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# SAINTGITS COLLEGE OF ENGINEERING (AUTONOMOUS)

(AFFILIATED TO APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY, THIRUVANANTHAPURAM)

**THIRD SEMESTER B.TECH DEGREE EXAMINATION (Regular), DECEMBER 2022**
**ELECTRICAL AND ELECTRONICS ENGINEERING**
**(2020 SCHEME)**

**Course Code :** **20EET201**

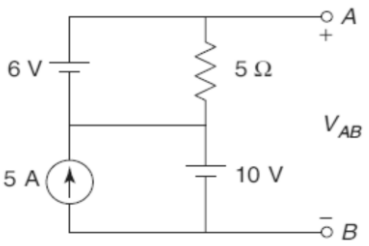
**Course Name:** **Circuits and Networks**

**Max. Marks :** **100** **Duration: 3 Hours**

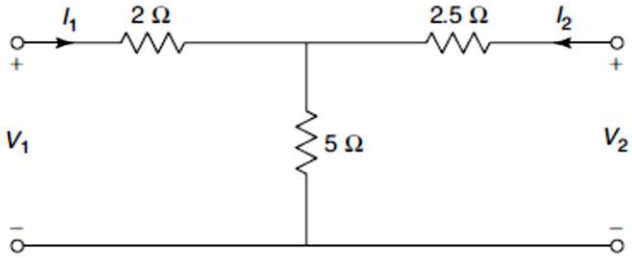
## PART A

***(Answer all questions. Each question carries 3 marks)***

1. State and explain reciprocity theorem.
2. Using superposition theorem find $V_{AB}$




3. A series RL circuit with R=30Ω and L=15H has a constant voltage V= 60V applied at t=0. Determine the current i(t), the voltage across resistor and the voltage across the inductor.
4. Define time constant and find the time constant of series RC circuit powered by DC source having R = 10Ω and C = 0.1 F.
5. The equivalent inductance of two coils connected in series is 0.6H and 0.1H depending on relative directions of currents in the two coils. If one of the coils has a self-inductance of 0.2 H, find (a) mutual inductance, and (b) coefficient of coupling.
6. Define (i) transfer function, (ii) poles and (ii) zeros of an electrical network.
7. Calculate half power frequencies of a series resonant circuit where the resonance frequency is 150kHz and the bandwidth is 75 kHz.
8. Explain the phenomenon of neutral shift voltage in a 3ϕ systems.
9. Write the conditions for a two-port network to be reciprocal in case of all parameters.
10. Find the equivalent π-network for the T-network.



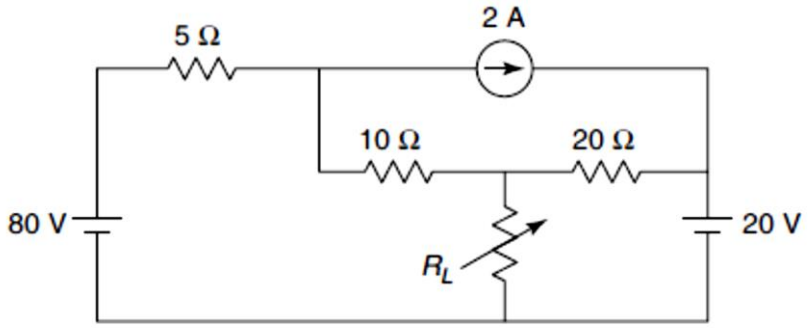
## PART B

***(Answer one full question from each module, each question carries 14 marks)***

### MODULE I

11. a) Derive the condition for which maximum power is transferred from source to load for a AC circuit. (4)

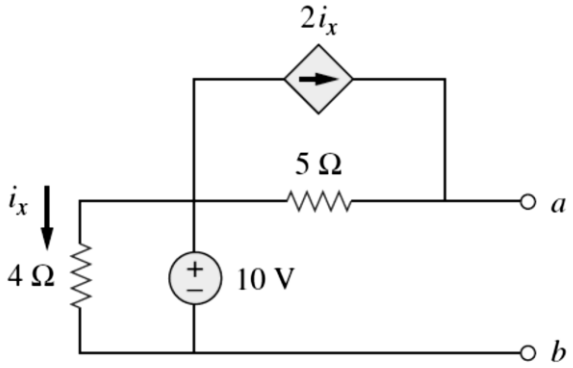
b) Calculate the value of load resistance $R_L$ for maximum power transfer from source to load and also calculate the maximum power.




