

Note: 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. What is meant by time constant?
- ii. What is the effect of dielectric medium on electrical force, when it is placed between two point charges?
- iii. How can you identify that which plate of a capacitor is positively charged?
- iv. If a point charge 'q' of mass 'm' is released in a non-uniform electric field with field pointing in the same direction, will it make a rectilinear motion?
- v. State the Lenz's law and write its expression.
- vi. How can a current loop be used to determine the presence of a magnetic field in a given region of space?
- vii. What should be the orientation of a current carrying coil in a magnetic field so that the torque acting upon the coil is: (i) maximum (ii) minimum
- viii. Is it possible to orient a current loop in a uniform magnetic field such that the loop will not tend to rotate? Explain.
- ix. Describe a brief account of interaction of various types of radiations with matter.
- x. How can radioactivity help in the treatment of cancer?
- xi. Write down nuclear reactions occur in the sun.
- xii. What is meant by half-life, also write down the relation, which exists between decay constant and half-life?

**3. Write short answers to any EIGHT questions.****(2 x 8 = 16)**

- i. Explain why the terminal potential difference of a battery decreases when the current drawn from it is increased?
- ii. Under what conditions the terminal potential difference of a battery is (a) equal (b) less than, the emf of the battery.
- iii. A potential difference is applied across the ends of a copper wire. What is the effect on the drift velocity of electrons by decreasing the length and temperature of the wires?
- iv. In R-L circuit, will the current lag or lead the voltage? Illustrate your answer by a vector diagram.
- v. What is the three phase A.C. supply? Write down its two uses.
- vi. A sinusoidal current has rms value of 10A. What is the peak value of sinusoidal current?
- vii. Describe briefly the feature "coercivity" of magnetic material in the study of hysteresis loop.
- viii. Distinguish between Intrinsic and Extrinsic semiconductors.
- ix. What is "Domains" region which exists in ferromagnetic material?
- x. What is the net charge on a n-type or p-type substance? Explain.
- xi. Write down four uses of operational amplifier.
- xii. Why a photo diode is operated in reverse biased state?

**4. Write short answers to any SIX questions.****(2 x 6 = 12)**

- i. When an electric motor, such as electric drill, is being used, does it also act as a generator? If so, what is the consequence of this?
- ii. Can a step-up transformer increase the power level?
- iii. In a transformer, there is no transfer of charge from the primary to the secondary. How is, then the power transfer?
- iv. As a solid is heated and begins to glow, why does it first appear red?
- v. Will higher frequency light eject greater number of electrons than low frequency light?
- vi. When a light shines on a surface, is momentum transferred to the metal surface?

**(Turn Over)**

- vii. Explain wave-particle duality.
- viii. Write down two uses of x-rays.
- ix. Explain, how line spectrum can be used for the identification of elements?

(SECTION - II)

**Note:** Attempt any three (3) questions.

5. (a) Derive the relation for energy stored in a capacitor in terms of electric field intensity. (5)
- (b) A rectangular bar of iron is 2.0 cm by 2.0 cm in cross section and 40 cm long. Calculate the resistance if the resistivity of iron is  $11 \times 10^{-8} \Omega\text{m}$ . (3)
6. (a) Define Motional EMF and derive its relation. (5)
- (b) A coil of  $0.1\text{m} \times 0.1\text{m}$  and of 200 turns carrying a current of 1.0 mA is placed in a uniform magnetic field of 0.1 T. Calculate the maximum torque that acts on the coil. (3)
7. (a) What is RLC parallel circuit? Find its impedance diagram and resonance frequency. Give its two properties. (5)
- (b) The current flowing into the base of transistor is  $100 \mu\text{A}$ . Find its collector current  $I_c$ , its emitter current  $I_E$  and the ratio  $\frac{I_c}{I_E}$ . The value of current gain  $\beta$  is 100. (3)
8. (a) What is meant by strain energy? Derive the relation for strain energy in a deformed material. (5)
- (b) What is the mass of a 70 kg man in a space traveling at  $0.8c$  from us to measure from Earth? (3)
9. (a) Define laser. Explain laser operation. Give some uses of laser. (5)
- (b) A 75 kg person receives a whole body radiation dose of 24 m-rad, delivered by  $\alpha$ -particles for which RBE factor is 12. Calculate (a) The absorbed energy in joules (b) equivalent dose in rem. (3)