# CLASS XII

# MID-TERM EXAM

# MS- SET-A1/A2

# PHYSICS (042)

**Time – 3 hours** **Max. Marks – 70**

**General instructions:**

**1. The Question Paper contains five sections and total number of questions are 33.**

**2. Section A has 16 questions (12 MCQ and 4 Assertion – Reason); each question is of 1M**

**3. Section B has 5 questions having 2M each.**

**4. Section C has 7 questions; each question is of 3M.**

**5. Section D has 2 questions; each question is of 4M.**

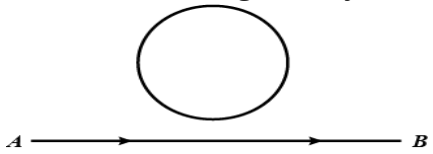
**6. Section E has 3 questions; each question is of 5M.**

**7. There is no overall choice. However, an internal choice has been provided in one question in Section B, one question in Section C, one question in each CBQ and all three questions in Section E. You have to attempt only one of the choices in such questions.**

**8. This paper contain 12 pages.**

## SECTION-A

1. Predict the directions of induced current in metal ring lying in the same plane where current I in the wire is increasing steadily.




(a) Clock wise **(b) Anti clock wise**

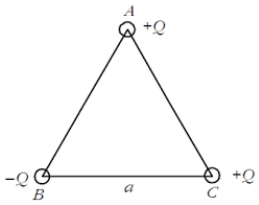
(c) No current (d) Can not be determined

2. The angle between electric dipole moment of a dipole with the electric field on its axial line at a point outside is?

**(a) 0 degree** (b) 45 degree

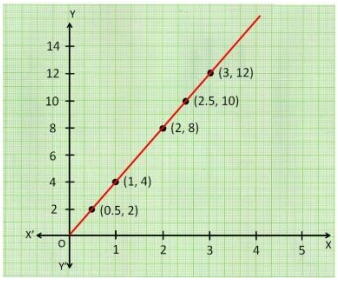
(c) 90 degree (d) 180 degree

3. For the given equilateral triangle, which of the following statement is correct.




(a) The magnitude of resultant of electrostatic force at A,B,C is same.
(b) The magnitude of resultant of electrostatic force at A,B is same.
**(c) The magnitude of resultant of electrostatic force at A,C is same.**
(d) The magnitude of resultant of electrostatic force at B,C is same.

4. For the Given graph, what will the slope of the graph represent if




Y- axis represents J (current density), X axis represents E (electric field intensity)

(a) Resistivity (b) **Conductivity**

(c) Electric flux (d) Mobility

5. For large value of 'm' of an Astronomical telescope (normal adjustment) ?

(a) Focal length of objective lens and eye lens are large
(b) Focal length of objective lens and eye lens are small
**(c) Focal length of objective lens is large and eye lens is small**
(d) Focal length of objective lens is small and eye lens is large

6. Choose the correct alternative:

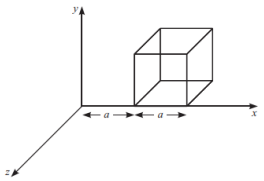
(a) Alloys of metals usually have less resistivity than that of their constituent metals.

(b) Alloys usually have much higher temperature coefficients of resistance than pure metals.

(C) The resistivity of the alloy manganin increases rapidly with increase of temperature.

**(d) The resistivity of a typical insulator (e.g., amber) is greater than that of a metal**

7. For the given diagram if electric field is working towards y-axis, through how many faces flux passing is zero?




(a) 2 **(b) 4** (c) 6 (d) 0

8. The frequency of helix of charge particle moving in magnetic field

(a) Independent of radius only (b) Independent of velocity only
(c) Dependent on radius and velocity both **(d) independent on radius and velocity both**

9. Which of the following expression is correct for a charge particle moving in magnetic field **B** with a velocity **v** at any angle θ.