(10)

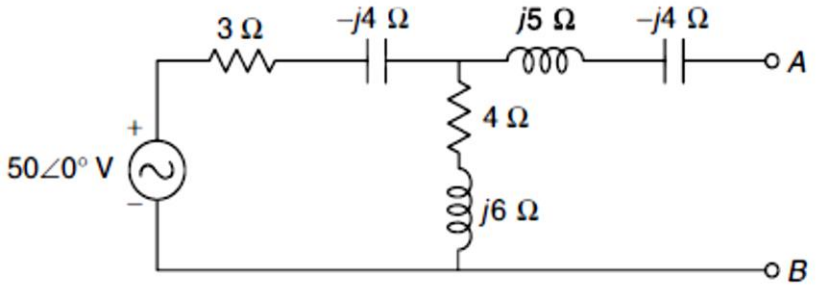
**OR**

12. a) Using Norton's theorem, find $R_N$ and $I_N$ for the circuit shown below between the terminals a-b. Hence draw the equivalent circuit for the same.




(7)

b) Obtain the Thevenin's equivalent network between the terminals A and B

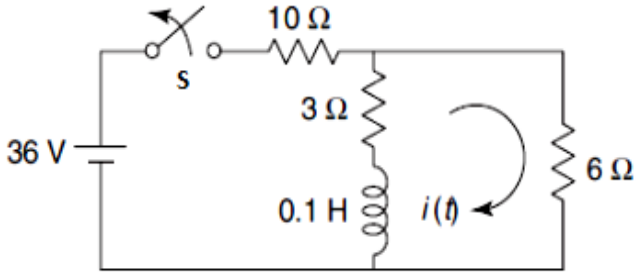



(7)

### MODULE II

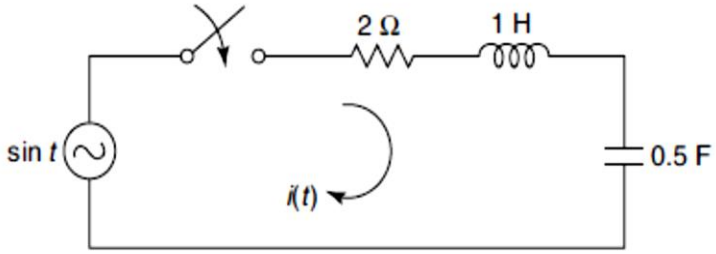
13. a) Explain the classification of series RLC circuits based on damping ratio. (4)

b) In the network shown below, the switch 's' is opened at t = 0. Find i(t). (10)



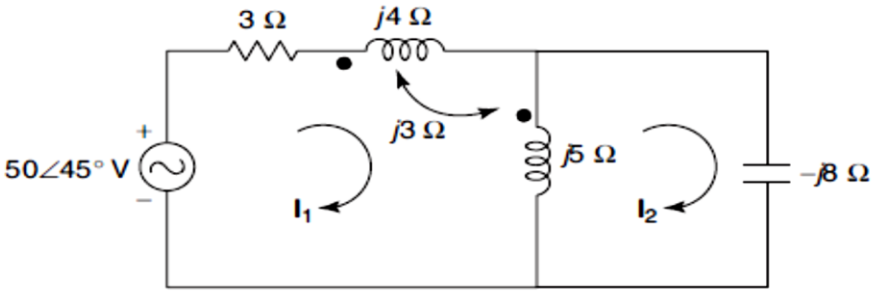

**OR**

14. a) For the network shown below, the switch 's' is closed at t = 0. Determine the current i(t) assuming zero initial conditions. (14)

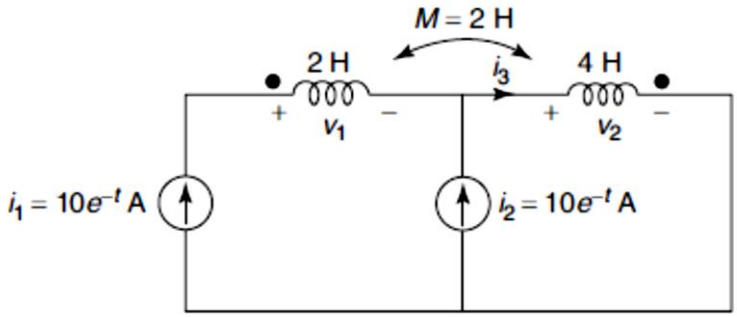



**MODULE III**

15. a) For the coupled circuit, Determine the current through the capacitor $i_2(t)$. (7)

