

# CBCS SCHEME

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17EE32

**Third Semester B.E. Degree Examination, July/August 2021**

## Electric Circuit Analysis

Time: 3 hrs.

Max. Marks: 100

*Note: Answer any FIVE full questions.*

1. a. Differentiate the following :

- (i) Linear and Non-Linear networks
- (ii) Active and Passive Elements
- (iii) Lumped and Distributed Network.
- (iv) Ideal and Practical sources

(04 Marks)

b. Reduce the given network to a single voltage source in series with a resistance using source shifting and source transformation techniques. [Refer Fig.Q1(b)]

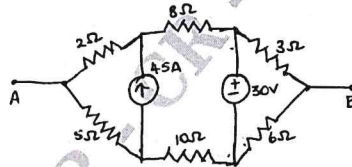


Fig.Q1(b)

(08 Marks)

c. Find the equivalent resistance between the terminals A and B using star-delta transformation for Fig.Q1(c).

(08 Marks)

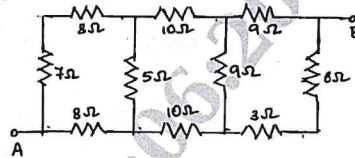


Fig.Q1(c)

2. a. Using Mesh Analysis, find  $I_x$  and  $V_x$  for the circuit shown in Fig.Q2(a).

(05 Marks)

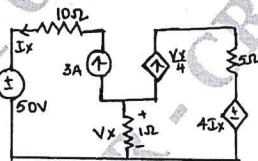


Fig.Q2(a)

b. Apply the nodal voltage technique to obtain the voltages at all nodes for the circuit in Fig.Q2(b).

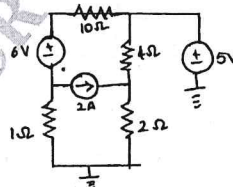


Fig.Q2(b)

(07 Marks)

c. For the network in Fig.Q2(c), draw the dual and write the mesh and nodal equations.

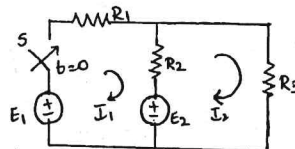


Fig.Q2(c)

(08 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.

- 3 a. State and prove Superposition theorem. (06 Marks)  
 b. Obtain the Thevenin's equivalent of the network shown in Fig.Q3(b) between terminals X and Y.

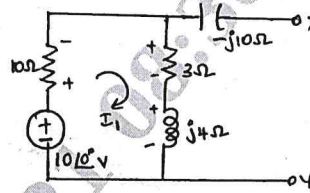


Fig.Q3(b)

(07 Marks)

- c. Find  $V_{ab}$  for the circuit in Fig.Q3(c) using superposition principle between terminals a and b.

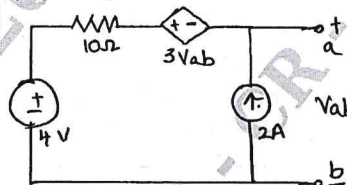


Fig.Q3(c)

(07 Marks)

- 4 a. State and prove Maximum Power Transfer theorem. (06 Marks)  
 b. Obtain Norton's Equivalent for the network in Fig.Q4(b) and determine the current through 5 Ω.

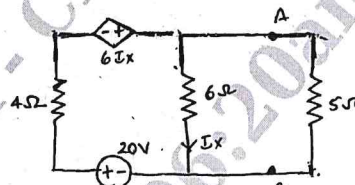


Fig.Q4(b)

(07 Marks)

- c. Find voltage  $V_x$  and verify Reciprocity theorem for the network in Fig.Q4(c).

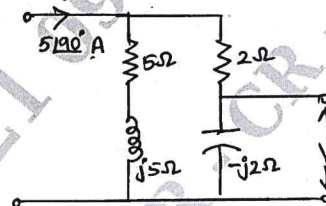


Fig.Q4(c)

(07 Marks)

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- 5 a. Define the following :  
 (i) Resonance (ii) Bandwidth (iii) Q factor (iv) Selectivity (04 Marks)  
 b. Show that in a series resonant circuit, the resonant frequency is the geometric mean of the half power frequencies. (08 Marks)  
 c. For the circuit shown in Fig.Q5(c), find the values of capacitor to achieve resonance. Derive the formula used and take  $f = 50$  Hz.

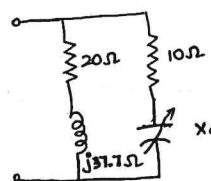


Fig.Q5(c)

(08 Marks)

- 6 a. Explain the behavior of circuit elements under switching action [ $t = 0$  and  $t = \infty$ ]. (06 Marks)

- b. In the network shown, switch K is closed at  $t = 0$ , with the capacitor uncharged. Find the values of  $i(t)$ ,  $di/dt$ ,  $d^2i/dt^2$  at  $t = 0^+$ . [Refer Fig.Q6(b)]

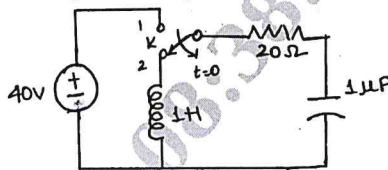


Fig.Q6(b)

(08 Marks)

- c. Derive an expression for transient response of a series RC circuit under DC excitation.

(06 Marks)

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

- b. Obtain the Laplace transform of (i)  $\delta(t)$  (ii)  $U(t)$ . (04 Marks)

- c. Using initial and final value theorems, find  $f(0)$  and  $f(\infty)$  for the following :

(i)  $\frac{s^3 + 7s^2 + 5}{s(s^3 + 3s^2 + 4s + 2)}$

(ii)  $\frac{s(s+4)(s+8)}{(s+1)(s+6)}$

(08 Marks)

- 8 a. Obtain the Laplace transform for the waveform shown in Fig.Q8(a).

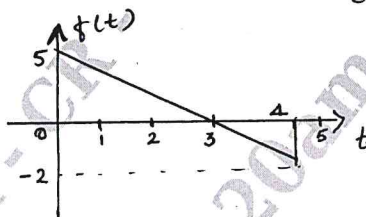


Fig.Q8(a)

(10 Marks)

- b. Synthesize the waveform shown in Fig.Q8(b) and also find its Laplace transform.

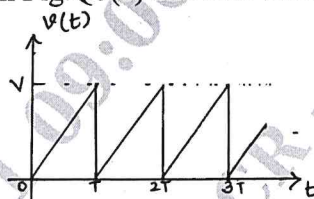


Fig.Q8(b)

(10 Marks)

- 9 a. A 3 phase, 3 wire 208 V, ABC system has a star connected unbalanced load with  $Z_A = 5 \angle 0^\circ$ ,  $Z_B = 5 \angle 30^\circ$ ,  $Z_C = 10 \angle -60^\circ$ . Obtain the line currents and voltages across each impedance, using star-delta transformation technique. (10 Marks)

- b. Three equal inductors connected in star, take 5 kW at 0.7 power factor when connected to a 400V, 50Hz, 3 phases, 3 wire supply. Calculate the line currents if (i) One of the inductors is disconnected. (ii) One of the inductors is short circuited. (10 Marks)

- 10 a. Explain Z parameters and express Z-parameters in terms of Y parameters. (10 Marks)

- b. Find the transmission parameters for the bridge circuit shown in Fig.Q10(b).

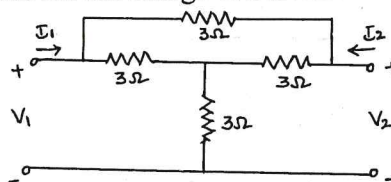


Fig.Q10(b)

(10 Marks)

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