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

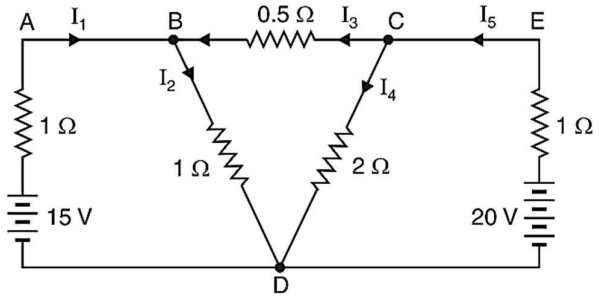
CLASS: BTECH & IMSC **SEMESTER : I/ADD**
BRANCH: ME/CE/PIE/CHEM Engg./BT/FET/IMSc (Phy) **SESSION : MO/2025**

SUBJECT: EE24101 / EE101 BASIC OF ELECTRICAL ENGINEERING

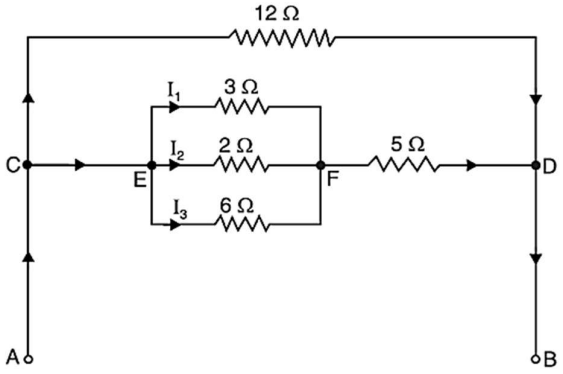
TIME: 3 Hours **FULL MARKS: 50**

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.

				CO	BL
Q.1(a)	(i)	Differentiate between ideal and practical voltage source. Draw suitable circuit diagrams as applicable. [*2 marks*]	[5]	CO1	II
	(ii)	Find the voltages at node B and C of the following circuit: [*3 marks*]			

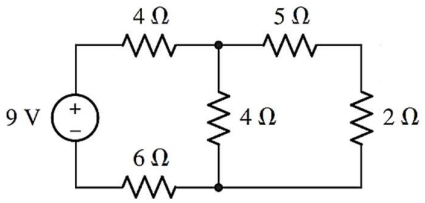


Q.1(b)		A battery having an e.m.f. of E volts and internal resistance 1 Ω is connected across terminals A and B of the circuit shown in figure. Calculate the value of E so that the power dissipated in 2 Ω resistor shall be equal to 4.5 W.	[5]	CO1	IV



Q.2(a)	(i)	Write the steps of applying Norton's theorem to solve an electrical circuit with independent sources. [*2 marks*]	[5]	CO2	I
	(ii)	For a DC circuit operating at maximum power transfer condition, derive the circuit efficiency (in %) and the expression for maximum power transferred. Draw suitable circuit diagrams and write related equations. [*3 marks*]			
Q.2(b)		Reduce the given circuit into its Thevenin's equivalent circuit. Consider 2 Ω resistor as load. Also draw Norton's equivalent circuit using the concept of source transformation.	[5]	CO2	III

PTO



Q.3(a) (i) List any four important points that describe the behaviour of a series RLC circuit at resonance. [*2 marks*] [5] CO3 II

(ii) State and explain maximum power transfer theorem in case of AC circuits. Use related equation and circuit diagram for illustration. [*3 marks*]

Q.3(b) A 100 Ω resistor is connected in series with an inductor of inductive reactance equal to 200 Ω. The circuit is supplied by a voltage source of $220\angle 0^{o}$ volt. Calculate the following: [5] CO3 V

(i) current supplied by voltage source
(ii) power factor
(iii) Active power supplied by source
(iv) Reactive power supplied by source
(v) Voltage across inductor

Write the answer using complex (phasor) representation of circuit quantities wherever applicable.

Q.4(a) (i) The input power to a three load was measured by the two-wattmeter method. The readings were 4.2 kW and −1.4 kW, while the line voltage was 400 V. Calculate the value of reactive power and operating power factor of the circuit. [*2 marks*] [5] CO4 IV

(ii) In a two-wattmeter method of power measurement of balanced three-phase load,
(a) when both wattmeters show equal readings?
(b) when will one of the wattmeters show a negative reading?
(c) what will be the readings of the wattmeters be when the load is purely inductive?

[*3 marks*]

Q.4(b) A balanced three-phase system with a line voltage of 240 V is supplying a balanced star-connected load with 1 kW at lagging power factor of 0.8. Find the following: [5] CO4 V

(i) Line current
(ii) Per phase load impedance
(iii) Active power supplied to load
(iv) Reactive power supplied to load
(v) Apparent power supplied to load

Write the answers using complex (phasor) representation of circuit quantities wherever applicable.

Q.5(a) (i) Define reluctance of a magnetic circuit. Also write the mathematical expression for Ohm's law for magnetic circuit. [*2 marks*] [5] CO5 I

(ii) Draw the magnetization curve (B-H curve) for a practical ferromagnetic material. Also label all the segments of B-H curve. [*3 marks*]

Q.5(b) A ferromagnetic ring of cross-sectional area 900 mm^2 and of mean radius 180 mm has two windings connected in series, one of 400 turns and one of 600 turns. If the relative permeability is 1500, calculate the self-inductance of both the coil and the mutual inductance between them. Also calculate the coefficient of coupling in this case. [5] CO5 IV

Assume that there is no flux leakage and the windings are uniformly distributed around the circumference of the ferromagnetic ring.