

# CBCS SCHEME

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18EE32

Librarian  
Learning Resource Centre  
Acharya Institutes

**Third Semester B.E. Degree Examination, Feb./Mar. 2022**

## 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. Use Source transformation and Source shift methods to convert the circuit shown in Fig. Q1(a) to a single current source in parallel with a single resistor. (06 Marks)

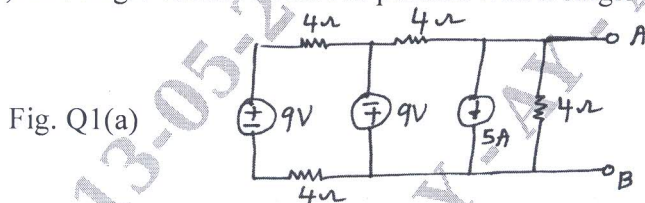


Fig. Q1(a)

- b. Compute the resistance across the terminals XY of network, shown in Fig. Q1(b). (06 Marks)

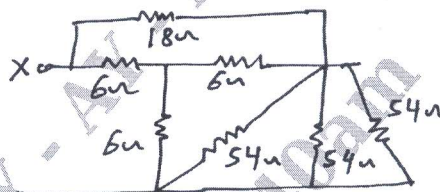


Fig. Q1(b)

- c. For the network shown in Fig. Q1(c), write the mesh equations for the meshes indicated in time domain. Draw the dual network and write its nodal equations. (08 Marks)

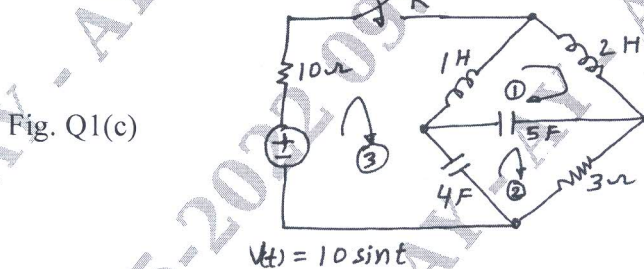


Fig. Q1(c)

OR

- 2 a. Use Node equations to determine what value of E will cause  $V_x$  to be zero for the circuit shown in Fig. Q2(a). (08 Marks)

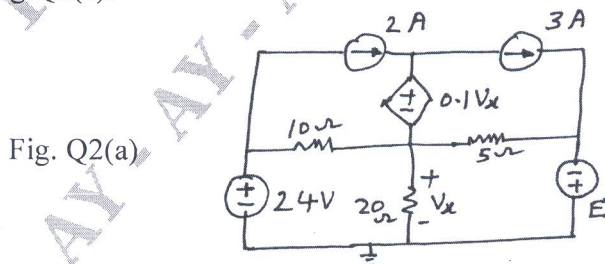
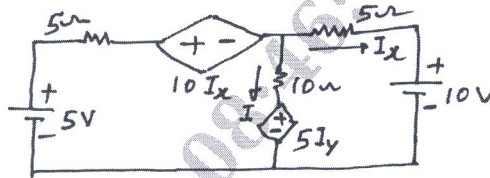


Fig. Q2(a)

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.

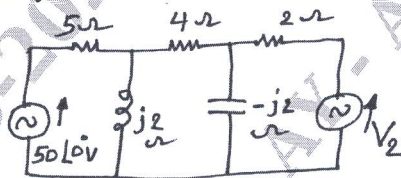
- b. Using Mesh analysis, find the current through  $10\Omega$  resistor in the circuit shown in Fig. Q2(b). (06 Marks)

Fig. Q2(b)



- c. In the circuit shown in Fig. Q2(c), determine  $V_2$  which results in zero current through  $4\Omega$  resistor. Use Mesh current analysis. (06 Marks)

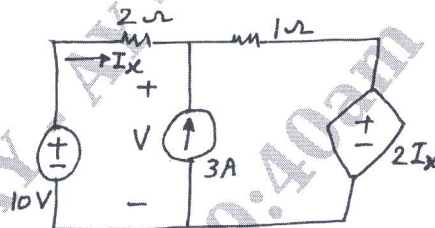
Fig. Q2(c)



**Module-2**

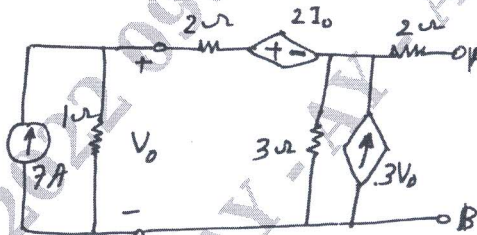
- 3 a. Use Superposition principle to find the current in  $2\Omega$  resistor in the network shown in Fig. Q3(a). (06 Marks)

Fig. Q3(a)



