[This question paper contains 4 printed pages.]

**Sr. No. of Question Paper : 1174** **G** **Your Roll No.....**

Unique Paper Code : 222581

Name of the Paper : Physics II

Name of the Course : **B.Sc. Mathematical Science**
**Concurrent Credit Course III (i)**

Semester : V

Duration : 3 Hours Maximum Marks : 75

**Instructions for Candidates**

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. Attempt **five** questions in all.
3. Question number **1** is compulsory.

1. Attempt any **five** of the following :

   (a) State Biot-Savart's law.

   (b) Show that the electrostatic potential energy density stored in establishing an electric field $\bar{E}$ is $\frac{1}{2}\varepsilon_0 E^2$.

   (c) What do you understand by the terms Coercivity and Retentivity in 'magnetic hysteresis curve' ?

   (d) Discuss different polarization mechanisms in dielectrics.

   (e) Write down the Maxwell's equations in dielectric medium.

*P.T.O.*

(f) Draw the input and output characteristics of a transistor in common-base (CB) mode.

(g) Define d.c. load line in a transistor. Give the significance of Q-point.

(h) Write down the truth table of NXOR gate. (3×5=15)

## SECTION – A

2. (a) What is the Gauss's law of electrostatics ? Using this law find the electric field at a distance d from the centre of a uniformly charged non conducting solid sphere of radius 'R' when (i) $d < R$, (ii) $d = R$ and (iii) $d > R$. Where the total charge on non conducting sphere is 'q'. (2,6)

(b) Four negative charges, each of magnitude 'q' coulomb, are placed at the corners of a square of side 'a' meter, at the centre of which a positive charge of +2q coulomb is placed. What is the electrostatic potential energy of the system ? (4)

(c) Electric field in a given region of space is $\vec{E} = 5x\hat{i} + 6y\hat{j} + 3z\hat{k}$, find the volume charge density. (3)

3. (a) State the Biot-Savart's law and use it to obtain an expression for the magnetic field at a point on the axis of a current carrying circular coil having 'N' number of turns. (2,6)

(b) What do you mean by the self inductance ? Calculate the energy stored in an inductor of inductance 'L' and carrying a steady current 'I'. (4)

(c) Establish the relation between magnetic flux density (B), magnetic intensity (H) and magnetization (M). (3)

4. (a) Derive the equation of continuity. (5)

(b) Derive equations of propagation of electromagnetic wave in dielectric medium and show that electromagnetic waves are transverse in nature. (5,5)

5. (a) Draw a circuit diagram of full wave rectifier and explain its working. Obtain expression for its :

(i) Ripple factor, and

(ii) Efficiency. (4,2,2)

(b) Draw the input and output characteristics of a common base (CB) transistor using suitable circuit diagram. (4)

(c) What is Zener diode ? Explain how it is used as a voltage regulator. (3)

6. (a) State Barkhausen criteria for self sustained oscillations. (4)

(b) What do you understand by the biasing circuits ? Explain the fixed bias circuit for transistor. (4)

(c) Design base resistor bias circuit for a CE amplifier such that operating point is $V_{CE} = 8V$ and $I_C = 2$ mA. You are supplied with a fixed 15V d.c. supply and a silicon transistor with $\beta = 100$. Take base-emitter voltage $V_{BE} = 0.6V$. Calculate also the value of load resistance that would be employed ? (7)

7. (a) Convert $(1101001.1101)_2$ in its decimal equivalent. (5)

(b) Design half subtracter and full subtracter using NAND gates only and give their truth tables. (6)

(c) State De – Morgan's theorems and simplify the following expression-

$A\bar{B}\bar{C} + A\bar{B}C + ABC + \bar{A}\bar{B}C$. (4)