

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).

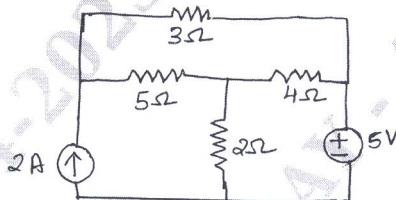


Fig.Q1(a)

(06 Marks)

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

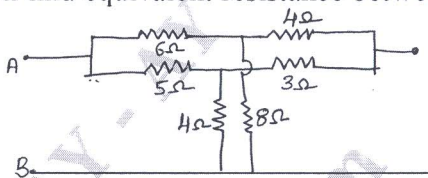


Fig.Q1(b)

(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 $(2 + j3)\Omega$ is zero.

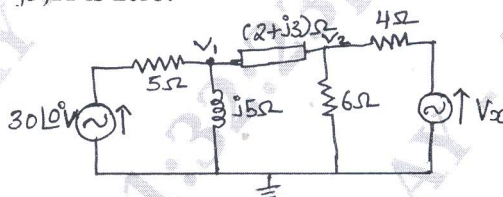


Fig.Q1(c)

(06 Marks)

OR

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

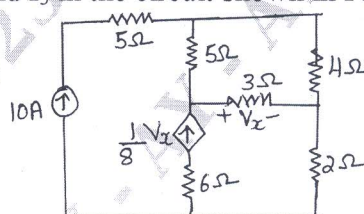


Fig.Q2(a)

(06 Marks)

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

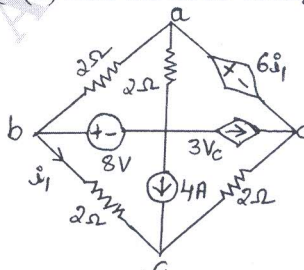


Fig.Q2(b)

(08 Marks)

- c. Explain with circuit diagram how to find loading effect of different voltmeter in an electric circuit.

(06 Marks)

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8=50, will be treated as malpractice.

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).

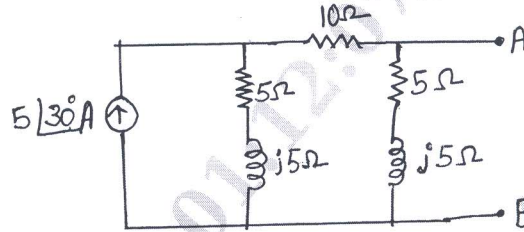


Fig.Q3(b)

(08 Marks)

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

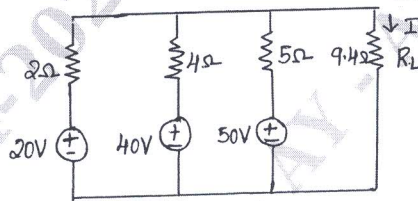


Fig.Q3(c)

(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).

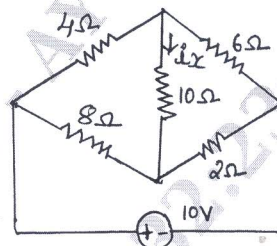


Fig.Q4(b)

(08 Marks)

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

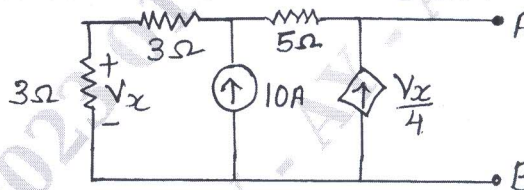


Fig.Q4(c)

(06 Marks)

Module-3

- 5 a. Explain parallel resonance. Derive the condition for parallel resonance when R_L 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 from position 1 to 2 at $t = 0$ for the network shown in Fig.Q5(b). Assume capacitor is initially uncharged.