- b. Find the Thevenin and Norton equivalent circuit at terminals AB for the circuit shown in Fig. Q3(b). (10 Marks)

Fig. Q3(b)

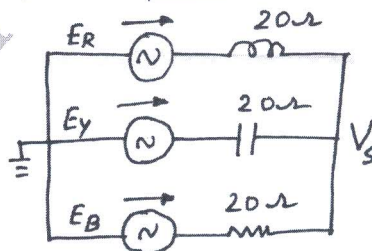


- c. State and prove maximum Power Transfer theorem as applied to DC network. (04 Marks)

OR

- 4 a. Use Millman's theorem to determine the voltage ' $V_s$ ' of the network shown in Fig. Q4(a). Given that  $E_R = 230 \angle 0^\circ$  V ;  $E_Y = 230 \angle -120^\circ$  V ;  $E_B = 230 \angle 120^\circ$  V. (06 Marks)

Fig. Q4(a)



- b. For the circuit shown in Fig. Q4(b), determine the impedance  $Z_X$  such that maximum power is transferred from the source to the load of impedance  $Z_X$ . (08 Marks)

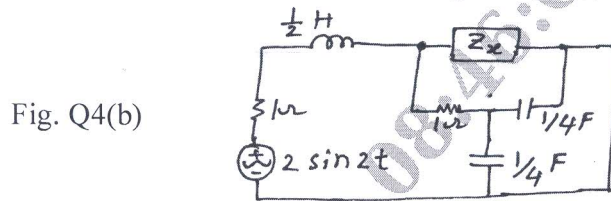


Fig. Q4(b)

- c. Verify Reciprocity theorem for the circuit shown in Fig. Q4(c). (06 Marks)

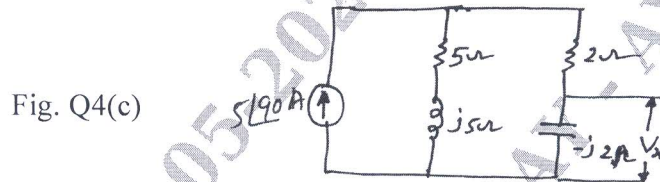


Fig. Q4(c)

**Module-3**

- 5 a. Define Q of the circuit and show that the resonant frequency is the geometric mean of half power frequencies. (07 Marks)  
 b. Determine the RLC parallel circuit parameters whose impedance response curve is shown in Fig. Q5(b). What are the new values of  $W_r$  and bandwidth if 'C' is increased 4 times? (07 Marks)

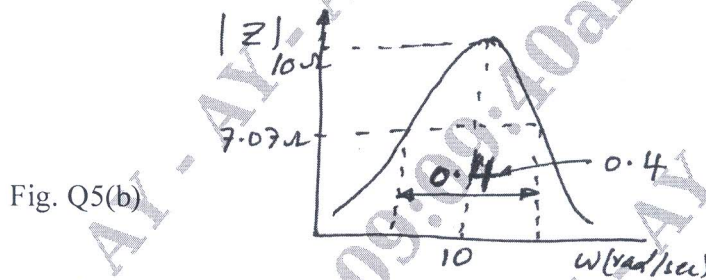


Fig. Q5(b)

- c. A parallel R - L circuit is energized by a current source of 1A. The switch across the source is opened at  $t = 0^+$ . Solve for  $V$ ,  $DV$  and  $D^2V$  at  $t = 0^+$ , if  $R = 100\Omega$  and  $L = 1H$ . (06 Marks)

OR

- 6 a. A two branch anti resonant circuit contains  $L = 0.4H$  and  $C = 40\mu F$ . Resonance is to be achieved by variation of  $R_L$  and  $R_C$ . Calculate the resonance frequency for the following cases : i)  $R_L = 120\Omega$  ;  $R_C = 80\Omega$  ii)  $R_L = 80\Omega$  ;  $R_C = 0$  iii)  $R_L = R_C = 100\Omega$ . (08 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  $t = 0$  in the network shown in Fig. Q6(b). Steady state having been reached before switching. (06 Marks)

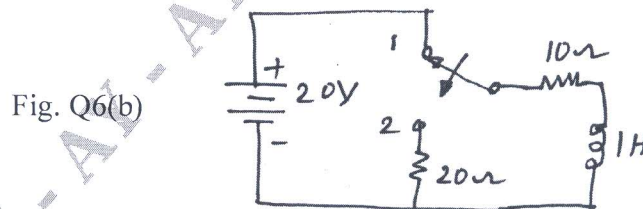


Fig. Q6(b)

- c. Why do we need to study initial conditions? Write the equivalent form of the elements in terms of the initial and final conditions of the element. (06 Marks)

**Module-4**

- 7 a. The current function  $i(t)$  shown in Fig. Q7(a) is impressed on a capacitor 'C'. What should be the strength 'A' of the impulse so that the voltage across the 'C' becomes zero for  $t > 5$  sec. (10 Marks)

