Total number of printed pages = 6

2022

APPLIED PHYSICS - II

Full Marks – 100

Time – Three hours

The figures in the margin indicate full marks for the questions.

Answer any *five* questions.

1. (a) Distinguish between reflection and refraction of light.   2

    (b) What is refractive index ? Does it depend on the wavelength of light ?   2+2=4

    (c) Explain total internal reflection with the help of two examples.   6

    (d) A small candle, 2.5 cm in size is placed at 27 cm in front of a concave mirror of radius of curvature 36 cm. At what distance from the mirror should a screen be placed in order to obtain a sharp image ? Describe the nature and size of the image.   4

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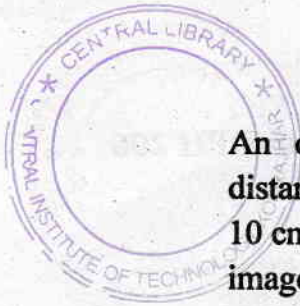
Or

An object of size 10 cm is placed at a distance of 15 cm from a convex lens of 10 cm focal length. Find the position of image and size of the image. 4

(e) Show that the refractive index of the material of a prism is given by

$$n = \frac{\sin\left[(A + \delta m)/2\right]}{\sin(A/2)},$$

where n, A and δm represent refractive index, angle of prism and minimum deviation respectively. 4

2. (a) State Coulomb's inverse square law in electrostatics and hence obtain the expression of the electrostatic force between two-point charges in C.G.S and S.I units ? 2+4=6

(b) What are electric lines of force ? Write few properties of the electric lines of force. 1+2=3

(c) Define electric field strength and electric potential. Obtain the expression of the electric potential due to a point charge +Q at a point at a distance r from it.

2+4=6

(d) Define capacity of a condenser? Write its S.I. unit and dimensional formula.

3

(e) Find the equivalent capacity of the combination of three capacitors 400µF, 3.3µF and 47µF are connected in

(a) in series

(b) in parallel.

2

3. (a) Distinguish between Natural and Artificial Magnet with examples.

4

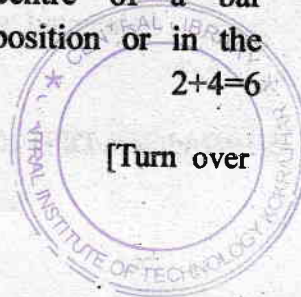(b) Write short note on Modern Theory of Magnetism.

6

(c) Define Magnetic field and Magnetic field intensity. Obtain the expression of the magnetic field intensity at a point at a distance r from the centre of a bar magnet in the end on position or in the broad side on position.
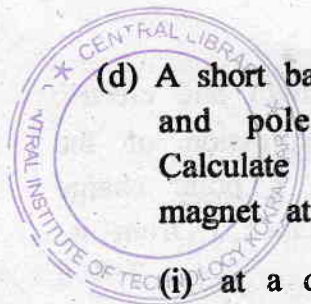
2+4=6

(d) A short bar magnet has length 0.05 metre and pole strength $64n^2 \times 10^{-2}$ weber. Calculate the magnetic field due to this magnet at a point

  (i) at a distance of 0.5 metres from the centre of magnet on the axial line

  (ii) at a distance of 0.5 metres from the centre of magnet on the equatorial line.   4

4. (a) Define emf and internal resistance of a cell. Distinguish between primary and secondary cells. Write short notes on the two defects of Simple Voltaic Cell.

$$2+2+6=10$$

  (b) What is importance of grouping of cells? What is the condition for maximum current in the circuit containing mixed grouping of the cells. $1+3=4$

  (c) In how many rows and columns will you arrange 640 number of identical cells (20V, 1.5 ohm) in a mixed grouping circuit connected an external resistance of 15 ohm.   6

5. (a) Define resistivity and conductivity. Write their units in S.I ? 3

(b) State Ohm's law. How would you verify Ohm's law experimentally ? 2+3=5

(c) State the Joule's law of heating effect. 2

(d) If three resistors of 3Ω, 6Ω and 9Ω are connected in parallel in a closed electrical circuit and a battery of 18V is connected across them, find the equivalent resistance and also the total current in the circuit. 4

(e) An electric lamp marked 50W is worked on 220 V mains. Find the resistance of the lamp and the current passing through it. How much electrical energy would be consumed in lighting this electric bulb for a duration of 24 hours. 2+2+2=6

6. (a) Discuss the nature of magnetic fields due to a straight conductor and a solenoid carrying current. 2+2=4

(b) State and explain Faraday's law of electromagnetic induction. What is Lenz's law ? 4+1=5
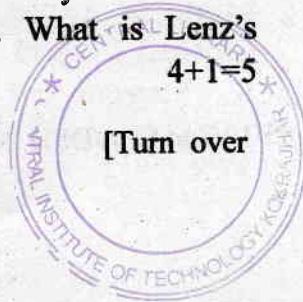
(c) What is a triode valve? Explain the different components of a triode valve.
$1+3=4$

(d) What is photoelectric effect? Write down Einstein's photoelectric equation and state the physical significances of the symbols used.
$1+3+3=7$

7. (a) Define binding energy and mass defect. Express 1 a.m.u in MeV.
$1+1+4=6$

(b) Write four properties of X-rays.
4

(c) Explain intrinsic and extrinsic semiconductors. Define doping.
$2+2+1=5$

(d) How a diode can be used as a rectifier?
5