BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI
(END SEMESTER EXAMINATION)

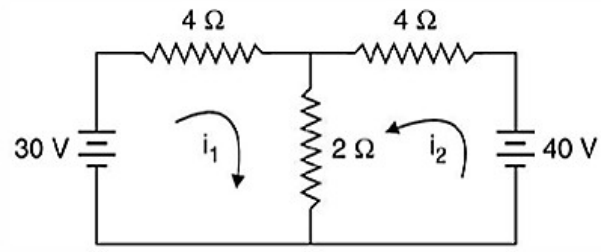
CLASS: IMSc **SEMESTER : III**
BRANCH: Physics **SESSION : MO/2025**

SUBJECT: PH24203 ELECTRICITY AND MAGNETISM

TIME: 3 Hours **FULL MARKS: 50**

INSTRUCTIONS:
1. The question paper contains 5 questions each of 10 marks and total 50 marks.
2. Attempt all questions.
3. The missing data, if any, may be assumed suitably.
***4*. Before attempting the question paper, be sure that you have got the correct question paper.**
5. Tables/Data handbook/Graph paper etc. to be supplied to the candidates in the examination hall.

			CO	BL
Q.1(a)	Develop the equation for electrostatic energy in terms of field distribution.	[5]	1	3
Q.1(b)	Starting from Gauss's law establish Poisson's equation in electrostatics. What is Laplace's modification of the same?	[5]	1	1
Q.2(a)	Determine the capacitance of a spherical capacitor consisting of two concentric spheres of radii a and b, respectively, the space between them being filled with a dielectric of relative permittivity ε_r.	[5]	2	5
Q.2(b)	Explain electric susceptibility and dielectric constant. How are they related?	[5]	2	2
Q.3(a)	Apply Ampere circuital law to derive magnetic field due to a current carrying toroid at an internal and external point.	[5]	3	3
Q.3(b)	Find the torque on a current carrying loop in uniform magnetic field and hence define magnetic dipole moment.	[5]	3	3
Q.4(a)	Define self inductance and mutual inductance. Obtain Neumann's formula for mutual inductance between two loops to show that $M_{12} = M_{21}$.	[5]	4	3
Q.4(b)	In a series LCR circuit, $L = 0.16\ \mathrm{H}$, $C = 0.01\ \mu\mathrm{F}$ and $R = 50\ \Omega$. Find (i) resonance frequency, (ii) bandwidth (FWHM), and (iii) quality factor of the circuit.	[5]	4	3
Q.5(a)	State and explain (i) Norton theorem, and (ii) maximum power transfer theorem.	[5]	5	2
Q.5(b)	State superposition theorem. Use superposition theorem to find the current through $2\ \Omega$ resistance in the given circuit.	[5]	5	3



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