(a) **F**= q(**v. B**) (b) **F**= q (**B** x **v**) (c) **F** = q (**v** x **B**) (d) **F** = v (**q** x **B**)

10. Name the electromagnetic waves that are widely used as a diagnostic tool in medicine.

(a) IR Rays **(b) X-rays** (c) UV rays (d) Microwaves

11. In an LCR circuit, capacitance is changed from C to 2C. For the resonant frequency to remain unchanged, the inductance should be changed from L to

(a) 4L (b) 2L
**(c) L/2** (d) L/4

12. The transformation ratio for a step up transformer is?

(a) less then 1 (b) equal to 1
(c) **greater then 1** (d) transformation ration does not define the type of transformer

**Assertion Reason type question**

In the following questions, two statements are given-one labelled Assertion (A) and

the other labelled Reason (R). Select the correct answer to these questions from the

codes (a), (b), (c) and (d) as given below.

a) Both A and R are true and R is the correct explanation of A

b) Both A and R are true but R is NOT the correct explanation of A

c) A is true but R is false

d) A is false and R is also false

Q.13. ASSERTION: There is no current in the metals in the absence of electric

field.

REASON: Motion of free electron are randomly in absence of external electric field.

Ans- (A)

Q.14. Assertion- A charge moving in a circular orbit can produce electromagnetic wave.

Reason- An accelerating charge produces electromagnetic waves.

Ans- (A)

Q.15. Assertion- Compound microscope is used to show clear images of very far objects only.

Reason- Compound microscope have a single convex lens of large focal length.

Ans- (D)

Q.16.ASSERTION**:** A charge, only in motion produces a magnetic field around it.
REASON**:** Moving charges produce only electric field in the surrounding space.

Ans- (C)

## SECTION -B

Q.17. Two thin lenses of power 4D and -2D are placed in contact coaxially. Find the focal length of the combination.

Ans- 50cm(1M for net power and 1M for focal length)

Or

Q17. An object is placed in front of a concave lens. It is observed that a virtual image is formed. Draw the ray diagram to show the image formation and hence write the lens formula.

Ans- diagram 1.5 M and formula ½ M

Q.18. A 100 turn closely wound circular coil of radius 10 cm carries a current of 3.2 A in anti-clock wise direction. What is the magnetic moment of this coil (magnitude and direction both)?

Ans- M=NiA(1/2M)

M= 3.2πA-m, perpendicular outward(1.5M)

Q.19. If a biconvex lens of focal length 15cm cut in two equal parts, Explain with necessary diagram or calculation to show, how the focal length of each part can be 30cm.

Ans- any correct explanation

Q.20. Draw a diagram to show (i) uniform (ii) non uniform electric field, having electric field lines parallel to each other. (2)

Ans- 1M for each diagram

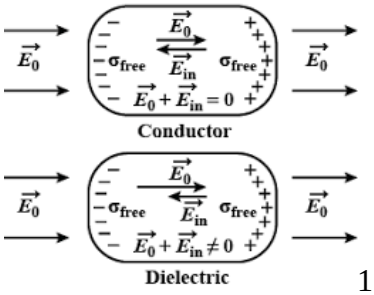
Q21. State the principle of a transformer, write any two sources of energy loss in transformer.
Ans- 1M for principle , ½ M for each loss

## SECTION-C

Q22- (i) What is dielectric polarisation?

(ii) Draw diagram showing electric field inside a conductor and a dielectric placed in external electric field .

ANS- def-1M




1+1

Q23- A long straight wire of a circular cross-section (radius a) carrying steady current I. The current I is uniformly distributed across this cross-section. Calculate the magnetic field in the region r < a and r > a.

Ans- 2+1

(i) Iin =

$$= I.\frac{\pi r^2}{\pi a^2} = \frac{Ir^2}{a^2}$$

$$\therefore \quad B \oint \vec{dl} = \mu_o . I_e = \frac{\mu_o I r^2}{a^2}$$

$$\text{Or} \quad B = \frac{\mu_o I r^2}{a^2} \cdot \left(\frac{1}{2\pi r}\right) = \left(\frac{\mu_o}{2\pi}\frac{I}{a^2}\right)$$

(ii) For $r > a$

$$\oint \vec{B}.\vec{dl} = \mu_o I$$

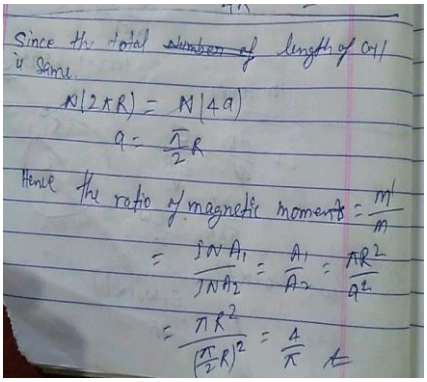
$$\therefore \quad B.2\pi r = \mu_o I$$

$$\text{or} \quad B = \frac{\mu_o I}{2\pi r}$$

OR

Q23. A circular coil of N turns and radius R carries a current I. It is unwound and rewound to make another square coil of side ‘a’ keeping number of turns and current same. Calculate the ratio of magnetic moment of the new coil and the original coil.

