Register No.: ..... Name: .....

SAINTGITS COLLEGE OF ENGINEERING (AUTONOMOUS)

(AFFILIATED TO APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY, THIRUVANANTHAPURAM)

THIRD SEMESTER B.TECH DEGREE EXAMINATION (R,S), DECEMBER 2023
ELECTRICAL AND ELECTRONICS ENGINEERING

(2020 SCHEME)

Course Code : **20EET201**

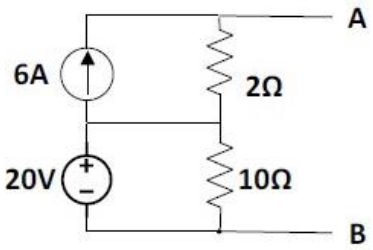
Course Name: **Circuits and Networks**

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

PART A

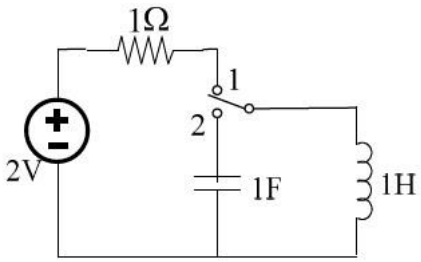
(Answer all questions. Each question carries 3 marks)

1. State and explain reciprocity theorem using an example.
2. Replace the network given below with a single current source and a resistor.



3. A resistance R and 5μF capacitor are connected in series across a 100V DC supply. Calculate the value of R such that the voltage across the capacitor becomes 50V in 5sec after the circuit is switched on.

4. In the circuit shown below, steady state exists when switch is in position 1. At t = 0, it is moved to position 2. Determine the expression for current i(t) through the inductance for t ≥ 0.



5. Obtain the transfer function of a typical series RLC circuit. Take the voltage across the capacitor as output variable.

6. Define coefficient of coupling in a coupled circuit. What are its maximum and minimum values?

7. Describe the variation of the impedance, power factor and current as a function of frequency in a series resonant circuit.

8. Explain the phenomenon of neutral shift in three phase 3 - wire systems.
9. Express ABCD parameters in terms of Z parameters.
10. Determine whether the two-port network represented by the following network equations is reciprocal.

$$V_1 = 3V_2 - 2I_2$$

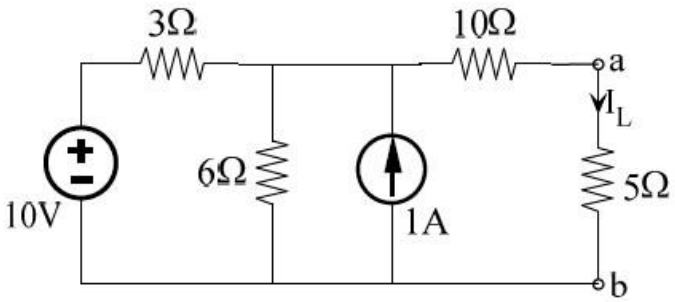
$$I_1 = 4V_2 - 3I_2$$

PART B

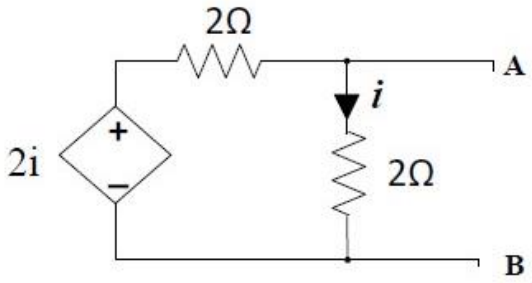
(Answer one full question from each module, each question carries 14 marks)

MODULE I

11. a) Determine the voltage drop across the 5Ω resistance in the circuit given below, using Norton's theorem. (9)

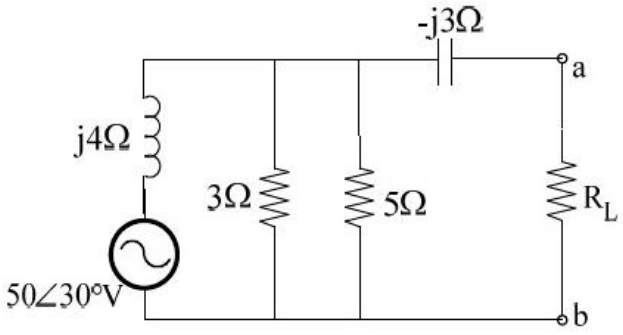


b) Determine the thevenin's equivalent circuit of the given network (5)

