

Reg No :

Name :

**MAR ATHANASIUS COLLEGE OF ENGINEERING, KOTHAMANGALAM**

(Govt. Aided Autonomous Institution)

Second Semester B.Tech. Degree Examination, May, 2026

Course Code: B24EC1T02

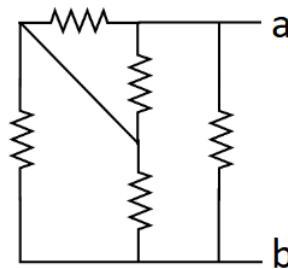
Course Name: ELECTRICAL CIRCUIT THEORY

Max. Marks: 100

Duration:3 Hours

PART - A: 30 Marks (10 Qns x 3 Marks)**Answer all questions**

1. Convert a 10V voltage source with a 5Ω series resistor into an equivalent current source.
2. Find the resistance across the terminals **a-b** if each resistance equals 100 ohms.



3. State Norton's Theorem and explain how it is used in circuit analysis.
4. A circuit consists of two meshes in which the first mesh contains a 10Ω resistor and a 20 V independent voltage source, while the second mesh contains a 5Ω resistor and a 10 V independent voltage source, and the two meshes are connected through a common 2Ω resistor. Write the mesh equations using KVL.
5. A series circuit consists of a non-inductive resistance of 6Ω and an inductive reactance of 10Ω . When connected to a single-phase ac supply, it draws a current $i(t) = 27.89\sin(628t - 45^\circ)$. Calculate the voltage applied to the series circuit in the form $V_m \sin(\omega t + \phi)$ and the power drawn by the circuit.
6. A voltage source $v_1 = 20\sin(\omega t)$ is applied to a load impedance $z = 3 + 4j\Omega$. Draw the phasor diagram of voltage and current through the load.
7. A voltage source $V_s = 20\sin(\omega t + 45^\circ)$, operating at 50 Hz is applied to a parallel combination of 10 ohm resistor and $50\mu F$ capacitor. Find the current supplied by the source.
8. Define and explain the relationship between Active, Reactive and Apparent power. Illustrate these using a Power Triangle and state their respective units.

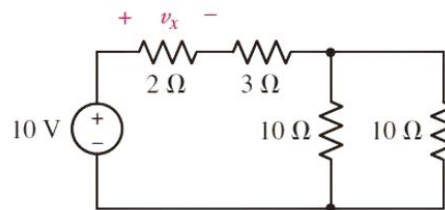
9. A transformer with 600 turns on the primary has an induced EMF of 330 V at 50 Hz. If the frequency is reduced to 40 Hz with the same maximum flux, calculate the new induced EMF.
10. A wooden ring has a mean diameter of 150 mm and a cross-sectional area of 250mm^2 . It is wound with 1,500 turns of insulated wire. A second coil of 900 turns is wound on the top of the first. Assuming that all flux produced by the first coil links with the second, calculate the mutual inductance.

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

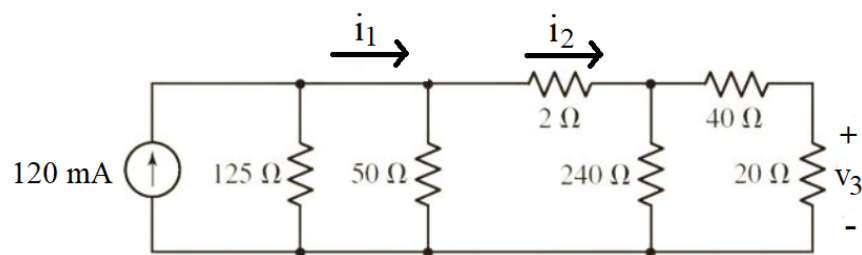
Answer any One full question from each module.

Module 1

11. a. Use voltage division to determine v_x in the circuit of Figure. (7 marks)

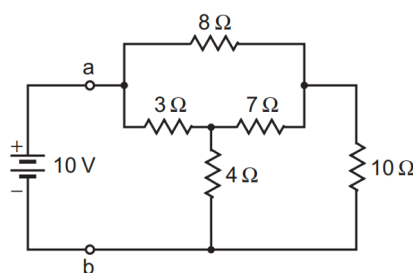


- b. In the circuit shown in Figure, use resistance combination methods and current division to find i_1 , i_2 , and v_3 . (7 marks)

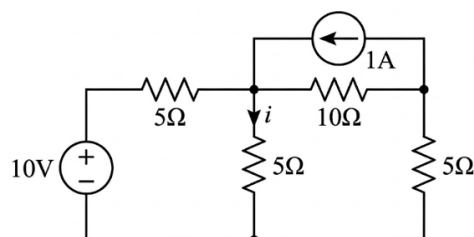


OR

12. a. Using delta star transformation, determine the resistance between terminals a and b and the total power drawn from the supply in the circuit shown in Figure. (7 Marks)