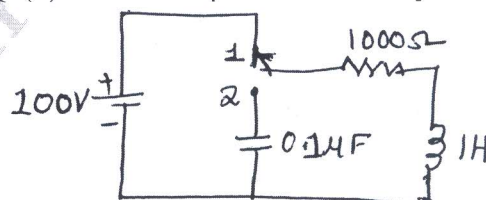


Fig.Q5(b)

(08 Marks)

- c. A series RLC circuit has $R = 4\Omega$, $L = 1\text{ mH}$ and $C = 10\text{ }\mu\text{F}$. 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) $V = 10V$, $R = 10\Omega$, $L = 1H$, $C = 10\mu F$ and $V_C(0) = 0$. Find $i(0^+)$, $\frac{di}{dt}(0^+)$ and $\frac{d^2i}{dt^2}(0^+)$.

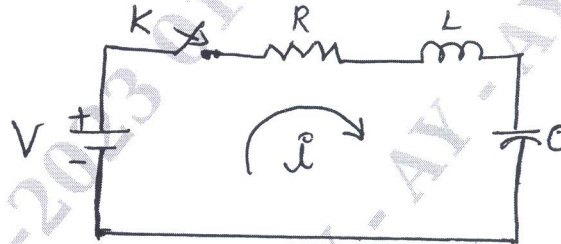


Fig.Q6(b)

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

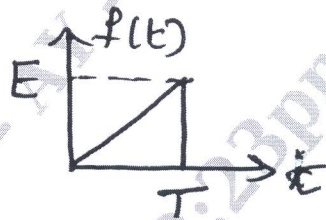


Fig.Q7(b)

(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).

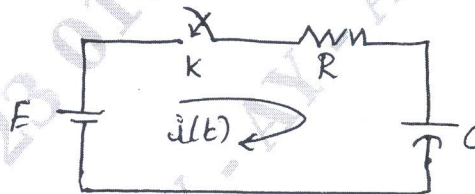


Fig.Q7(c)

(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).

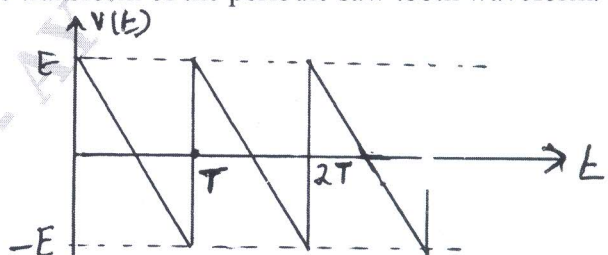


Fig.Q8(c)

(08 Marks)

Module-5

- 9 a. Define $[Z]$ and $[T]$ parameters and derive $[Z]$ in terms of $[T]$. (06 Marks)
 b. Find y parameters for the networks shown in Fig.Q9(b).

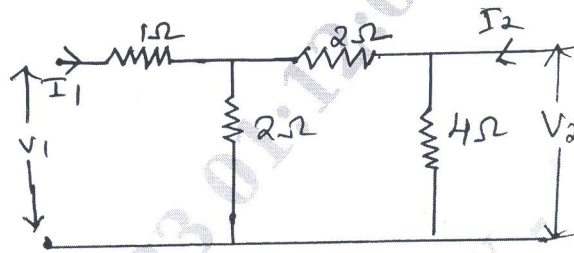


Fig.Q9(b)

(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).

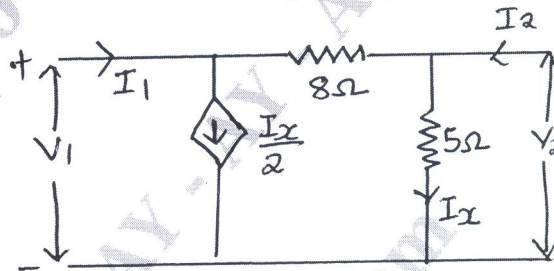


Fig.Q10(a)

(10 Marks)

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

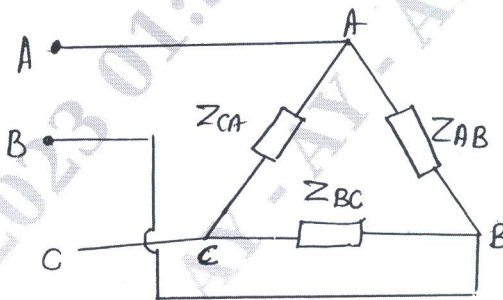


Fig.Q10(b)

(10 Marks)