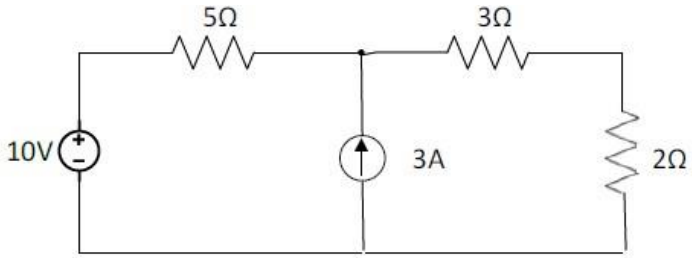


OR

12. a) In the network shown below, determine the value of R_L for maximum power transfer. Also, find the maximum power transferred. (9)



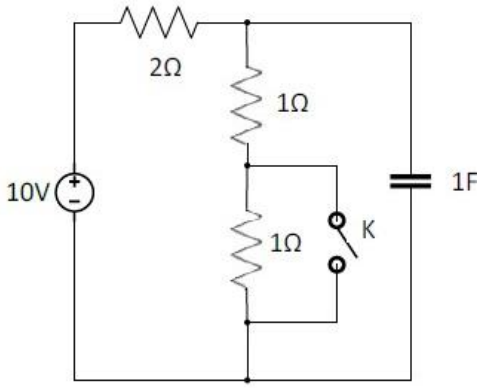
b) Compute the power dissipated in the 2Ω resistance in the network shown below, using superposition principle. Assume all the active sources are ideal.



(5)

MODULE II

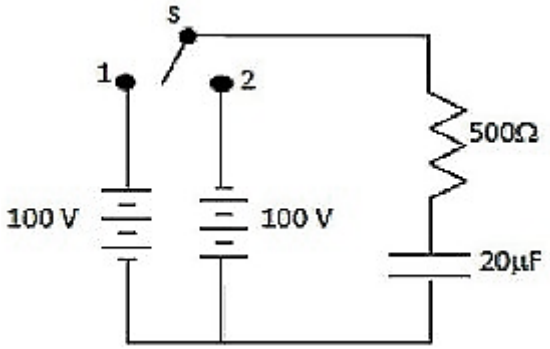
13. The circuit shown in the figure is initially at steady state, with the switch K opened. If the switch is closed at time t = 0, determine the expression for the voltage across the capacitor for t ≥ 0. Also find its final steady state value.



(14)

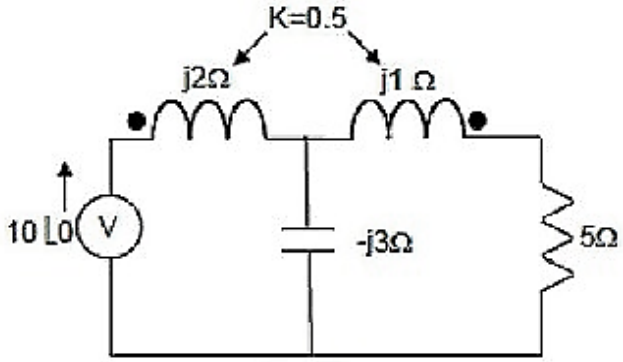
OR

14. In the given circuit shown below, the switch is closed to position 1 at t=0 and after a time equal to one time constant it is moved to position 2. Find the expression for current after moving to position 2. Assume zero initial charge on the capacitor. (14)



MODULE III

15. a) Find the voltage across the 5Ω resistor in time domain for the circuit shown below.

