlR}{(x^2+R^2)^{3/2}}$. Magnetic field due to entire loop of length $2\pi R$ is, $\vec{B} = \sum\overrightarrow{dB_x} = \frac{\mu_0}{4\pi}\frac{IR\sum dl}{(x^2+R^2)^{3/2}}\hat{\imath}$ But $\sum dl = 2\pi R$. Therefore $\vec{B} = \frac{\mu_0 IR^2}{2(x^2+R^2)^{3/2}}\hat{\imath}$. **Note: Diagram without proper direction of current, deduct ONE mark.**	1 diagram 1 1 1 1
42.	**Derive an expression for the refractive index (n) of the material of a prism in terms of the angle of the prism and angle of minimum deviation**	
Ans	  The angle of incidence and refraction at first surface AB are iand r_1 while the angle of incidence at the second face AC is r_2 and the angle of emergence e. The angle of deviation is δ. In quadrilateral AQNR, $\angle A + \angle QNR = 180°$ ------- (1) From the triangle QNR, $r_1 + r_2 + \angle QNR = 180°$ ------- (2) From (1) and (2), $r_1 + r_2 = A$ ------- (3) The total deviation $\delta = (i - r_1) + (e - r_2)$ OR $\delta = i + e - A$ ------- (4)	1 Diagram 1 1

	The angle of deviation varies with angle of incidence as in the graph. At minimum deviation D_m, the refracted ray inside the prism becomes parallel to the base. Then we have, $\delta = D_m, i = e$ and $r_1 = r_2 = r$. (Graph or explanation of minimum deviation position) Equation (3) gives $2r = A$ OR $r = \frac{A}{2}$. Equation (4)gives, $D_m = 2i - A$ OR $i = \frac{A + D_m}{2}$. Refractive index of the material of the prism, by Snell's law, $n_{21} = \frac{n_2}{n_1} = \frac{\sin i}{\sin r} = \frac{\sin\left(\frac{A+D_m}{2}\right)}{\sin\left(\frac{A}{2}\right)}$. **Note: Diagram without arrow mark, deduct ONE mark.**	1 1
43.	**(i) Define work function of a metal for photoelectric emission. (1)** **(ii) Write any two experimental observations of photoelectric effect. (2)** **(iii) Write the expression for de Broglie wavelength in terms of electric potential and explain the terms. (2)**	
Ans	**(i)** Work function of a metal is the minimum light (radiation) energy required by an electron to escape from the metal surface. **(ii) Experimental observations of photoelectric effect:** **a.** Above threshold frequency, photoelectric current is directly proportional to the intensity of radiation. **b.** Above threshold frequency, for a given photosensitive material and frequency of incident radiation, saturation current is directly proportional to intensity of radiation whereas the stopping potential is independent of intensity. **c.** Photoelectric emission cannot take place if the frequency of radiation is less than threshold frequency. **d.** Above threshold frequency, the stopping potential or equivalently the maximum kinetic energy of the photoelectrons increases linearly with the increase of frequency of radiation, but independent of intensity. **e.** The photoemission is an instantaneous process. **(Any TWO observations)** **(iii)** de – Broglie wavelength, $\lambda = \frac{h}{\sqrt{2meV}}$, where h – Plank's constant, m – mass of electron, e –electronic charge, V– electric potential difference.	1 1e ach 1 1
44.	**(i) What is rectification? (1)** **(ii) With neat circuit diagram, explain the working of half - wave rectifier. (3)** **(iii) Draw input and output wavefors of the half – wave rectifier. (1)**	
Ans	**(i)** Process of conversion of AC into DC is called rectification. **(ii)** The secondary of a transformer supplies the desired ac voltage across terminals A and B. When the voltage at A is positive (During +ve half cycle of AC input), the diode is forward biased and it conducts. When A is negative (during the –ve half cycle of AC input), the diode is reverse biased and it does not conduct. Thus the current flows through the circuit during positive half cycles. The current through R_L is from X to Y, unidirectional and output in the form of pulsating D.C. 	1 1circuit diagram 1 1

