QP Code:EE1T01-6 **(Pages:4)**

Reg No : ..... Name : .....

MAR ATHANASIUS COLLEGE OF ENGINEERING, KOTHAMANGALAM

(Govt. Aided Autonomous Institution)

First Semester B.Tech. Degree (SAY) Examination, February, 2026

Course Code: B24EE1T01

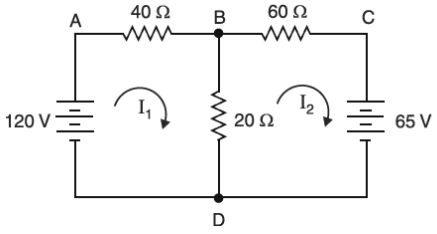
Course Name: INTRODUCTION TO ELECTRICAL ENGINEERING

Max. Marks: 100 Duration:3 Hours

PART - A: 30 Marks (10 Qns x 3 Marks)

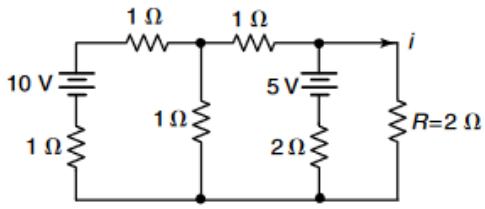
Answer all questions

1. Find the current through 40 ohm resistor by applying mesh current analysis.



2. List any three passive components. Also, represent it symbolically.

3. Compute Thevenins voltage w.r.t the load resistor 2 Ω



4. Describe the condition under which maximum power is transferred from a source to a load in a circuit.

5. Derive the expression for coefficient of coupling in terms of mutual inductance and self-inductances of two coils.

6. Derive the RMS value of a pure sinusoidal waveform.

7. Explain how the power factor is derived from the power triangle and discuss its importance in electrical systems.

8. With neat phasor diagram derive the expression for power factor of RLC series circuit.

9. A balanced delta-connected load is supplied from a 3-phase 415 V source. If the line current is 15 A and the total power consumed is 8,000 W, calculate:(i) The impedance in each branch, and (ii) The power factor of the load.

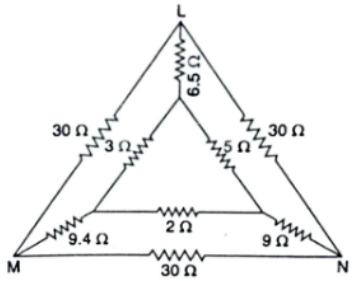
10. Derive the expression for neutral current in an unbalanced 3-wire, 3-phase system.

PART - B: 70 Marks (5 Qns x 14 Marks)

Answer any One full question from each module.

Module 1

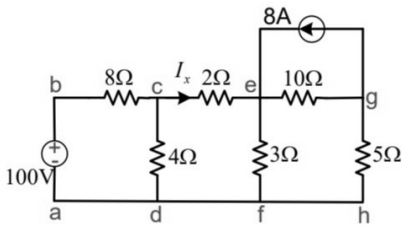
11. a. Using Delta/Star transformation, find the resistance between M and N for the below network. (10 Marks)



b. Explain the concept of source transformations. (4 Marks)

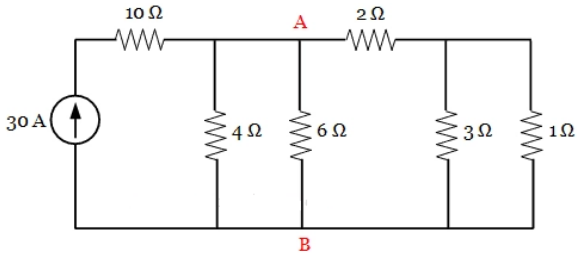
OR

12. Apply nodal voltage analysis to find out the nodal voltages and current flowing through various resistances



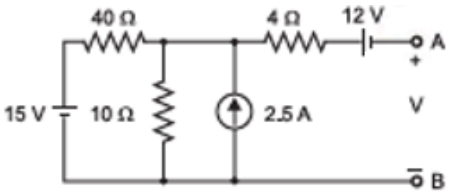
Module 2

13. Determine the current through AB in the circuit given below using Norton's Theorem and hence find Thevenin's Equivalent. Also state Norton's Theorem.



OR

14. Use Superposition Theorem, to find V in the circuit below:



Module 3

15. a. A coil with 200 turns give rise to a magnetic flux of 500 μWb when carrying a certain current. If this current is reversed in 0.1 second, find the induced e.m.f. in the coil. (4 marks)

b. A straight conductor of length 0.5 m carries a current of 10 A and is placed in a uniform magnetic field of strength 0.3 T. Calculate the force acting on the conductor when the angle between the conductor and the magnetic field is 60°. (4 marks)

c. Find the emf induced in a straight conductor of length 20 cm, placed in a uniform magnetic field of strength 0.5 T when it is moved at a rate of 5 m/s, in the following three cases: (i) its motion is parallel to the magnetic field (ii) its motion is perpendicular to the magnetic field and (iii) its motion is at an angle of 30° to the magnetic field. (6 marks)

OR

16. a. Compare electric and magnetic circuits with suitable sketches (6 marks)

b. A magnetic circuit consists of three parts in series, each of uniform cross-sectional area. They are :(a) a length of 80 mm and cross-sectional area 50 mm^2 ;(b) a length of 60 mm and cross-sectional area 90 mm^2 ;(c) an air gap of length 0·5 mm and cross-sectional area of 150 mm^2. A coil of 4000 turns is wound on part (b), and the flux density in the air gap is 0·3 Wb/m^2. Assuming that all the flux passes through the given circuit, and that relative permeability μ_r is 1300, estimate the coil current to produce such a flux density. (8 marks)

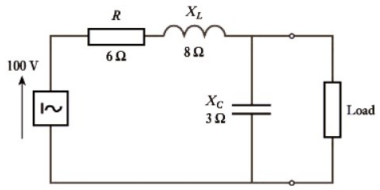
Module 4

17. a. The voltage and current through a circuit element are $v = 200 \sin(314t+45^0)V$ and $i = 20 \sin(314t+315^0)A$. Identify the element and its value. Derive the expression for the power consumed by the identified element and calculate the power. (8 marks)

b. A capacitor of 200μF is connected across a 200V, 50 Hz single phase supply. Calculate the reactance of the capacitor, rms value of the current and maximum current. (6 marks)

OR

18. a. Determine the Norton equivalent circuit for the network supplying the load shown (10 marks)



b. Compare and contrast Thevenin's Theorem with Norton's Theorem. How are they related? (4 marks)

Module 5

19. Calculate the active and reactive components of current in each phase of a balanced star-connected 10,000 volts, 3-phase generator supplying 5,000 kW at a lagging p.f. of 0.8. Find the output if the current is maintained at the same value, but the p.f. is raised to 0.9 lagging.

OR

20. Three coils, each having a resistance of 10 Ω and an inductive reactance of 5 Ω are connected in star to a 400 V, 3-phase, 50 Hz supply. Find the phase current, line current, power factor, total active power (W), reactive power (VAR), and apparent power (VA) power. Also draw the phasor diagram.

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