

SECTION – I

2. Write short answers to any EIGHT (8) questions :

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- (i) What is electric intensity? What is its SI unit?
- (ii) Show that $\frac{1 \text{ volt}}{1 \text{ meter}} = \frac{1 \text{ Newton}}{1 \text{ Coulomb}}$
- (iii) Describe the force or forces on a positive point charge when placed between parallel plates with similar and equal charges.
- (iv) Do electrons tend to go to region of high potential or of low potential?
- (v) Describe the change in the magnetic field inside a solenoid carrying a steady current I, if the length of the solenoid is doubled but the number of turns remains the same.
- (vi) What is CRO? What is the function of grid in CRO?
- (vii) Define ammeter. How can we increase the range of an ammeter?
- (viii) Suppose that a charge q is moving in a uniform magnetic field with a velocity V . Why is there no work done by the magnetic force that acts on the charge q ?
- (ix) State Faraday's law of electromagnetic induction and also write expression for it.
- (x) Define mutual inductance of the coils and also define its unit henry.
- (xi) 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?
- (xii) In a transformer, there is no transfer of charge from the primary to secondary. How is, then the power transferred?

3. Write short answers to any EIGHT (8) questions :

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- (i) Define temperature coefficient of resistance and write its formula.
- (ii) A potential difference is applied across the ends of a copper wire. What is the effect on the drift velocity of free electrons by decreasing the length and the temperature of the wire?
- (iii) Is the filament resistance lower or higher in a 500 w, 220 v light bulb than in a 100 w, 220 v?
- (iv) What is impedance? Write its formula.
- (v) A sinusoidal current has rms value of 10A. What is the maximum or peak value?
- (vi) What is meant by A.M. and F.M.?
- (vii) Differentiate between ductile and brittle substances.
- (viii) Define stress and strain. What are their SI units?
- (ix) What is meant by hysteresis loss?
- (x) What is depletion region?
- (xi) How does the motion of an electron in a n-type substance differ from the motion of holes in a p-type substance?
- (xii) What is the principle of virtual ground?

4. Write short answers to any SIX (6) questions :

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- (i) Define Compton effect. At what angle Compton shift becomes equal to the Compton wave length?
- (ii) As a solid is heated and begins to glow, why does it first appear red?
- (iii) What happens to radiation energy from a blackbody if its temperature is doubled?

4. (iv) Define excitation energy and ionization energy.

(v) How can spectrum of hydrogen contain so many lines when hydrogen contains one electron? Explain.

(vi) Can X-rays be reflected, refracted and polarized just like any other waves? Explain.

(vii) Write down two advantages of solid state detector.

(viii) Why are heavy nuclei unstable?

(ix) A particle which produces more ionization is less penetrating. Why?

SECTION – II

Note : Attempt any THREE questions.

5. (a) What is Gauss's law? Applying Gauss's law find the electric intensity between two oppositely charged parallel plates. 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 $11 \times 10^{-8} \Omega m$. 3

6. (a) Derive an expression for torque acting on current carrying coil placed in uniform magnetic field. 5

(b) A circular coil has 15 turns of radius 2 cm each. The plane of the coil lies at 40° to a uniform magnetic field of 0.2 T. If the field is increased by 0.5 T in 0.2 s, find the magnitude of induced emf? 3

7. (a) Define comparator, describe how it is used as a night switch. 1,1,3

(b) A circuit has an inductance of $\frac{1}{\pi} H$ and resistance of 2000Ω . A 50 Hz A.C is supplied to it. Calculate the reactance and impedance offered by the circuit. 3

8. (a) Describe the formation of energy bands in solids. Explain the difference amongst electrical behaviour of conductors, insulators and semiconductors in terms of energy band theory. 5

(b) An electron is to be confined to a box of the size of the nucleus ($1.0 \times 10^{-14} m$). What would the speed of the electron if it were so confined? 3

9. (a) What are postulates of Bohr's model of the hydrogen atom? Show that energy of hydrogen atom is quantized. 5

(b) How much energy is absorbed by a man of mass 80 kg who receives a lethal whole body equivalent dose of 400 rem in the form of low energy neutrons for which RBE factor is 10? 3