	(iii) 	**1**
VI. Answer any TWO of the following questions:		**2 × 5 = 10**
45.	**Three capacitors of capacitances 2 pF, 3 pF and 4 pF are connected in parallel.** **(a) What is the total capacitance of the combination?** **(b) Determine the charge on each capacitor, if the combination is connected to a 100 V supply.**	
	Given $C_1 = 2\ pF, C_2 = 3\ pF, C_3 = 4\ pF, V = 100$ V (a) Total (Effective) capacitance, $C_P = C_1 + C_2 + C_3$ $C_P = 2$ pF+3 pF+4 pF= 9 pF (b) Charge on the capacitor, Q=CV Charge on C_1, $Q_1 = C_1V = 2$ pFx100 = 200 pC. Charge on C_2, $Q_2 = C_2V = 3$ pFx100 = 300 pC. Charge on C_3, $Q_3 = C_3V = 4$ pFx100 = 400 pC.	**1** **1** **1** **1** **1**
46.	**Calculate the current density and average drift speed of conduction electrons in a copper wire of cross – sectional area $1.0\text{x}10^{-7}$ m^2 carrying current of 1.5 A. Given free electron density of copper, $n = 8.5\text{x}10^{28}$ m^{-3}, $e = 1.6\text{x}10^{-19}$ C.**	
Ans	Given $A = 1.0\text{x}10^{-7}$ m^2 $I = 1.5$ A, $n = 8.5\text{x}10^{28}$ m^{-3}, $e = 1.6\text{x}10^{-19}$ C Current density, $J = \frac{I}{A}$ $= \frac{1.5}{1.0\text{x}10^{-7}} = 1.5\text{x}10^{7}$ Am^{-2}. Drift velocity, $v_d = \frac{I}{neA}$ $= \frac{1.5}{8.5\text{x}10^{28}\text{x}1.6\text{x}10^{-19}\text{x}1.0\text{x}10^{-7}}$ $= 1.103\text{x}10^{-3}$ ms^{-1}	**1** **1** **1** **1** **1**
47.	**A resistor of resistance 100 Ω, a coil of inductance 0.2 H and a capacitor of capacitance 20 μF are connected in series across A. C source of 200 V, 50 Hz. Calculate** **(a) impedance of the circuit and (b) current through the circuit.**	
Ans	Given $R = 100\ \Omega$, $L = 0.2$ H, $C = 20$ μF, $v_{rms} = 200$ V, $\nu = 50$ Hz **(a)** Inductive reactance, $X_L = \omega L = 2\pi\nu L = 2\text{x}3.142\text{x}50\text{x}0.2 = 62.84\ \Omega$ Capacitive reactance, $X_C = \frac{1}{\omega C} = \frac{1}{2\pi\nu C} = \frac{1}{2\text{x}3.142\text{x}50\text{x}20\text{x}10^{-6}} = 159.1\ \Omega$ Impedance, $Z = \sqrt{R^2 + (X_C - X_L)^2}$ $= \sqrt{100^2 + (159.1 - 62.84)^2} = 138.8\ \Omega$ **(b)** Current, $i_{rms} = \frac{v_{rms}}{Z} = \frac{200}{138.8} = 1.44$ A	**1** **1** **1** **1** **1**

48.	**In Young's double slit experiment, the slits are 0.4 mm apart. Interference fringes of width 1.5 mm are observed on a screen placed 1.2 m away from the slits. Calculate the wavelength of light used. If the apparatus is immersed in water of refractive index 1.33, what is the change in fringe width?**	
Ans	Given $d = 0.4$ mm, $\beta = 1.5$ mm, $D = 1.2$m, $n_W = 1.33$ V Fringe width, $\beta = \frac{\lambda D}{d}$ Wavelength of the light used, $\lambda = \frac{\beta d}{D}$ $= \frac{1.5\text{x}10^{-3}\text{x}0.4\text{x}10^{-3}}{1.2}$ $= 0.5\text{x}10^{-6}$ m OR 500 nm Fringe width in water, $\beta' = \frac{\beta}{n_W} = \frac{1.5\text{x}10^{-3}}{1.33} = 1.128\text{x}10^{-3}$ m Change in fringe width, $\Delta\beta = \beta - \beta' = (1.5 - 1.128)\text{x}10^{-3} = 0.372\text{x}10^{-3}$m OR 0.372 mm	**1** **1** **1** **1** **1**

Note: Any other alternate correct method/answer should be considered.

Answer without correct unit OR no unit deduct ONE mark in PARD D problems

Registration No: [redacted]

A – 2023

Supply Exam – 2

Subject Code 33

PHYSICS

(Kannada and English Versions)

Time : 3 Hours 15 Minutes] [Total No. of Questions : 48] [Max. Marks : 70

(Kannada Version)

ಸಾಮಾನ್ಯ ಸೂಚನೆಗಳು :

