

## Third Semester B.E. Degree Examination, Dec.2024/Jan.2025

### Network Theory

Time: 3 hrs.

Max. Marks: 100

*Note: Answer any FIVE full questions, choosing ONE full question from each module.*

#### Module-1

- 1 a. Define the following terms : (i) Network and Circuit (ii) Active and Passive circuits (06 Marks)  
(iii) Mesh and Loop (iv) Node
- b. Reduce the circuit using source transformation technique for the circuit shown in Fig. Q1 (b). (07 Marks)

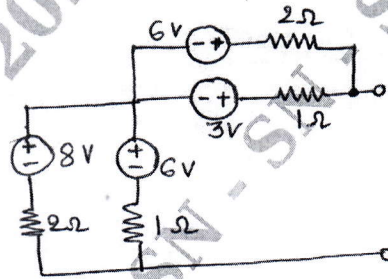


Fig. Q1 (b)

- c. Find the voltage across capacitor using mesh analysis for the circuit shown in Fig. Q1 (c). (07 Marks)

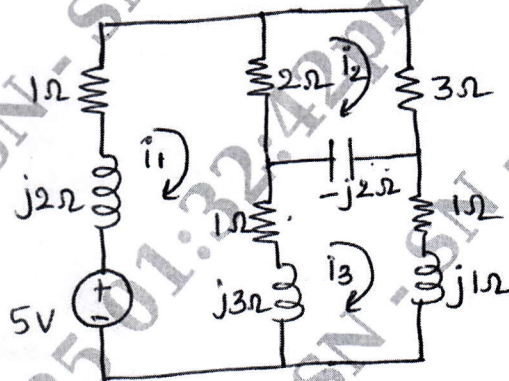


Fig. Q1 (c)

OR

- 2 a. Derive the expression for, (i)  $\Delta$  to Y transformation (ii) Y to  $\Delta$  transformation , (10 Marks)  
 $\Delta$  - delta, Y - Star
- b. Use the nodal analysis to find the value of  $V_x$  in the circuit shown in Fig. Q2 (b), such that the current through  $(2 + j3)\Omega$  is zero. (10 Marks)

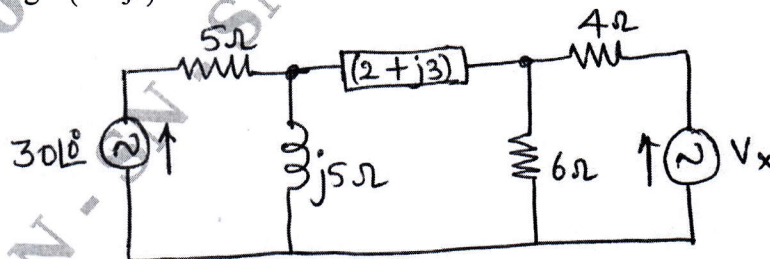


Fig. Q2 (b)

**Module-2**

- 3 a. State superposition theorem and hence obtain the response  $I$  for the network shown in Fig. Q3 (a).

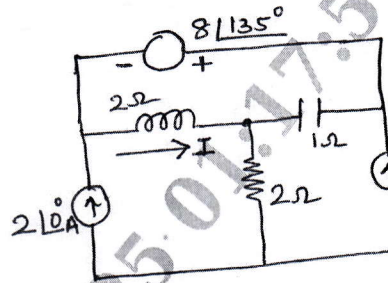


Fig. Q3 (a)

(12 Marks)

- b. State and prove Millman's theorem.

(08 Marks)

**OR**

- 4 a. Obtain the Thevenin's and Norton's Equivalent circuit for the network shown in Fig. Q4 (a).

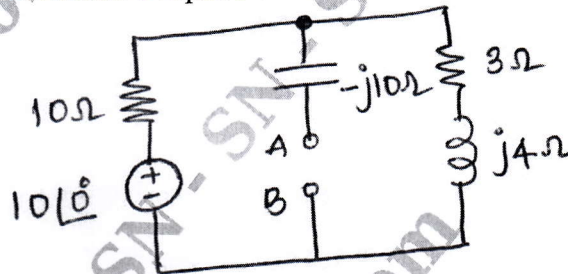


Fig. Q4 (a)

(08 Marks)

- b. State and prove Maximum power transfer theorem for AC circuits. (06 Marks)  
 c. Determine the Norton's Equivalent circuit across AB terminals and hence find current through 5Ω resistor for the network shown in Fig. Q4 (c). (06 Marks)

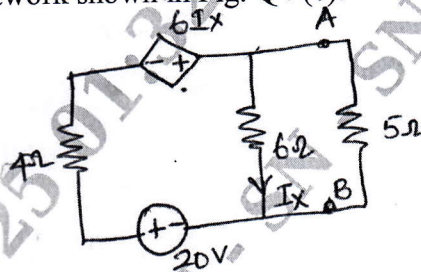


Fig. Q4 (c)

**Module-3**

- 5 a. Explain in detail the transient response of a R-L circuit for D.C. Excitation. (10 Marks)  
 b. Find  $i(t)$  for the network shown in Fig. Q5 (b), if the switch  $K$  is opened at  $t = 0$ , assume circuit was in steady state condition before the switch was opened at  $t = 0$ . (10 Marks)