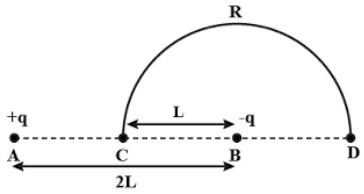
Ans- 1M for new side of square 2 M for final result




Q24- Using Biot Savart law find the expression for the magnetic field at the axial line at a distance ‘x’ from of a current carrying coil having N number of turns, the radius of coil is R and carrying current I .(3)

Ans- derivation with diagram required

Q25- Charges (+q) and (–q) are placed at the points A and B respectively which are a distance 2L apart. C is the midpoint between A and B. What is the work done in moving a charge +Q along the semicircle CRD.




Ans- (1+2)

From figure, $AC = L$, $BC = L$, $BD = BC = L$

$AD = AB + BD = 2L + L = 3L$

Potential at $C$ is given by

$$V_C = \frac{1}{4\pi\varepsilon_0}\left[\frac{q}{AC} + \frac{(-q)}{BC}\right] = \frac{1}{4\pi\varepsilon_0}\left[\frac{q}{L} - \frac{q}{L}\right] = 0$$

Potential at $D$ is given by

$$V_D = \frac{1}{4\pi\varepsilon_0}\left[\frac{q}{AD} + \frac{(-q)}{BD}\right] = \frac{1}{4\pi\varepsilon_0}\left[\frac{q}{3L} - \frac{q}{L}\right]$$

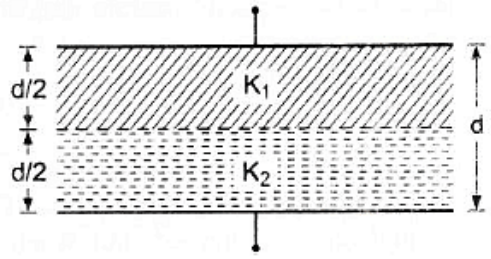
$$= \frac{1}{4\pi\varepsilon_0}\frac{q}{L}\left[\frac{1}{3} - 1\right] = \frac{-q}{6\pi\varepsilon_0}.$$

W= -qQ/6πε0

Q26- Give diagram to show the behaviour of Diamagnetic, Paramagnetic and Ferromagnetic material when they are placed in external magnetic field (separate diagram for each material).

Ans- 1M for each correct diagram

Q27- For the given diagram calculate the total capacity of the combination, if area of each plate is A.




Ans- 1+1 M for C1,C2
Ans is k1k2(AE0)/d(K1+K2)

Q28- Derive an expression for the torque experienced by an electric dipole kept in a uniform electric field. Also show that it is in translatory equilibrium.
Ans- 2+1

## SECTION-D CASE STUDY BASE QUESTION

Q.29- **Moving Coil Galvanometer**

The moving coil galvanometer is made up of a rectangular coil that has many turns and it is usually made of thinly insulated or fine copper wire that is wounded on a metallic frame. The coil is free to rotate about a fixed axis. This galvanometer can be converted in to an ammeter and a voltmeter by using resistor.

(i) Moving coil galvanometer is used to detect

a) potential difference b) **electric current** c) electric resistance d) electric field

(ii) Shape of magnets used to produce magnetic field in moving coil galvanometer

a) Plane b) convex c) **concave** d) none of the above

(iii) A galvanometer can be converted in to ammeter by connecting

a) low resistance in series b) high resistance in series

c) **low resistance in parallel** d) high resistance in parallel

(iv) 2 moving coil galvanometers $M_1$ and $M_2$(having the same spring constants), have the following specifications:
$R_1 = 10\Omega$, $N_1 = 40$, $A_1 = 3.6\times10^{-3}m^2$, $B_1 = 0.25T$
$R_2 = 14\Omega$, $N_2 = 20$, $A_2 = 1.8\times10^{-3}m^2$, $B_2 = 0.5T$
Find the ratios of current sensitivities between the 2 galvanometers.