1. ಎಲ್ಲಾ ಭಾಗಗಳೂ ಕಡ್ಡಾಯವಾಗಿರುತ್ತವೆ.
2. ಭಾಗ – A ನಲ್ಲಿನ ಪ್ರಶ್ನೆಗಳಿಗೆ ಪ್ರಥಮವಾಗಿ ಬರೆದ ಉತ್ತರಗಳನ್ನು ಮಾತ್ರ ಪರಿಗಣಿಸಲಾಗುವುದು.
3. ಅವಶ್ಯವಿರುವೆಡೆ ಉತ್ತರಗಳಲ್ಲಿ ಸಂಬಂಧಿತ ಚಿತ್ರ/ರೇಖಾಚಿತ್ರ/ಮಂಡಲ ಬರೆಯದಿದ್ದಲ್ಲಿ ಯಾವುದೇ ಅಂಕಗಳನ್ನು ನೀಡಲಾಗುವುದಿಲ್ಲ.
4. ಸಾಂಖ್ಯಿಕ ಲೆಕ್ಕಗಳನ್ನು ಸಂಬಂಧಿತ ಸೂತ್ರ ಬರೆಯದೆ ಬಿಡಿಸಿದಲ್ಲಿ ಯಾವುದೇ ಅಂಕಗಳನ್ನು ನೀಡಲಾಗುವುದಿಲ್ಲ.

ಭಾಗ – A

I. ಕೆಳಗಿರುವ ಎಲ್ಲಾ ಪ್ರಶ್ನೆಗಳಿಗೆ ಕೊಟ್ಟಿರುವ ನಾಲ್ಕು ಆಯ್ಕೆಗಳಿಂದ ಸರಿಯಾದ ಉತ್ತರವನ್ನು ಆಯ್ದು ಬರೆಯಿರಿ : **(15 × 1 = 15)**

1. ಸುಲಭವಾಗಿ ವಿದ್ಯುತ್ತನ್ನು ತನ್ನ ಮೂಲಕ ಹಾದುಹೋಗಲು ಬಿಡುವಂತಹ ವಸ್ತುಗಳನ್ನು ———— ಎಂದು ಕರೆಯುತ್ತಾರೆ.

   (a) ವಾಹಕಗಳು (b) ಅವಾಹಕಗಳು

   (c) ಅರೆವಾಹಕಗಳು (d) ಇವುಗಳಾವುದೂ ಅಲ್ಲ

2. ಒಂದು ಪರಾವಿದ್ಯುತ್ ಮಾಧ್ಯಮವು ಮುರಿದು ಬೀಳದೆ ತಡೆದುಕೊಳ್ಳಬಹುದಾದ ಗರಿಷ್ಟ ವಿದ್ಯುತ್ ಕ್ಷೇತ್ರವನ್ನು ಅದರ ———— ಎನ್ನುವರು.

   (a) ವಿದ್ಯುತ್ ಶೀಲತೆ (b) ಪರಾವೈದುತ್ ಸ್ಥಿರಾಂಕ

   (c) ವಿದ್ಯುತ್ ಪ್ರೇರಕತ್ವ (d) ಪರಾವಿದ್ಯುತ್ ಸಾಮರ್ಥ್ಯ

(English Version)

General Instructions :

1. *All Parts are* **compulsory.**
2. *Only the first written answers will be considered for Part A.*
3. *Answers without relevant diagram / figure / circuit wherever necessary will not carry any marks.*
4. *Direct answers to the numerical problems without detailed solutions will not carry any marks.*

Part - A

I. Pick the correct option among the four given options for all the following questions: **(15 × 1 = 15)**

1) The substances which allow electricity to pass through them easily are called

(a) Conductors (b) Insulators

(c) Semiconductors (d) None of these

2) The maximum electric field that a dielectric medium can withstand without breakdown is called

(a) permitivity (b) dielectric constant

(c) electric susceptibility (d) dielectric strength

3) Which of the following is the S.I. Unit of capacitance?

(a) coulomb (C) (b) farad (F)

(c) volt (V) (d) tesla (T)

4) As the temperature of a counductor increases, then its resistance

(a) increases (b) decreases

(c) remains constant (d) both (a) and (b) are correct

5) To convert a galvanometer to an ammeter one should connect

(a) high resistance in series with galvanometer

(b) low resistance in series with galvanometer

(c) low resistance in parallel with galvanometer

(d) high resistance in parallel with galvanometer.

6) An angle between the true geographic north and the north shown by a compass needle at a place is called

(a) magnetic declination

(b) magnetic inclination

(c) Brewster's angle

(d) Critical angle

7) The phenomenon in which an emf is induced in a coil whenever the magnetic flux linked with it changes is known as

(a) magnetic effect of an electric current

(b) mechanical effect of an electric current

(c) electromagnetic induction

(d) photoelectric effect

8) Lenz's law is the consequence of law of conservation of

(a) mass (b) energy

(c) charge (d) momentum

9) Which of the following is independent of the frequency of applied A.C.?

(a) resistance (b) inductive reactance

(c) capacitive reactance (d) impedance

10) Which of the following are not electromagnetic waves?