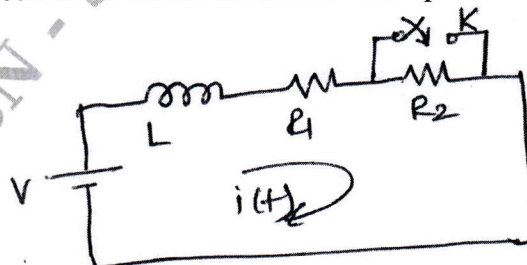


Fig. Q5 (b)

OR

- 6 a. Explain in detail the transient response of R-C circuit for A.C. Excitation. (10 Marks)
- b. Determine  $i(0^+)$ ,  $\frac{di(0^+)}{dt}$ ,  $\frac{d^2i(0^+)}{dt^2}$  if switch K is closed at  $t = 0$  for the circuit shown in Fig. Q6 (b). Given  $V = 10\text{ V}$ ,  $R = 10\ \Omega$ ,  $L = 1\text{ H}$ ,  $C = 10\ \mu\text{F}$  and  $V_C = 0$ . (10 Marks)

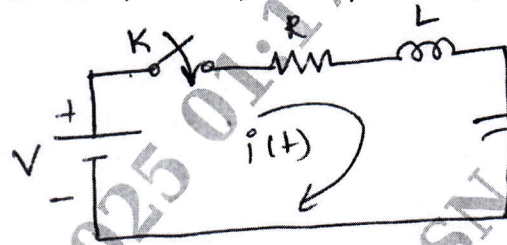


Fig. Q6 (b)

**Module-4**

- 7 a. State and prove initial value and final value theorem. (10 Marks)
- b. Find the Laplace transform of waveform shown in Fig. Q7 (b). (10 Marks)

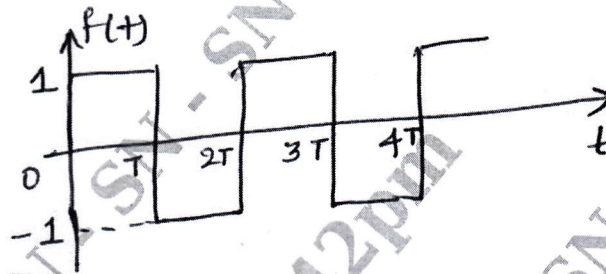


Fig. Q7 (b)

OR

- 8 a. Obtain the Laplace transform of, (i) Step (ii) Ramp (iii)  $\sin \omega t$  (10 Marks)
- b. Find the Equivalent impedance of the circuit shown in Fig. Q8 (b), using Laplace transform.

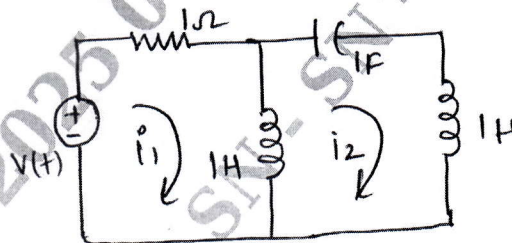


Fig. Q8 (b)

(10 Marks)

**Module-5**

- 9 a. Define resonant frequency, half power frequencies with respect to series circuit and hence show that resonant frequency is geometric mean of half power frequencies. (08 Marks)
- b. A coil of inductance  $10\text{ H}$  and  $10\ \Omega$  resistance is connected in parallel with  $100\text{ PF}$  capacitor. The combination is applied with a voltage of  $100\text{ V}$ . Find resonant frequency and current at resonance. (06 Marks)
- c. A series RLC circuit consists of a resistance of  $1\text{ K}\Omega$  and an inductance of  $100\text{ mH}$  in series with capacitor of  $10\text{ PF}$ . If  $100\text{ V}$  is applied as input across the combination determine resonant frequency, Max-current, Q-factor. (06 Marks)



OR

- 10 a. Explain z and y parameters with equivalent circuit and also express z-parameters in terms of y-parameters. (08 Marks)
- b. Find the transmission parameters for the circuit shown in Fig. Q10 (b).

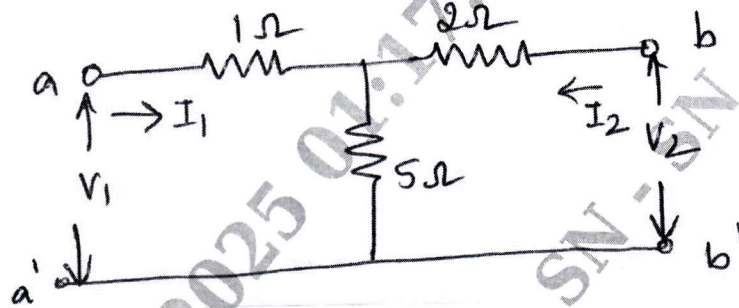


Fig. Q10 (b)

(06 Marks)

- c. Define Q-factor, Selectivity, Bandwidth and hence derive the relation between resonant frequency and half power frequencies. (06 Marks)

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