UNIVERSITY OF THE PUNJAB

Note: Attempt any Five Questions, selecting not more than Two questions from each section.

Section-I

Q.1 (a) Derive the expression for electric field at any point from the ring of charge along its central axis. (10)

(b) A plastic rod whose length is 220 cm and radius is 3.6 mm, carries a negative charge of magnitude 3.8×10^{-7} C, spread uniformly over its surface. What is the electric field near the midpoint of the rod, at a point on its surface? (3)

(c) Electric lines of force never cross, why. (2)

Q.2 (a) Discuss the growth of charge on capacitor in RC series circuit connected with battery. Also find the value of current RC series circuit. (8,2)

(b) In an RC series circuit ε= 11V, R=1.42 MΩ and capacitor C=1.80 μF (a) Calculate the time constant (b) Find the maximum charge that will appear on the capacitor during the charging. (c) How long does it take for charge to build up to 15.5 μF C. (3)

(c) What is the difference between emf and potential difference? (2)

Q.3 (a) Using Biot-Savart law, derive the formula for the magnitude of magnetic field due to circular loop of current at any point on the axis of loop. (10)

(b) A solenoid has the length 1.23 m and an inner diameter 3.55 cm. It has five layers of winding of 850 turns each and carries a current 5.57 A. What is B at its center? (3)

(c) Discuss the analogies and differences between Amperes law and Gauss's law. (2)

Q.4 (a) When a rectangular conducting loop of width D is moved inside a uniform magnetic field , pointing normal to the plane of loop. Compute the rate at which energy is dissipated in the loop. (10)

(b) A circular UF television antenna has diameter of 11.2 cm. The magnetic field of TV signal is normal to the plane of the loop, and at one instant of time, its magnitude is changing at the rate of 157 mT/s. The field is uniform. Find the emf in antenna. (3)

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(c) In Faraday's law of induction, does induced emf depends on the resistance of the circuit. If so, how. (2)

Section-II

Q.5 **(a)** Define Compton Effect. In photon-electron collision, show that Compton shift depends on scattering angle of photon. (1,9)

(b) X rays with $\lambda=100$ pm are scattered from the carbon target. The scattered radiation is viewed at 90° to the incident beam. What is Compton Shift? (3)

(c) In both photoelectric effect and Compton effect, there is an incident photon and an ejected electron. What is the difference between these two effects? (2)

Q.6 **(a)** What is the purpose of Stern–Gerlach experiment? Using Stern–Gerlach experiment show that net force on dipole depends on gradient. Also describe the experimental results of Stern–Gerlach experiment. (1,7,2)

(b) Explain briefly the Zeeman Effect. (5)

Q.7 **(a)** What is thermonuclear fusion? Describe three main problems in controlled thermonuclear fusion. (1,7)

(b) Explain Proton-Proton cycle for energy production in stars, give mathematical steps as well. (5)

(c) Describe very briefly the Lawson's criterion for successful operation of thermonuclear reactor. (2)

Section-III

Q.8 **(a)** What are N and P type semiconductor materials. How depletion region is created in the PN junction. Analyze the revere bias characteristics of PN diode by giving graph. What happens to PN diode at reverse breakdown voltage? (1,2,4,1)

(b) Explain the operation of bridge rectifier circuit. Give the answer by giving path of current in bridge rectifier circuit. (7)

Q.9 **(a)** Describe the basic structure and operation of NPN transistor. (2,6)

(b) Draw the circuit for common emitter transistor configuration and describe any two of its characteristics (7)

Q.10 **(a)** Discuss the working of an Astable Multivibrator. Also give its three uses. (8,2)

(b) What is AND gate, give its symbol, Boolean equation and truth table. Explain the function of AND gate by using suitable PN diode circuit. (2,3)