

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

**CLASS: BTECH/IMSC
BRANCH: BT/CIVIL/CHEMICAL/MECH/PIE/FT/PHYSICS**

**SEMESTER: I/ADD
SESSION: MO/2024**

SUBJECT: EE24101 BASICS OF ELECTRICAL ENGINEERING

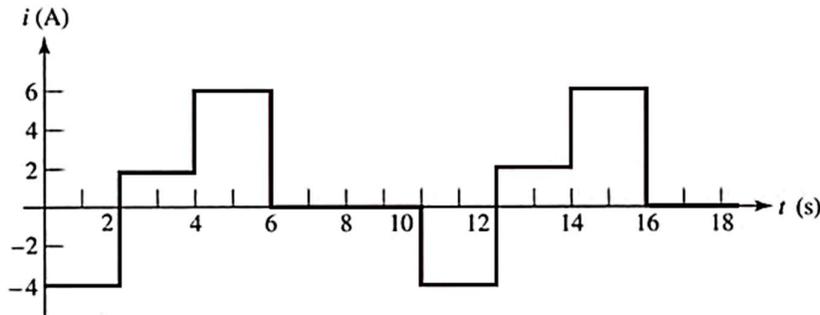
TIME: 3 Hours

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 hand book/Graph paper etc. to be supplied to the candidates in the examination hall.

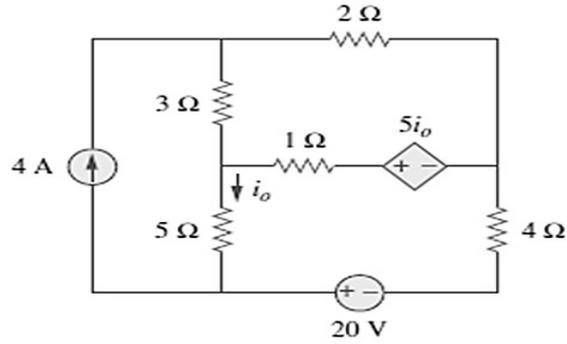
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|--|-----|----|----|
| Q.1(a) The waveform shown in figure below has period of 10s. (a) What is the average value of the current over one period? (b) How much charge is transferred in the interval $1 < t < 12$ s ? (c) If $q(0) = 0$, sketch $q(t)$, $0 < t < 16$ s. | [5] | 1 | 3 |



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|--|-----|---|-----|
| Q.1(b) Define and derive the resonance condition for RLC series circuit and hence determine the behavior of circuit before, at, and after resonance. | [5] | 3 | 1,2 |
| Q.2(a) A coil, having both resistance and inductance, has a total effective impedance of 50Ω and the phase angle of the current through it with respect to the voltage across it is 45° lag. The coil is connected in series with a 40Ω resistor across a sinusoidal supply. The circuit current is 3 A. Determine the supply voltage, the circuit phase angle, and the true power consumed by the circuit. Hence draw the phasor diagram and power triangle. | [5] | 3 | 3 |
| Q.2(b) For a voltage given by $v(t) = 100\sin(376.9t)$, find the average value, the rms value, the peak factor, the form factor, and the frequency of the supply. | [5] | 3 | 1,3 |
| Q.3(a) In context of magnetic circuit explain the following terms in brief.
(a) Eddy current loss, (b) Hysteresis loss, (c) reluctance, (d) non-linear magnetic circuits, (e) MMF. | [5] | 5 | 2 |
| Q.3(b) An iron ring of mean circumference 50-cm has an air gap of 1-mm length. It is uniformly wound with a coil having 200 turns. If the relative permeability of iron is 300 when a current of 1 ampere flows through the coil, find the flux density in the air gap. Neglect leakage and fringing. | [5] | 5 | 3 |
| Q.4(a) A balanced ABC-sequence Y-connected source with $V_{an} = 100\angle 10^\circ$ is connected to a Δ -connected balanced load $(8 + j4) \Omega$ per phase. Calculate the phase and line currents. Draw a neat phasor diagram representing the phase current (I_{AB}), line current (I_A) and line to line voltage (V_{AB}). | [5] | 4 | 3 |
| Q.4(b) Prove that the true power consumed in a 3-phase load is equal to $\sqrt{3}V_L I_L \cos(\phi)$ for both star and delta connection. | [5] | 4 | 2 |

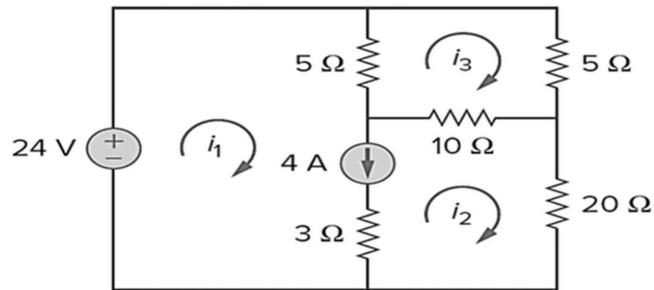
Q.5(a) Find i_o in the circuit of figure shown below using superposition.

[5] 2 3



Q.5(b) Use mesh analysis to determine the mesh currents.

[5] 2 3



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