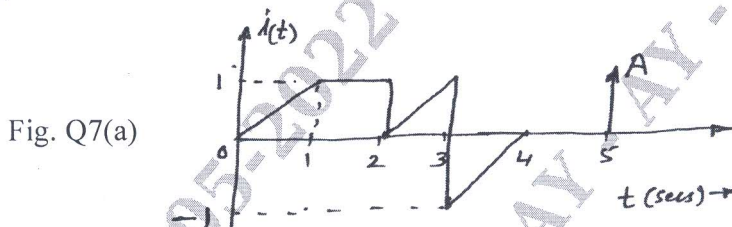


Fig. Q7(a)

- b. In the circuit shown in Fig. Q7(b), the switch is opened at  $t = 0$ , with  $V = 1V$ ,  $C = 1F$ ,  $L = \frac{1}{2}H$  and  $G = 1\Omega$ . Find the node voltages  $V_1(t)$  and  $V_2(t)$  by Laplace transform method. (10 Marks)

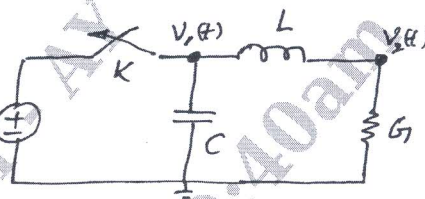


Fig. Q7(b)

**OR**

- 8 a. State and prove Initial and Final value theorems. (08 Marks)  
 b. If  $f(t) = 2t$ , sketch the following i)  $f(t-2)u(t)$  ii)  $f(t)u(t-2)$  iii)  $f(t-2)u(t-2)$   
 iv)  $f(t)\delta(t)$  v)  $f(t)\delta(t-2)$ . (06 Marks)  
 c. In the circuit shown in Fig. Q8(c), the switch is closed at  $t = 0$  and there is no initial charge on either of the capacitors. Find the resulting current 'i'. Using Laplace transformation. (06 Marks)

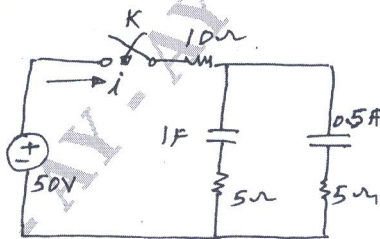


Fig. Q8(c)

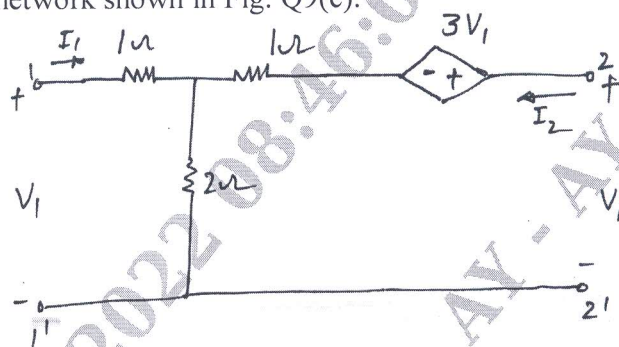
**Module-5**

- 9 a. A three phase, 4 – wire 150V, CBA system has a star connected load with  $Z_A = 6 \angle 0^\circ \Omega$ ,  $Z_B = 6 \angle 30^\circ \Omega$  and  $Z_C = 5 \angle 45^\circ \Omega$ . Obtain all the i) Line currents ii) Currents in the neutral iii) Hence draw the Phasor diagram. (08 Marks)  
 b. Define [Z] and [Y] of a two port network and derive for [Z] in terms of [Y]. (08 Marks)

c. Determine  $[Z]$  for the network shown in Fig. Q9(c).

(04 Marks)

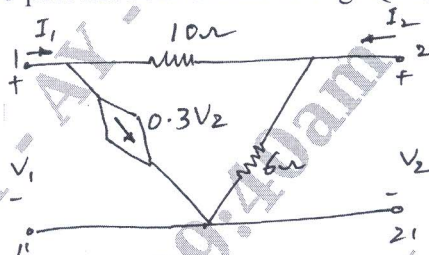
Fig. Q9(c)



OR

- 10 a. A three phase, 339.4V, ABC system has a delta connected load with  $Z_{AB} = 10 \angle 0^\circ \Omega$ ,  $Z_{BC} = 10 \angle 30^\circ \Omega$  and  $Z_{CA} = 15 \angle -30^\circ \Omega$ . Obtain phase and line currents as well as draw the phasor diagram. Assume  $V_{BC}$  as a reference phasor. (10 Marks)
- b. Obtain  $[Z]$  and  $[Y]$  for the two port network shown in Fig. Q10(b).

Fig. Q10(b)



(10 Marks)

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