

ESKPXII-XXVI (I)
PHYSICS PART-II

Time: 2 Hours 40 Minutes

SECTION "B"

Marks: 40

Note: Give Answers to any TEN (10) questions of the following. All questions carry equal marks.

- Q.1.** Define thermocouple. State its function and working principle. Name the two factors on which the thermoelectric e.m.f depends. 1+2+1
- Q.2.** State Kirchhoff's voltage law and write its mathematical form. How is this law based on the law of conservation of energy? 1+1+2
- Q.3.** The magnetic field through a single circular loop of area 0.05 m^2 is increased from 0.2T to 0.8T in 0.4 s . Calculate the magnitude of the induced e.m.f in the coil. 1+1+1+1
- Q.4.** Prove that the ratio of the number of turns in the secondary coil to the number of turns in the primary coil is equal to the ratio of secondary voltage to the primary voltage ($V_s / V_p = N_s / N_p$) in a transformer. 1+1+1+1
- Q.5.** Explain why a magnet falls quickly through a long tube of cardboard but falls more slowly through a long metal tube. 2+2
- Q.6.** Differentiate between soft and hard ferromagnetic materials on the basis of hysteresis loop, retentivity and coercive force. Give one example of each type of materials. 1+1+1+1
- Q.7.** What is P-type semiconductor and acceptor impurity? Why are holes considered to be the majority charge carriers in P-type semiconductor? 1+1+2
- Q.8.** Define the following terms related to PN junction diode. 1+1+1+1
- i. Forward biasing
 - ii. Reverse biasing
 - iii. Knee voltage
 - iv. Zener effect
- Q.9.** Calculate the wavelength of the photon emitted, when an electron in a hydrogen atom makes a transition from the fourth energy level to the first energy level. ($R_H = 1.0974 \times 10^7 \text{ m}^{-1}$) 1+1+1+1
- Q.10.** Briefly describe the role of meta stable state and population inversion in LASER operation. 2+2
- Q.11.** Define the following terms associated with nuclear physics. 1+1+1+1
- i. Radioactivity
 - ii. Half-life of a radioactive substance
 - iii. Nuclear fission
 - iv. Nuclear fusion
- Q.12.** A radioactive isotope has a decay constant of $6.93 \times 10^{-5} \text{ s}^{-1}$. Calculate the half-life of the sample in seconds. 1+1+1+1
- Q.13.** Why does a nuclear reactor contain a coolant and control rods as two of its important components? 2+2

SECTION "C"

Marks: 27

Note: Attempt any THREE (03) questions from the following. Each question carries equal marks.

- Q.14.** a) Define capacitance. Prove that the energy stored in a charged capacitor in terms of its capacitance and potential difference between the plates is given by $U = CV^2/2$. 1+1+1+1+1
- b) Two capacitors of capacitances $3\mu\text{F}$ and $6\mu\text{F}$ are connected in series across a battery of voltage 150V . Calculate the: 1+1+1+1
- i). equivalent capacitance
 - ii). charge stored on each capacitor
- Q.15.** a) Derive an expression for the angular velocity of a charged particle (q) which is moving in a circular path of radius (r) inside a uniform magnetic field (B). 1+1+1+1+1
- b) State the four factors that affect the magnitude of the torque acting on a current carrying coil placed in a uniform magnetic field. 1+1+1+1
- Q.16.** a) An alternating voltage V is applied to RL series AC circuit. Draw the phasor diagram of the circuit and show that the impedance of this circuit depends on both the resistance and the inductive reactance. 1+1+1+1+1
- b) Define inductive reactance and capacitive reactance. What is the effect of decreasing frequency of AC source on: 1+1+1+1
- i). inductive reactance of inductor
 - ii). capacitive reactance of capacitor
- Q.17.** a) What is Compton effect? Describe the theoretical explanation given by Compton for this effect. Also write the mathematical expression for Compton shift in wavelength. (without derivation). 1+3+1
- b) A photon has a wavelength of 500 nm . Calculate the energy of the photon in joules. 1+1+1+1