CBCS SCHEME

USN | | | | | | | | | | |

21EE33

Third Semester B.E. Degree Examination, Jan./Feb. 2023
Electric Circuit Analysis

Time: 3 hrs. Max. Marks: 100

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

Module-1

1 a. Using source transformation and source shifting techniques, find voltage across 2Ω resistor in the Fig.Q1(a).

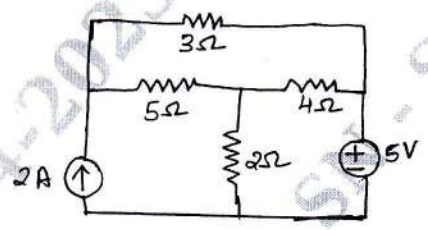

Fig.Q1(a) **(06 Marks)**

b. Using star delta transformation find equivalent resistance between AB in the Fig.Q1(b).

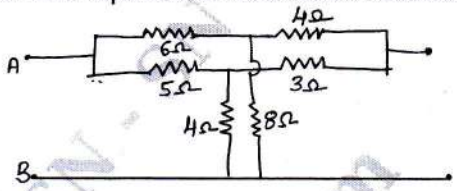

Fig.Q1(b) **(08 Marks)**

c. Use node analysis and find the value of V_x in the Fig.Q1(c) circuit such that the current through the impedance (2 + j3)Ω is zero.

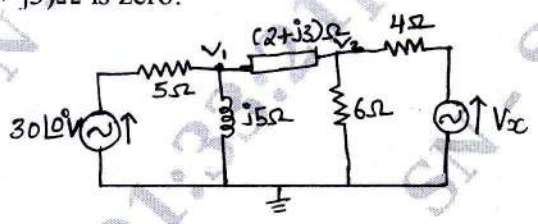

Fig.Q1(c) **(06 Marks)**

OR

2 a. Find the loop currents I_1, I_2 and I_3 in the circuit shown in Fig.Q2(a).

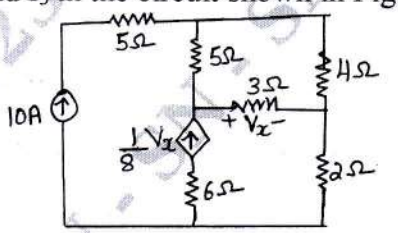

Fig.Q2(a) **(06 Marks)**

b. For the networks shown in Fig.Q2(b) find the node voltages V_d and V_c.

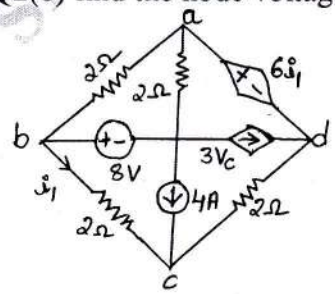

Fig.Q2(b) **(08 Marks)**

c. Explain with circuit diagram how to find loading effect of different voltmeter in an electric circuit. **(06 Marks)**

Module-2

3 a. State and explain superposition theorem. **(06 Marks)**

b. Obtain the Thevenin's and Norton's equivalent circuits at terminals AB for network. Find the current through 10Ω resistor across AB in the Fig.Q3(b).

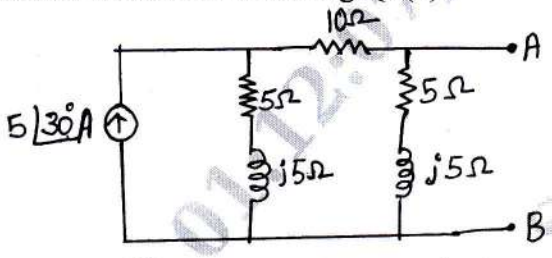

Fig.Q3(b) **(08 Marks)**

c. Using Millman's theorem, find I_L through R_L for the network shown in Fig.Q3(c).

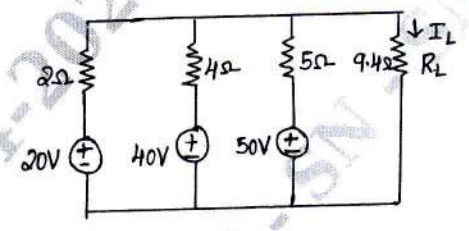

Fig.Q3(c) **(06 Marks)**

OR

4 a. State and prove maximum power transfer theorem for AC network. **(06 Marks)**

b. Calculate i_x and verify reciprocity theorem for the Fig.Q4(b).