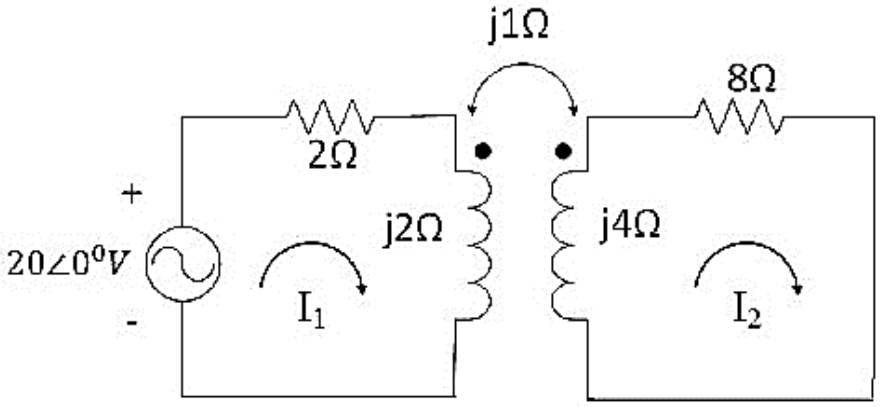


(10)

b) The current through a 1Ω resistor in a circuit with equation I(s) = $\frac{S+2}{(S+1)(S+1)}$ .Find the voltage across the resistor in time domain. (4)

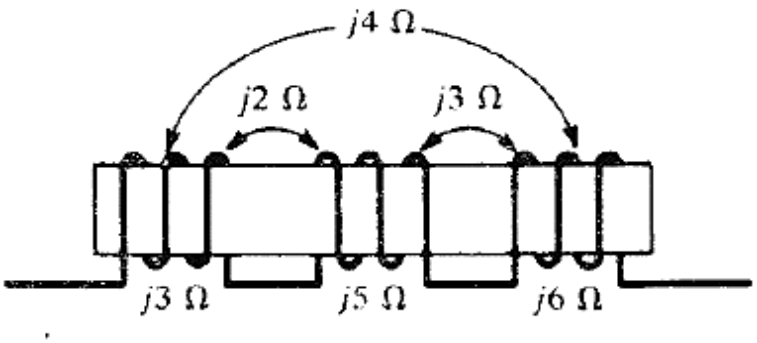
OR

16. Determine the loop current's $i_1(t)$ and $i_2(t)$ for the circuit given below.



(10)

b) Obtain the dotted equivalent circuit of the network shown below and then determine the net inductive reactance. (4)



MODULE IV

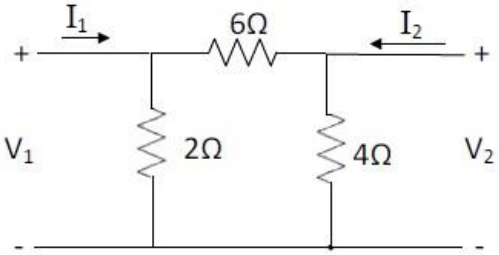
17. A 3-phase, 400V, 4-wire system has a star connected load with Z_1= 20Ω, Z_2= 15 + j10Ω and Z_3= j5Ω. Find the line currents, current through the neutral conductor, the total power consumed by the load and phase voltage across each impedance. (14)

OR

18. A resistor, capacitor and an inductor are connected in series with a 230 V, variable frequency AC source. When the supply frequency is varied to 50Hz, a maximum current of 2A flows and the corresponding voltage across the capacitor is 500 V. Determine,
(i) Resistance, inductance and capacitance of the circuit.
(ii) Q- factor and bandwidth of the circuit.
(iii)The source frequencies at which the circuit current is $1/\sqrt{2}$ times the maximum current. (14)

MODULE V

19. a) Find the transmission parameters of the network shown in the figure. Check it symmetry and reciprocity.

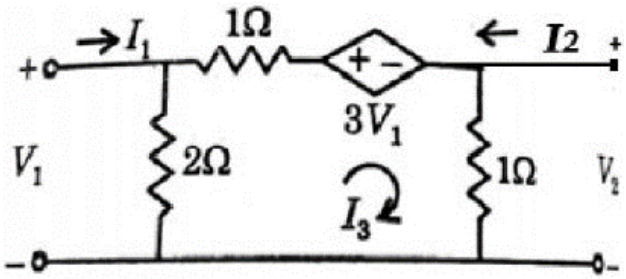


(10)

b) The Z parameters of a two-port network are Z_{11} = 10 Ω, Z_{22} = 20 Ω, Z_{12} = Z_{21} =5Ω.Find the equivalent T network (4)

OR

20. a) Find the Z and Y parameters for the given network.



(10)

b) The port currents of a two-port network are given by

$$I_1 = 4V_1 - 2V_2$$

$$I_2 = -2V1 + 5I_2$$

(4)

Find the equivalent pi network.

****