[This question paper contains 4 printed pages.]

Your Roll No................

Sr. No. of Question Paper : 1272     **F**

Unique Paper Code        : 2222511201

Name of the Paper       : Electricity and Magnetism

Name of the Course      : **B.Sc.**

Semester               : II

Duration : 2 Hours         Maximum Marks : 60

## Instructions for Candidates

1. Write your Roll No. on the top immediately on receipt of this question paper.

2. Attempt four questions in all. All questions carry equal marks.

3. **Question No. 1** is compulsory.

4. Non-programmable calculator is allowed.

1. Attempt all of the following :        (5x3)

(a) A certain parallel plate capacitor with capacitance $C = 12$ µF is connected to a source of EMF with potential 3 V. A material of dielectric constant 4 is then inserted between the plates of capacitor.

P.T.O.

By how much does the energy stored in the capacitor change?

(b) State and deduce the Gauss's law in differential form.

(c) Define $\vec{B}, \vec{M}$ and $\vec{H}$. Establish the relation $\vec{B} = \mu_0(\vec{H} + \vec{M})$.

(d) A solenoid has a length of 50 cm and a radius of 1 cm. If the number of turns in the solenoid is 500 and relative permeability of the material on which the turns are wounded is 800, calculate the coefficient of self-inductance.

(e) Determine Thevenin's equivalent circuit for the given network across the load resistance R
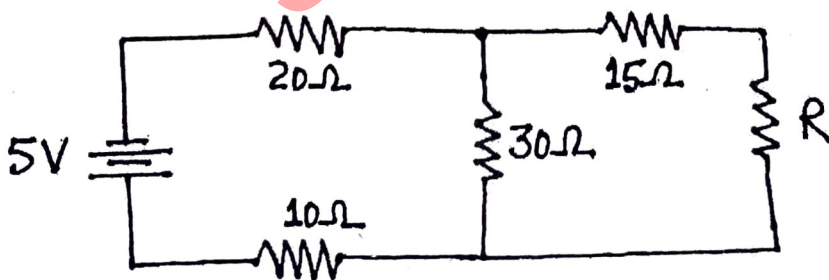
2. (a) What is an electric dipole? Derive the expressions for the electric potential and electric field intensity due to an electric dipole at any point.    (10)

   (b) Three identical charges q = 1μC are placed in the (x,y) plane at coordinates (-1,0), (1,0) and (0, 1). How much work is needed to move the charge placed at the initial position (0, 1) to a new position ( 0,0), while holding the other two charges in their original positions. (all the distances are in meter)    (5)

3. (a) State and explain Biot-Savart's law. Derive an expression for the magnetic field at a point on the axis of a circular coil carrying a steady current using Biot-Savart's law.    (10)

   (b) A uniform solenoid 100 mm in diameter and 400 mm long has 100 turns of wire. If a current of 3 A is flowing through it, calculate the magnetic field at its center.    (5)

4. (a) What is electromagnetic Induction? State and explain Faraday's and Lenz's law of electromagnetic induction. Explain the fact that Lenz's law in accordance with the law of conservation of energy    (10)

P.T.O.

(b) Write the Maxwell's Equations with their physical significance. (5)

5. (a) Write the statement of Superposition and Maximum Power transfer theorem for linear circuit and make necessary diagram to explain. What is the maximum power transferred to a load resistance $R_L$ by a voltage source of 8 Volts connected in series with a resistance of $100\Omega$ ? (10)

(b) A cell of E.M.F. 1.5 volt has internal resistance $2\ \Omega$. Find the current given by the cell and the current through each resistance in given figure by using Kirchhoff s law. (5)
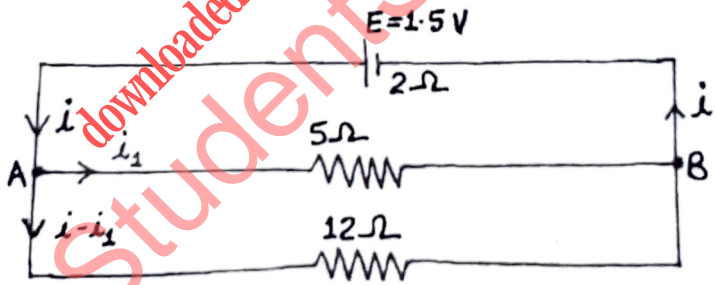


**Constants**:

$\mu_0 = 4\pi \times 10^{-7}$ henry/metre (free space)

$\epsilon_0 = 8.85 \times 10^{-12}$ C$^2$/N.m$^2$ (free space)

(1000)