a) 1:2 b) 1:1 **c) 2:1** d) 1:3

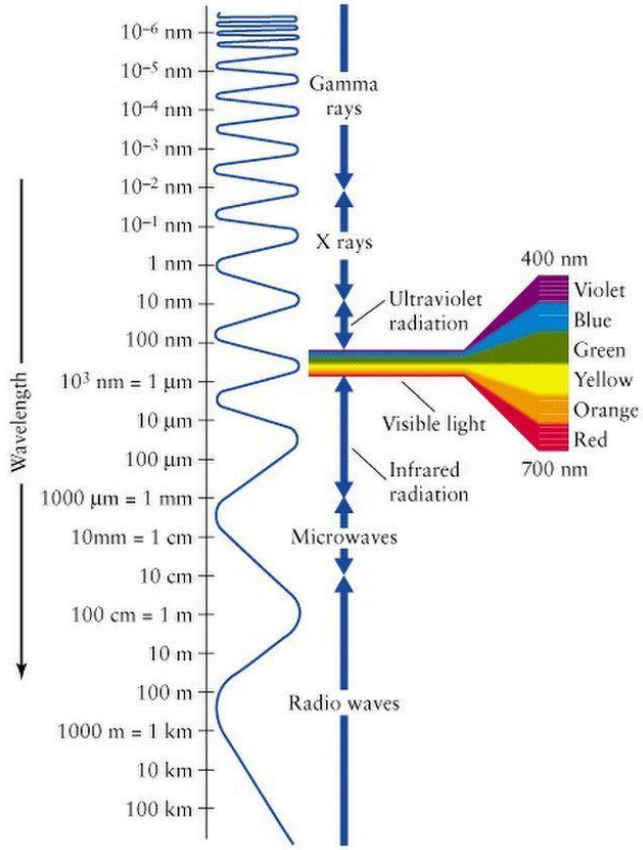
OR

(iv) A galvanometer of resistance 50 Ω and shows full scale deflection for 1 mA can be converted in voltmeter of range 0 – 5 V connecting resistance of

a) 495 Ω in series b) **4950 Ω in series** c) 495 Ω in parallel d) 4950 Ω in parallel

Q.30. **Electromagnetic waves**

At the time Maxwell predicted the existence of electromagnetic waves, the only familiar electromagnetic waves were the visible light waves. The existence of ultraviolet and infrared waves was barely established. By the end of the nineteenth century, X-rays and gamma rays had also been discovered. We now know that, electromagnetic waves include visible light waves, X-rays, gamma rays, radio waves, microwaves, ultraviolet and infrared waves. These waves have different practical application in different field.




(i).Name the constituent radiation of electromagnetic spectrum, which is used in satellite communication.

a. gamma rays

b. infrared

c. **microwave**

d. radio wave

(ii). Name the constituent radiation of electromagnetic spectrum, which is used for studying crystal structure.

a. **X- rays**

b. infrared

c. microwave

d. radio wave

(iii). Name the constituent radiation of electromagnetic spectrum, which is similar to the radiations emitted during decay of radioactive nuclei.

a. **gamma rays**

b. infrared

c. microwave

d. radio wave

(iv). Name the constituent radiation of electromagnetic spectrum, which is absorbed from sunlight by ozone layer.

a. **UV**

b. infrared

c. microwave

d. radio wave

OR

(iv). Name the constituent radiation of electromagnetic spectrum, which produces intense heating effect.

a. UV

**b. infrared**

c. microwave

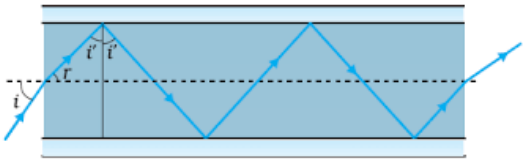
d. radio wave

## SECTION-E

Q31. (a)

(i) Write two conditions for the angle of minimum deviation when a monochromatic light passing through a prism.

(ii) (a) Figure shows a cross-section of a 'light pipe' made of a glass fibre of refractive index 1.68. The outer covering of the pipe is made of a material of refractive index 1.44. What is the range of the angles of the incident rays with the axis of the pipe for which total reflections inside the pipe take place, as shown in the figure.




Ans- (i)1M for each condition

(ii)(a)

$$\therefore \sin i_c' = \frac{n_1}{n_2} = \frac{1.44}{1.68} = 0.8571$$

or, $\sin i'_c = \sin 59^\circ \quad \therefore i'_c = 59^\circ$

$\therefore \quad \angle r = 90^\circ - \angle i'_c = 90^\circ - 59^\circ = 31^\circ$

At the air - glass fibre interface. As,

$$n = \frac{\sin i}{\sin r}, 1.68 = \frac{\sin i}{\sin 31^\circ}$$

$\Rightarrow \sin i = 1.68 \times \sin 31^\circ$

$= 1.68 \times 0.5150 = 0.8662$

$\therefore \quad \sin i = \sin 60^\circ$

$\therefore \quad i = 60^\circ$

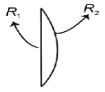
OR

Q.31. (a) Draw a ray diagram of simple microscope for the final image formed during normal adjustment.