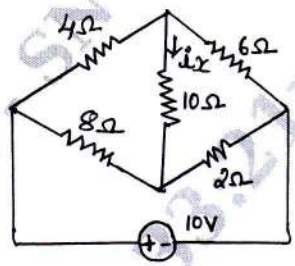

Fig.Q4(b) **(08 Marks)**

c. Find the Tevenin's equivalent of the network shown in Fig.Q4(c).

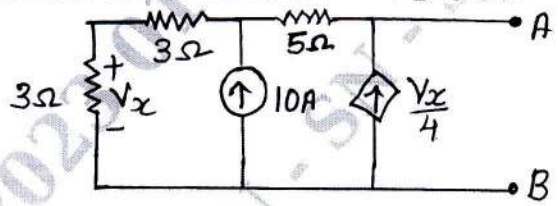

Fig.Q4(c) **(06 Marks)**

Module-3

5 a. Explain parallel resonance. Derive the condition for parallel resonance when RL connected parallel to RC. **(06 Marks)**

b. Determine i, $\frac{di}{dt}$ and $\frac{d^2i}{dt^2}$ at $t = 0^+$ when the switch K is moved form position 1 to 2 at $t = 0$ for the network shown in Fig.Q5(b). Assume capacitor is initially uncharged.

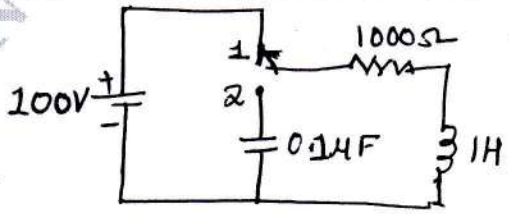

Fig.Q5(b) **(08 Marks)**

c. A series RLC circuit has R = 4 Ω, L = 1 mH and C = 10 μF. Calculate Q factor, bandwidth, resonant frequency and the half power frequencies f_1 and f_2. **(06 Marks)**

OR

6 a. What are initial conditions? Show the behavior of R, L, C elements at the time of switching at t = 0 both at $t = 0^+$ and $t = \infty$. **(06 Marks)**

b. In the network shown in Fig.Q6(b) V = 10V, R = 10Ω, L = 1H, C = 10μF and $V_C(0) = 0$. Find $i(0^+)$, $\frac{di}{dt}(0^+)$ and $\frac{d^2i}{dt^2}(0^+)$.

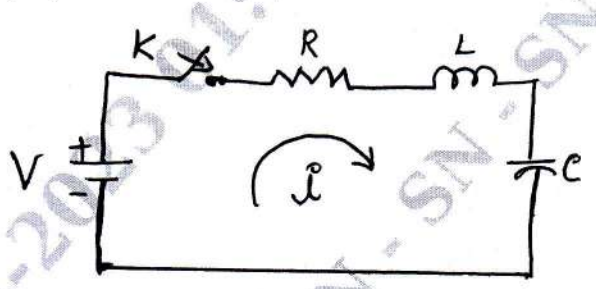

Fig.Q6(b) **(08 Marks)**

c. Derive the expression for quality factor (Q – factor) in a parallel resonant circuit. Explain its utility in comparing resonant circuits, selectivity. **(06 Marks)**

Module-4

7 a. State and prove initial and final value theorem. **(08 Marks)**

b. Find the Lapace transform of the wave form shown in Fig.Q7(b).

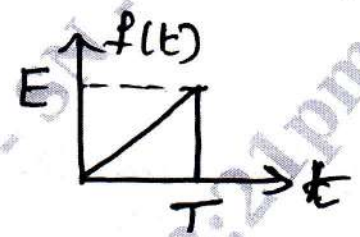

Fig.Q7(b) **(06 Marks)**

c. For the circuit shown Find an expression for i(t) when the switch K is closed at t = 0. Assume there is no initial charge on capacitor, shown in Fig.Q7(c).

