QP Code:EE2T01-3 **(Pages: 4)**

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

MAR ATHANASIUS COLLEGE OF ENGINEERING, KOTHAMANGALAM

(Govt. Aided Autonomous Institution)

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

Course Code: B24EE2T01

Course Name: CIRCUITS AND NETWORKS

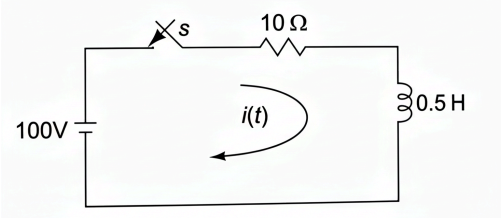
Max. Marks: 100 Duration:3 Hours

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

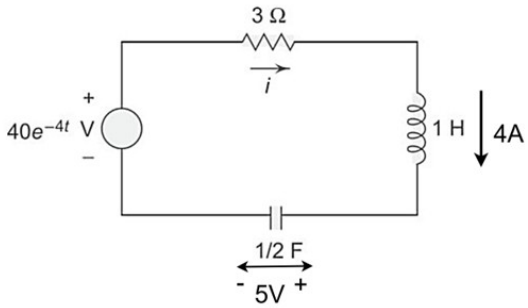
Answer all questions

1. Explain the significance of initial conditions in the transient response analysis of RLC circuit.

2. A series RL circuit is shown. A DC voltage of 100 V is applied at time t=0 through a switch. Find the expression for the transient current i(t) for time t > 0. Use time domain analysis.

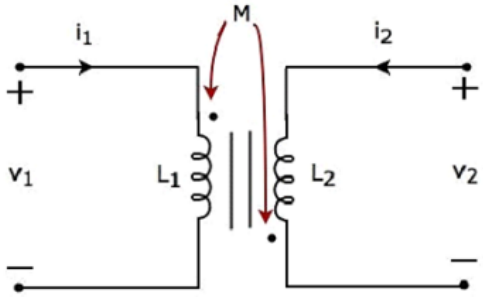


3. Draw the s-domain equivalent circuit of the following circuit. Initial conditions are indicated in the circuit.



4. Find the inverse Laplace transform of the function: $X(s) = 3s/((s^2+1)(s^2+4))$

5. Given L_1= 2 H, L_2= 1 H and M =1 H. Write the equations for $v_1(t)$ and $v_2(t)$.



6. Obtain the expression for the transient current in a series RL circuit excited by an AC source $v(t) = sin(wt)$ using s-domain analysis.

7. Plot the variation of current with frequency in a series RLC resonant circuit

8. Differentiate between three-phase unbalanced three wire and four wire star connected load.

9. Define the open circuit impedance of a two-port network

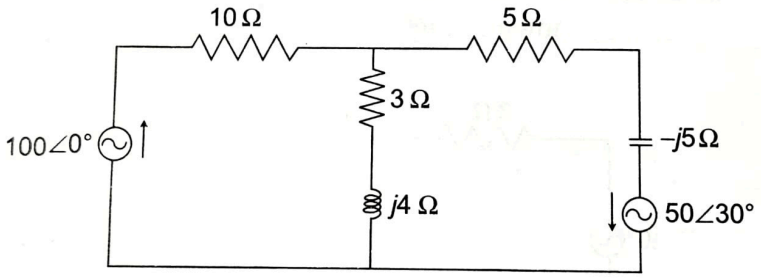
10. The Z parameters of a two-port network are Z_{11}=5 Ω, Z_{12}=Z_{21}=2.5 Ω, Z_{22}=10 Ω. Find the equivalent T-network.

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

Answer any One full question from each module.

Module 1

11. Write the mesh equations for the following circuit and solve for current and power through the 3 Ω resistance.



OR

12. A capacitor of 1F is initially charged to 8V. At time t = 0, it is connected in series with an inductor of 1 H and a resistor of 6 Ω.

i) Write the time domain differential equation governing the circuit.

ii) Obtain the expression for the transient current for time t > 0

iii) Obtain the expression for the capacitor voltage for time t > 0

iv) Comment on whether the response is oscillatory, overdamped, or critically damped.

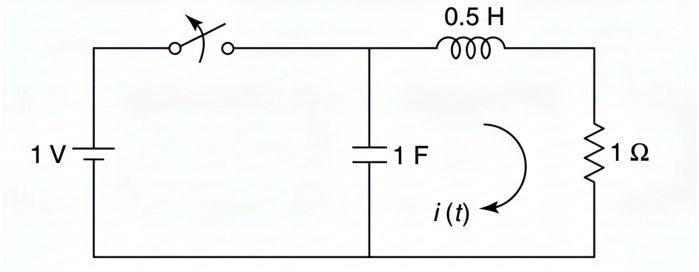
Module 2

13. In the RLC network shown, the switch is opened at time t=0. Steady state was achieved before t=0.

i) Determine the inductor current and capacitor voltage at t=0

ii) Draw the s-domain equivalent circuit for t>0

iii) Find i(t) for t>0



OR

14. Given $x_1(t) = 4u(t)$, $x_2(t) = e^{-t}u(t)$ and $x_3(t) = x_1(t) * x_2(t)$

i) Find $\mathcal{L}\{x_3(t)\}$ using convolution integral.

ii) Derive the Laplace transform of the convolution of two time domain signals.

iii) Using the result obtained in (ii), verify your answer obtained in (i).

Module 3

15. a. Draw the transformed s-domain circuit of an RL series circuit with a sinusoidal voltage source. Obtain the equation of current in the circuit. (7 Marks)

b. Draw the transformed s-domain circuit of an RC series circuit with a sinusoidal voltage source. Obtain the equation of voltage across the capacitor. (7 Marks)

OR

16. a. A coil having an inductance of 100 mH is magnetically coupled to another coil having an inductance of 900 mH. The coefficient of coupled between the coils is 0.45. Calculate the equivalent inductance if the two coils are connected in (i) series opposing, and (ii) parallel opposing. (8 Marks)

b. Derive the equivalent inductance in a differentially coupled parallely connected coils. (6 Marks)

Module 4

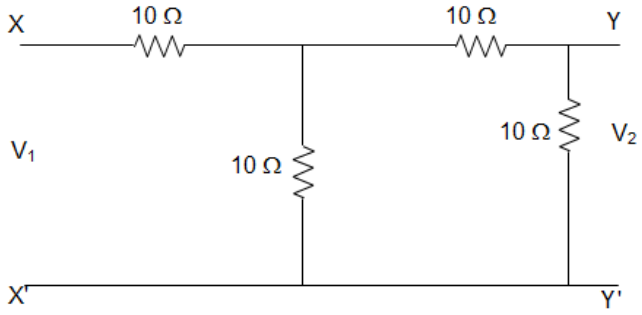
17. In a 400 V, 50 Hz three-phase supply, there is a three-wire star-connected load with impedances Z_A= 15 Ω, Z_B=(10+j5) Ω and ZC=(6-j8) Ω. Determine phase currents and line currents, if the phase sequence is ABC.

OR

18. In a 400 V, 50 Hz three-phase supply, there is a four-wire star-connected load with impedances Z_A= (10+j10) Ω, Z_B=(15+j10) Ω and Z_C=(0+j5) Ω. Determine phase currents, line currents, and the current through the neutral wire, if the phase sequence is ABC.

Module 5

19. Obtain the h parameters for the following network. Determine whether the network is symmetrical and reciprocal.



OR

20. a. Determine the resultant ABCD parameters of the cascade-connected two-port networks. (7 Marks)

b. Determine the resultant Z parameters of the series-connected two-port networks. (7 Marks)

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