

# CBCS SCHEME

18EE32



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**Third Semester B.E. Degree Examination, Dec.2019/Jan.2020**

## 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. Setup nodal equations for the circuit of Fig.Q1(a) and then find the power supplied by  $5 - V$  source.

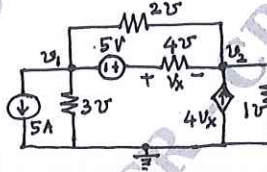


Fig.Q1(a)

(08 Marks)

- b. Making use of source shifting procedure, simplify the circuit of Fig.Q1(b) in such a way that the voltage  $V_x$  is determined.

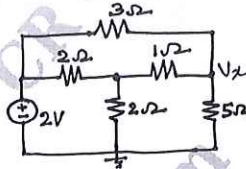


Fig.Q1(b)

(06 Marks)

- c. Use mesh analysis to determine the branch currents in the network indicated in Fig.Q1(c).

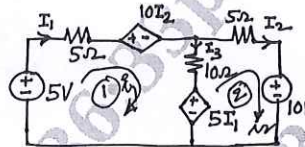


Fig.Q1(c)

(06 Marks)

**OR**

- 2 a. Find 'Req' for the network shown in Fig.Q2(a) across A and B.

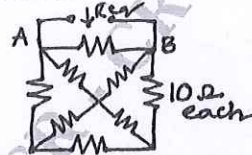


Fig.Q2(a)

(06 Marks)

- b. Draw the exact dual of the network shown in Fig.Q2(b) by writing Kirchoff's law equations.

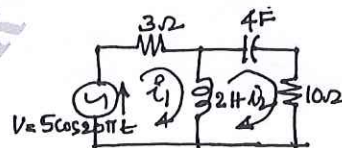


Fig.Q2(b)

(08 Marks)

- c. Reduce the network of Fig.Q2(c) to a form with only one current source across terminals using source transformation (terminals A and B).

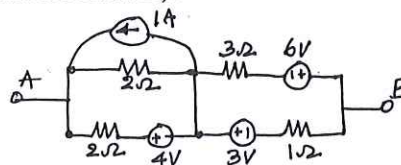


Fig.Q2(c)

(06 Marks)

1 of 4

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1 JAN 2020

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. Find the Thevenin's equivalent circuit at the terminals A and B of the circuit in Fig.Q3(a).

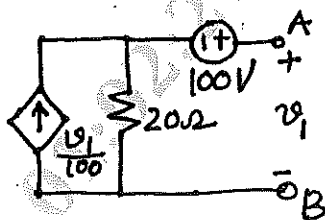


Fig.Q3(a)

(08 Marks)

- b. Find the value of  $R_L$  in the network shown in Fig.Q3(b) that will absorb a maximum power and specify the value of that power.

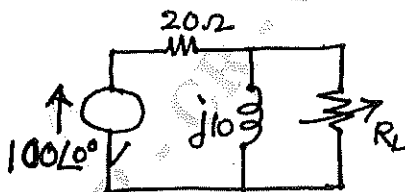


Fig.Q3(b)

(06 Marks)

- c. In the network shown in Fig.Q3(c) the voltage source of 5V causes a current I in the 2Ω resistor. Find 'I'. Verify the reciprocity theorem.

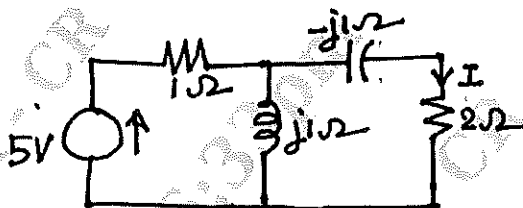


Fig.Q3(c)

(06 Marks)

OR

- 4 a. In the network shown in Fig.Q4(a) determine the nodal voltage  $V_2$  using superposition theorem.

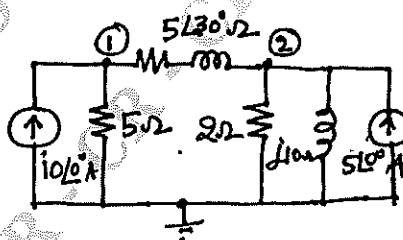


Fig.Q4(a)

(08 Marks)

- b. Use Thevenin's theorem to find current in  $R_L = 6\Omega$  in Fig.Q4(b).

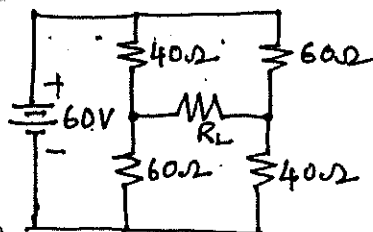


Fig.4(b)

(08 Marks)

- c. State and prove Millman's theorem.

(04 Marks)

**Module-3**

- 5 a. Derive an expression for resonant frequency ' $f_0$ ' for the general parallel resonant circuit show in Fig.Q5(a).