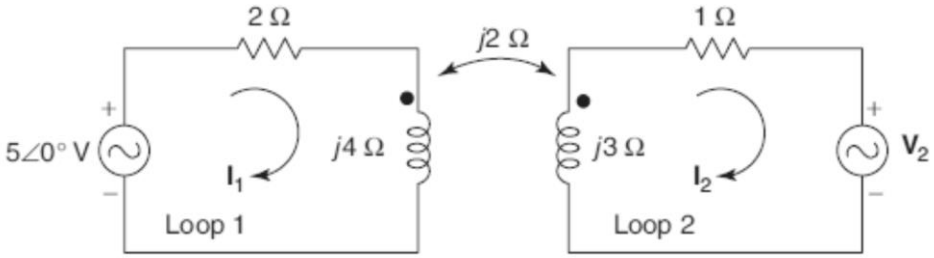


b) For the network shown below, determine the voltages $V_1$ and $V_2$. (7)



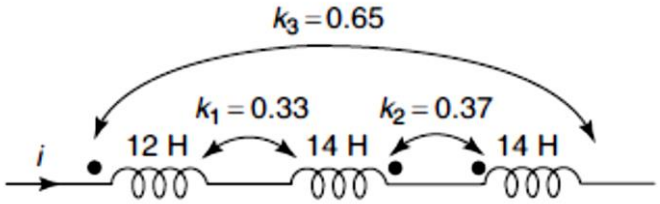

**OR**

16. a) Determine the voltage $V_2(t)$ in the circuit, such that the current in Loop 1 is zero.




(7)

b) Find the equivalent inductance for the network shown below.




(7)

**MODULE IV**

17. a) A series RLC circuit consists of a 50Ω resistance, 0.2 H inductance, and 10 μF capacitor with an applied voltage of 20 V. Determine
(a) The resonant frequency.
(b) The Q-factor of the circuit.
(c) The lower and upper frequency limits.
(d) The bandwidth of the circuit. (6)

b) A 400V, three-phase supply feeds an unbalanced three-wire, star-connected load. The branch impedances of the load are $Z_R$ = 4+8j Ω; $Z_y$ = 3+4j Ω and $Z_B$ = 15+20j Ω. With RYB as phase sequence. Determine the following considering line voltage as reference phasor. (8)

(i) neutral shift voltage.
(ii) voltage across each phase impedance.
(ii) the line currents.

**OR**

18. a) A 50 μF capacitor, when connected in series with the coil having 40 Ω resistance, resonate at 1000 Hz. Find the inductance of the coil and also obtain the circuit current if the applied voltage is 100V.Also calculate the voltage across the capacitor and the coil at resonance. (6)

b) Three impedances $Z_1 = 20\angle 30°$ V, $Z_2 = 40\angle 60°$ V and $Z_3 = 10\angle -90°$ V are delta-connected to a 400V, 3Φ system.
Determine
(a) Phase currents,
(b) Line currents, and
(c) Total power consumed by the load. (8)

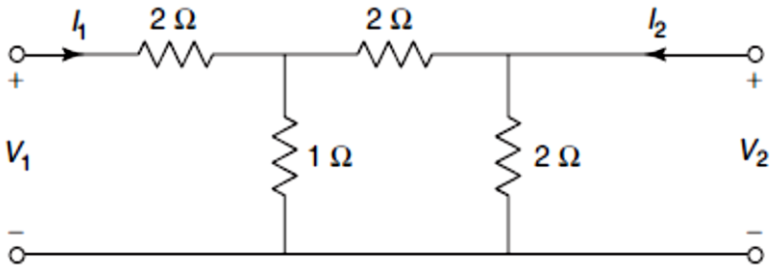
**MODULE V**

19. a) Currents $I_1$ and $I_2$ entering at Port 1 and Port 2 respectively of a two-port network are given by the following equations. Find Z and ABCD parameters. (8)

$$I_1 = 0.5\,V_1 - 0.2\,V_2$$

$$I_2 = -0.2\,V_1 + V_2$$

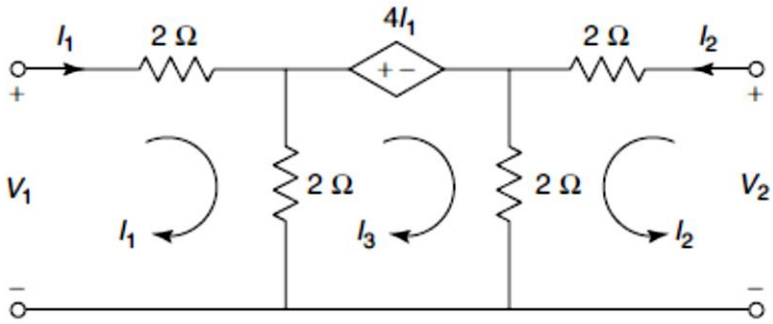
b) Two identical sections of the network shown below, are connected in cascade. Obtain the transmission parameters of the overall connection.




(6)

**OR**

20. a) Find Z and h-parameters for the network shown below. (8)




b) Explain series and parallel interconnection of two port network. (6)

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