(b) An object is placed 30 cm in front of a plano-convex lens with its spherical surface of radius of curvature 20 cm. If the refractive index of the material of the lens is 1·5, find the position and nature of the image formed.

Ans- (a)diagram 2M

(b) f= 40cm 2M, v= 120cm1M




For plano – convex lens,

$R_1 = \infty$

$R_2 = -20cm$

By lens maker's formula,

$$\frac{1}{f} = (\mu - 1)\left[\frac{1}{R_1} - \frac{1}{R_2}\right]$$

$$\frac{1}{f} = (1.5 - 1)\left[\frac{1}{\infty} - \frac{1}{(-20)}\right] = \frac{1}{40}$$

$f = 40cm$

Object distance, u = -30cm

By Lens formula;

$$\frac{1}{v} - \frac{1}{u} = \frac{1}{f}$$

$$\frac{1}{v} - \frac{1}{(-30)} = \frac{1}{40}$$

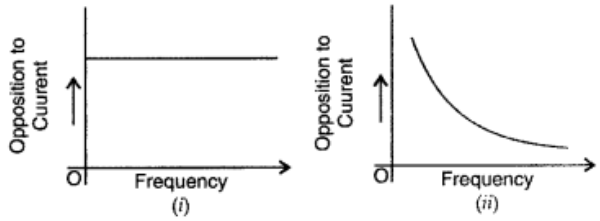
$$\frac{1}{v} + \frac{1}{30} = \frac{1}{40}$$

$$\frac{1}{v} = \frac{1}{40} - \frac{1}{30} = -\frac{1}{120}$$

$v = -120cm$

-ve sign indicates that image is virtual.

Q.32-(a) The graphs (i) , (ii) shown in the figure represent variation of opposition offered by the circuit elements X and Y respectively to ‘alternating current’ Vs the ‘frequency’ of the applied emf. Identify the elements X and Y.




(b) Arrive at the expression for the impedance offered by the series combination of these two elements connected to an ac source of voltage $V = V_0 \sin \omega t$. Also draw a graph showing the variation of inductive reactance with the frequency of applied a..c. voltage.

Ans- R, L (2M)

Expression 2M (stepwise marking), graph 1 M

OR

Q32.

(a) Draw graphs showing the variations of inductive reactance and capacitive reactance with frequency of applied ac source.

(b) When an alternating voltage of 220V is applied across a device X, a current of 0.25A flows which lags behind the applied voltage in phase by π/2 radian. If the same voltage is applied across another device Y, the same current flows but now it is in phase with the applied voltage. (i) Name the devices X and Y. (ii) Calculate the current flowing in the circuit when the same voltage is applied across the series combination of X and Y.

Ans- 1M+1 M

L,R (1M)

880 ohm,880ohm total resistance is 880√2 ohm I = 1/4√2 Ampere,Calculation of current 2M( proof of Z is not required)

Q.33- Give reason

(a) (i) Why the current flows instantly in a wire though the numerical value of drift velocity is very small.

(ii) How the drift velocity changes with the rise in temperature of a wire carrying current(neglect the effect of expansion)? (1+1)

(b) Show that the potential at the centre of dipole is zero. (1)

(c) Write the statement of kirchoff's first law and second law. Also write the conservation laws followed by both laws. (1+1)

Ans- marking as per question

OR

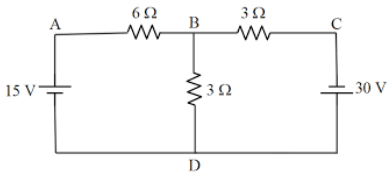
Q33.

(a) Draw a graph showing the variation of current with potential difference across a diode (1)
(b) Describe schematically the equipotential surfaces corresponding to a uniform electric field in the x-direction. (1)

Ans- as per marking

(c) Use Kirchhoff's rules to determine the value of all currents flowing in the circuit shown in the figure.

(3)




Ans- current through 6ohm 4A, current through 3ohm(branch BC) 7 A,