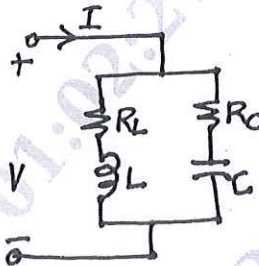


Fig.Q5(a)

(08 Marks)

- b. Fig.Q5(b) shows a network with zero capacitor voltage and zero inductor current when the switch 'K' is open. At  $t = 0$  the switch 'K' is closed. Solve for :

- i)  $V_1$  and  $V_2$  at  $t = 0^+$
- ii)  $\frac{dv_1}{dt}$  and  $\frac{dv_2}{dt}$  and  $t = 0^+$
- iii)  $V_1$  and  $V_2$  at  $t = \infty$

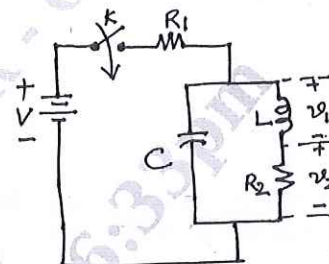


Fig. Q5(b)

(12 Marks)

OR

- 6 a. Fig.Q6(a) shows a RCL parallel circuit excited by a DC current source. At  $t = 0$ , the switch K is opened. Find  $v(t)$ .

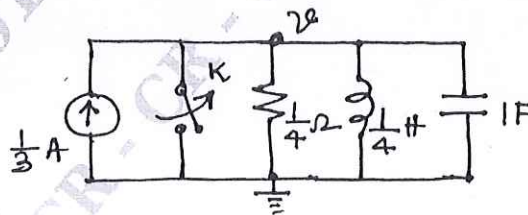


Fig.Q6(a)

(08 Marks)

- b. A 400V, 200Hz AC source is connected in series with a capacitor and a coil whose resistance and inductance are 20m $\Omega$  and 6mH respectively. If the circuit is in resonance at 200Hz, find :
- i) Value of capacitor
  - ii)  $V_g$  A/C the capacitor
  - iii) Maximum energy stored (instantaneous) in the coil
- c. iv) The half - power frequencies. (08 Marks)
- What are initial conditions in network? Write the equivalent form of the network elements interms of the initial conditions. (04 Marks)

**Module-4**

- 7 a. Find the Laplace transform of the square wave shown in Fig.Q7(a).

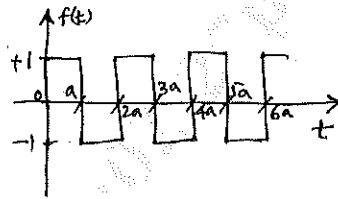


Fig.Q7(a)

(08 Marks)

- b. Fig.Q7(b) shows a series R-L-C circuit excited by a voltage  $v(t) = 12 \sin 5t$ . The initial current in the circuit is 5A and the initial voltage a/c capacitor is one volt with polarity shown. Find  $i(t)$  using Laplace transformation method.

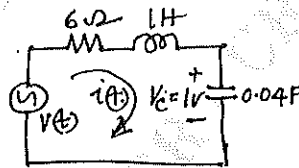


Fig.Q7(b)

(08 Marks)

- c. State and prove the initial-value theorem in the context of Laplace transformation. (04 Marks)

**OR**

- 8 a. A rectangular voltage pulse of unit height and duration 'T' is applied to a series R-C combination at  $t = 0$ . Determine the voltage across the capacitance 'C' as a function of time. Use Laplace transformation method. (10 Marks)
- b. Find the Laplace transforms of the two different functions given below and sketch the waveforms. i)  $\sin(\omega t) u(t - t_0)$  ii)  $\sin \omega(t - t_0) u(t - t_0)$ . (10 Marks)

**Module-5**

- 9 a. A symmetrical 3 -  $\phi$ , 100V, 3-wire supply feeds an unbalanced star-connected load with impedances of the load as  $Z_R = 5 \angle 0^\circ \Omega$ ,  $Z_Y = 2 \angle 90^\circ \Omega$  and  $Z_B = 4 \angle -90^\circ \Omega$ . Find the line currents, voltage across the impedances and the displacement natural voltage. Also calculate the power consumed by the load. Draw the phasor diagram sequence RYB. Take  $V_{RY}$  as ref. (10 Marks)
- b. For the circuit of Fig.9(b) find Z-parameters. Hence calculate transmission (ABCD) parameters. Find whether the network is symmetrical? Reciprocal?

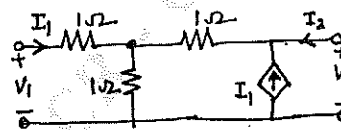


Fig.Q9(b)

(10 Marks)

**OR**

- 10 a. A 3- $\phi$  delta connected load has  $Z_{RY} = (100 + j50)\Omega$ ,  $Z_{YB} = (20 - j75)\Omega$  and  $Z_{BR} = (70.7 + j70.7)\Omega$  and it is connected to balanced 3 -  $\phi$ , 400V supply. Determine the line currents, power consumed by the load. Sketch the phasor diagram. Assume RYB phase sequence and take  $V_{YB}$  as the reference phasor. (10 Marks)
- b. For the circuit shown in Fig.Q10(b) find Y-parameters. Is the network symmetrical? Reciprocal?

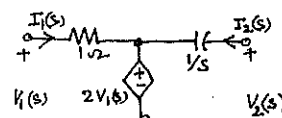


Fig.10(b)

(10 Marks)