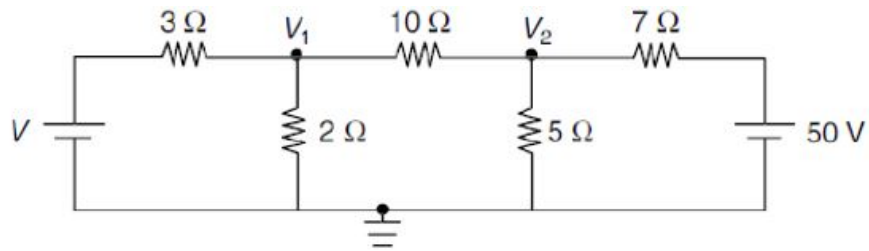
- b. Apply multiple source transformations to determine the current 'i'. (7 Marks)



Module 2

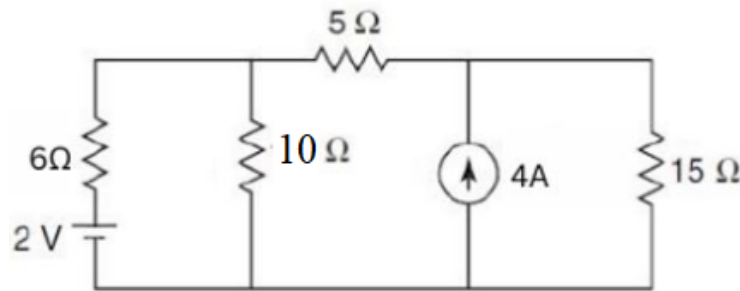
13. a. Determine the voltage V in the network which makes the current in the $10\ \Omega$ resistor zero.

(7 marks)



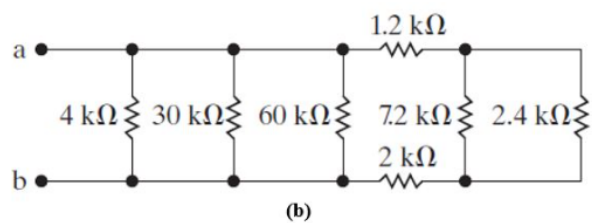
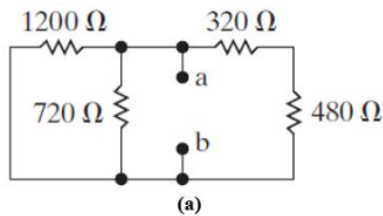
- b. Determine the current through the $10\ \Omega$ resistor using mesh analysis.

(7 marks)



OR

14. Determine the equivalent resistance R_{ab} for each of the circuits in Figure shown below.



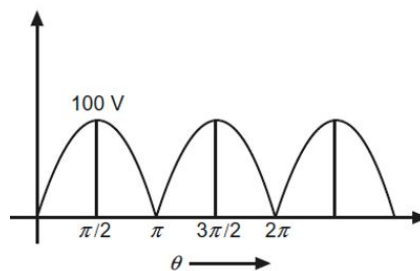
Module 3

15. a. Determine the average and rms values of the current, $I(t) = 15 + 15 \sin 230t$.

(6 marks)

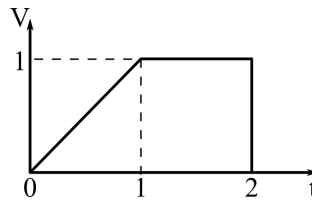
- b. Determine the rms value, average value, and form factor of the voltage waveform shown below.

(8 marks)



OR

16. Determine the RMS value, average value, form factor and peak factor of the following signal.

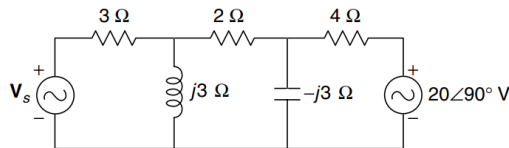


Module 4

17. An AC voltage source with rms voltage $120\angle 30^\circ$ is connected in series with two impedances $Z1$ & $Z2$. Compute the apparent power supplied by the source, the power factor of the combined loads and also the average power delivered to each load, if (a) $Z1 = 20\angle 45^\circ$ and $Z2 = 15\Omega$ (b) $Z1 = 10\Omega$ and $Z2 = 6 - 5j \Omega$.

OR

18. Find the value of V_s such that no current flows through 2 ohm resistor.



Module 5

19. A steel ring with a mean radius of 10 cm and of circular cross section 1 cm in radius has an air gap of 1 mm length. It is wound uniformly with 500 turns of wire carrying current of 3 A. Neglect magnetic leakage. The air gap takes 60% of the total mmf. Find the total reluctance and the flux in the ring.

OR

20. a. Three identical coils, each with a resistance of 8Ω and an inductance of 0.0191 H connected in series per phase, are supplied by a 400 V , three-phase, 50 Hz system in a Wye (Y) configuration. Determine the line current, power input, apparent power (kVA), and reactive power (kVAR) consumed by the load. (7 marks)
- b. In three-phase delta connected system, derive a relation between phase voltage and line voltage, phase current and line current. (7 marks)