(a) Radio waves (b) β-rays

(c) UV-rays (d) X-rays

11) Blue colour of sky is due to the phenomenon of Light

(a) reflection (b) refraction

(c) scattering (d) dispersion

12) Which of the following phenomenon confirms the transverse nature of the light waves?

(a) interference (b) diffraction

(c) polarisation (d) reflection

13) The phenomenon of emission of electrons from a metal surface by heating it is called

(a) field emission

(b) thermionic emission

(c) photoelectric emission

(d) secondary emission

14) Nucleids with same neutron number N but different atomic number Z are called

(a) isotopes (b) isobars

(c) radioactive nuclei (d) isotones

15) The given truth table is for which logic gate?

(a) NOT gate

(b) OR gate

(c) AND gate

(d) NAND gate

Input (A)	Output (Y)
0	1
1	0

II. Fill in the blanks by choosing appropriate answer given in the bracket for all the following questions: (5 × 1 = 5)

(Activity, Oil immersion objective, Gold leaf electroscope, Intrinsic, Meissner effect)

16) GLE is an apparatus used to detect charge on a body.

17) The phenomenon of perfect diamagnetism in superconductors is called the AC

18) The resolving power of a microscope can be increased by using Oio

19) The number of disintegration OR decay per second of the radioactive substance is named as ME

20) An Extra semiconductor will behave like an insulator at temperature T = 0K.

Part - B

III. Answer any five of the following questions: (5 × 2 = 10)

21) Mention two properties of an equipotential surface.

22) State and explain Ampere's circuital law.

23) Draw the magnetic hysteresis loop (B-H curve) for a ferromagnetic material.

24) What are eddy currents? Mention one of its uses.

25) What is resonant frequency of series LCR-circuit? Write the expression for it.

26) What is displacement current? Write an expression for it.

27) State Huygens principles of wavefront.

28) What is an impact parameter? When is it minimum?

29) Define binding energy of a nucleus. What is its significance?

Part - C

IV. Answer any five of the following questions: **(5 × 3 = 15)**

30) Mention three properties of electric field lines.

31) Mention three limitations of Ohm's law.

32) With a circuit diagram, explain how a galvanometer can be converted into a voltmeter?

33) Define the terms:

(i) magnetisation

(ii) magnetic intensity and

(iii) magnetic susceptibility.

34) Derive an expression for instantaneous emf induced in A.C. generator.

35) Draw a ray diagram for the formation of image at the near point by a simple microscope. Write the expression for magnification produced by it.

36) Write Bohr's postulates for the hydrogen atom model.

37) A radioactive isotope has a half-life of T years. How long will it take the activity to reduce to 3.125%?

38) Write any three differences between intrinsic and extrinsic semiconductors.

Part - D

V. Answer any three of the following questions: **(3 × 5 = 15)**

39) Derive the expression for the electric field at a point on the equatorial line of an electric dipole.

40) Two cells of different emfs and different internal resistances are connected in series. Obtain the expression for equivalent emf and equivalent internal resistance of the combination.

41) Derive an expression for the magnetic field at any point on the axis of a circular current loop.

42) Derive an expression for the refractive index (n) of the material of a prism in terms of the angle of the prism and angle of minimum deviation.

43) (i) Define work function of a metal for photoelectric emission. (1)

(ii) Write any two experimental observations of photoelectric effect. (2)

(iii) Write the expression for de Broglie wavelength in terms of electric potential and explain the terms. (2)

44) (i) What is rectification? (1)

(ii) With a neat circuit diagram explain the working of half-wave rectifier. (3)

(iii) Draw input and output waveforms of the half-wave rectifier. (1)

VI. Answer any **two** of the following questions: (2 × 5 = 10)

45) Three capacitors of capacitances 2pF, 3pF and 4pF are connected in parallel.

(a) What is the total capacitance of the combination?

(b) Determine the charge on each capacitor if the combination is connected to a 100V supply.

46) Calculate the current density and average drift speed of conduction electrons in a copper wire of cross-sectional area 1.0×10^{-7} m^2 carrying current of 1.5 A.

Given: Free electron density of copper, $n = 8.5 \times 10^{28}/m^3$,

$e = 1.6 \times 10^{-19}$C.

47) A resistor of resistance 100Ω, a coil of inductance 0.2H and a capacitor of capacitance 20μF are connected in series across an A.C. source of 200V, 50 Hz. Calculate

(a) impedance of the circuit and

(b) current through the circuit.

48) In Young's double slit experiment the slits are 0.4mm apart. Interference fringes of width 1.5 mm are observed on a screen placed 1.2m away from the slits. Calculate the wavelength of light used. If the apparatus is immersed in water of refractive index 1.33, what is the change in fringe width?
