

Section I is compulsory. Attempt any three (3) questions from Section II.

(SECTION - I)

2. Write short answers to any EIGHT questions.

(2 x 8 = 16)

- i. A particle carrying a charge of $2e$ falls through a potential difference of 3.0 V. Calculate the energy acquired by it.
- ii. Define electron volt.
- iii. Define electric flux. Also write down its unit.
- iv. How can you identify that which plate of a capacitor is positively charged?
- v. Why does the picture on a T.V screen become distorted when a magnet is brought near the screen?
- vi. How can you use a magnetic field to separate isotopes of chemical element?
- vii. A plane conducting loop is located in a uniform magnetic field that is directed along the x-axis. For what orientation of the loop, is the flux a maximum? For what orientation is the flux a minimum?
- viii. If a charged particle moves in a straight line through some region of space, can you say that the magnetic field in the region is zero?
- ix. Does the induced emf in a circuit depend on the resistance of the circuit?
Does the induced current depend on the resistance of the circuit?
- x. Does the induced emf always act to decrease the magnetic flux through a circuit?
- xi. Is it possible to change both the area of the loop and the magnetic field passing through the loop and still not have an induced emf in the loop?
- xii. Show that ϵ and $\frac{\Delta\phi}{\Delta t}$ have the same units?

3. Write short answers to any EIGHT questions.

(2 x 8 = 16)

- i. Is the filament resistance lower or higher in a 500 W, 220 V light bulb than in a 100 W, 220 V bulb.
- ii. Describe a circuit which will give a continuously varying potential.
- iii. What are thermistors? Write down their applications.
- iv. How many times per second will an incandescent lamp reach maximum brilliance when connected to a 50 Hz source?
- v. In a R-L circuit, will the current lag or lead the voltage? Illustrate your answer by a vector diagram.
- vi. A $100 \mu\text{F}$ capacitor is connected to an alternating voltage of 24 V and frequency 50 Hz. What will be the reactance of the capacitor?
- vii. Define stress and strain. What are their SI units?
- viii. What is meant by hysteresis loss? How is it used in the construction of transformer?
- ix. Define modulus of elasticity. Show that the units of modulus of elasticity and stress are the same.
- x. Why a photo diode is operated in reverse biased state?
- xi. Why is the base current in a transistor very small?
- xii. Define open loop gain and write down its relation.

4. Write short answers to any SIX questions.

(2 x 6 = 12)

- i. Define pair production and write down its equation.
- ii. What happens to total radiation from a black body if the absolute temperature is doubled?
- iii. Which photon red, green or blue carries the most (a) Energy and (b) Momentum ?
- iv. Write down two uses of Laser in Medicine.
- v. What do we mean when we say that the atom is excited?
- vi. What do we mean by the term critical mass?
- vii. Describe a brief account of interaction of various types of radiations with matter.
- viii. Define half-life of a radioactive element, write down its expression.
- ix. What is radioactivity?

(Turn Over)

(SECTION - II)

5. (a) What is a wheatstone bridge? How is it used to determine an unknown resistance? 5
(b) Compare magnitudes of electrical and gravitational forces exerted on an object (mass = 10.0 g, charge = 20.0 μ C) by an identical object that is placed 10.0 cm from the first. ($G=6.67 \times 10^{-11} \text{ Nm}^2 \text{ kg}^{-2}$) 3
6. (a) Discuss the principle, construction and working of an alternating current generator. Also find expression for induced emf and current. 5
(b) Find the radius of an orbit of an electron moving at a rate of $2.0 \times 10^7 \text{ ms}^{-1}$ in a uniform magnetic field $1.20 \times 10^{-3} \text{ T}$. 3
7. (a) Explain R-L-C series resonance circuit. Draw its impedance diagram and also write down its properties. 5
(b) In a certain circuit, the transistor has a collector current of 10 mA and base current of 40 μ A. What is the current gain of the transistor? 3
8. (a) What are radiation detectors? Describe the principle, construction and working of Wilson Cloud Chamber for detecting nuclear radiation. 5
(b) The length of a steel wire is 1.0 m and its cross-sectional area is $0.03 \times 10^{-4} \text{ m}^2$. Calculate the work done in stretching the wire when a force of 100 N is applied within the elastic region. Young's modulus for steel is $3.0 \times 10^{11} \text{ Nm}^{-2}$. 3
9. (a) What is LASER? Describe its principle and operation. 5
(b) An electron is placed in a box about the size of an atom that is about $1.0 \times 10^{-10} \text{ m}$. What is the velocity of the electron? 3

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