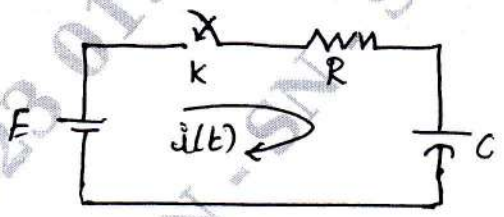

Fig.Q7(c) **(06 Marks)**

OR

8 a. Find the Laplace transform of unit step, unit impulse and unit ramp functions. **(06 Marks)**

b. Find initial and final values of following functions :

i) $i(t) = 3e^{-t} - e^{-2t}$

ii) $i(t) = 5u(t) - 3e^{-2t}$. **(06 Marks)**

c. Determine the Laplace transform of the periodic saw tooth waveform. Shown in Fig.Q8(c).

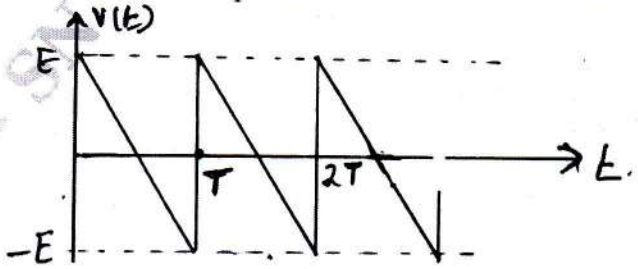

Fig.Q8(c) **(08 Marks)**

Module-5

9 a. Define [Z] and [T] paraemters and derive [Z] interms of [T]. **(06 Marks)**

b. Find y parameters for the networks shown in Fig.Q9(b).

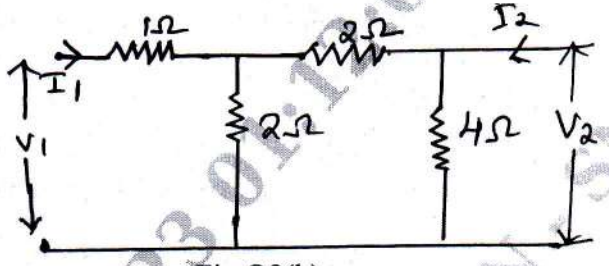

Fig.Q9(b) **(08 Marks)**

c. Derive the relationship between transmission and Z – parameters. **(06 Marks)**

OR

10 a. Find the Z-parameter of the circuit shown in Fig.Q10(a).

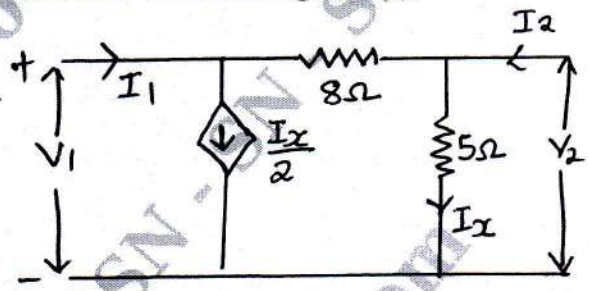

Fig.Q10(a) **(10 Marks)**

b. Determine the line currents and total power supplied to a delta connected load of $Z_{AB} = 10\angle 60°$, $Z_{BC} = 20\angle 90°$, and $Z_{CA} = 25\angle 30°$. Assume a 3ϕ 400V, ABC system shown in Fig.Q10(b). Draw phasor diagram also.

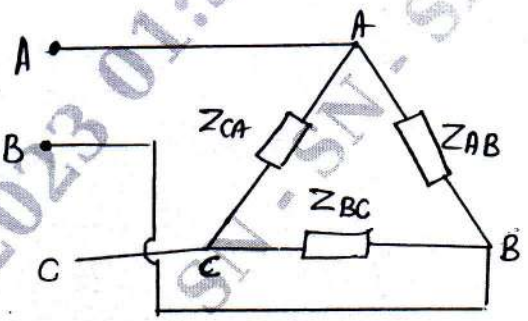

Fig.Q10(b) **(10 Marks)**

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