Code : PCC-EEE-01 (100306)

B.Tech 3rd Semester Special Exam., 2020

ELECTRICAL CIRCUIT ANALYSIS

Time : 3 hours *Full Marks* : 70

Instructions :

(i) The marks are indicated in the right-hand margin.

*(ii) There are **NINE** questions in this paper.*

*(iii) Attempt **FIVE** questions in all.*

*(iv) Question No. **1** is compulsory.*

1. Answer any *seven* questions of the following : 2×7=14

(a) Find the current I in the circuit of Fig. 1 by using the superposition theorem :

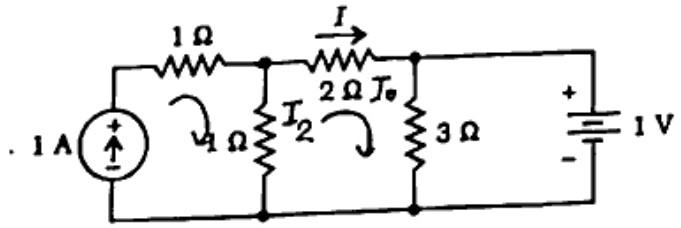

Fig. 1

(b) In Fig. 2, find the value of R_{Th} and I_{SC} :

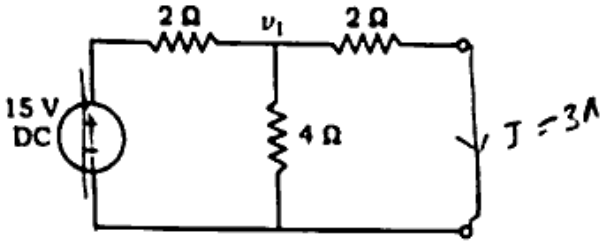

Fig. 2

(c) Find the value of R_L of Fig. 3 so that the maximum power can be transferred :

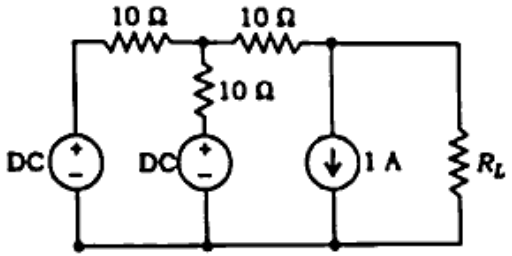

Fig. 3

(d) Find the Z-parameters of the two-port network shown in Fig. 4 :

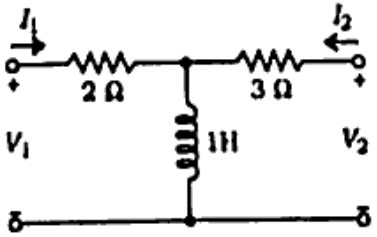

Fig. 4

(i) Two coupled coils have self-inductances $L_1 = 50$ mH and $L_2 = 200$ mH, and a coefficient of coupling $k = 0{\cdot}5$. If coil 2 has 1000 turns, and $i_1 = 5{\cdot}0 \sin 400t$ A, find the voltage at coil 2.

2. (a) Use the superposition theorem in the circuit shown in Fig. 7 to find current I: 7

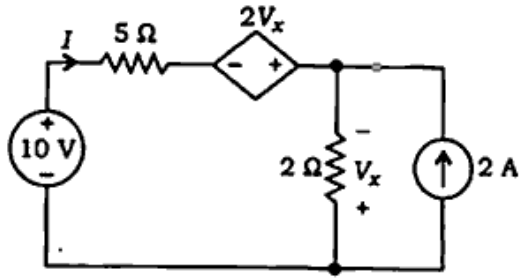

Fig. 7

(b) Draw the Thévenin's equivalent circuit of Fig. 8 and hence find the current through $R = 2\,\Omega$. (All the resistances shown in the figure are in ohm) : 5

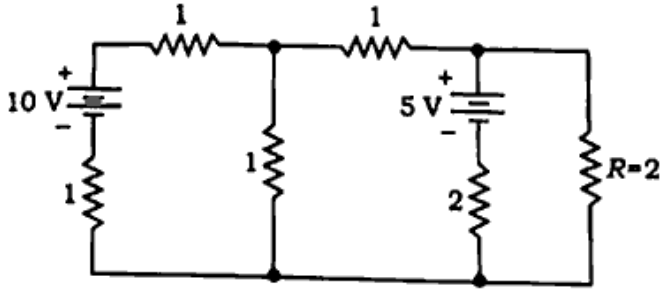

Fig. 8

(c) State compensation theorem. 2

3. (a) Find the current I_0 of Fig. 9 using the superposition theorem : 5

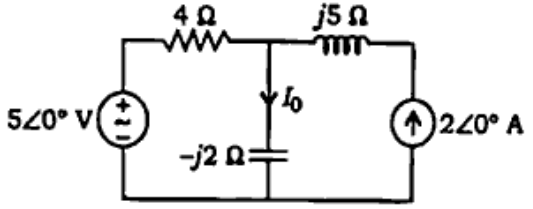

Fig. 9

(b) In the circuit of Fig. 10, find the effective value of the resistance seen by the source V_s : 3

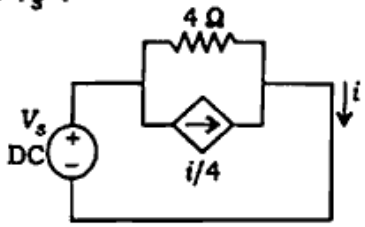

Fig. 10

(c) Define incidence matrix. Find the complete incidence matrix of the graph shown in Fig. 11 : 2+4=6

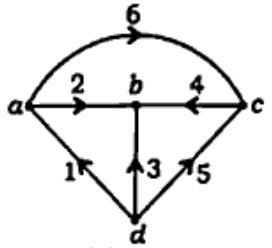

Fig. 11

4. *(a)* Define the *g*-parameters of an electrical circuit. 2

(b) Find the *g*-parameters in the circuit shown in Fig. 12 : 5

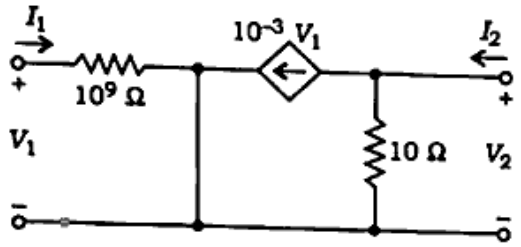

Fig. 12

(c) Find the *Z*-parameters and *Y*-parameters of the circuit shown in Fig. 13 : 7

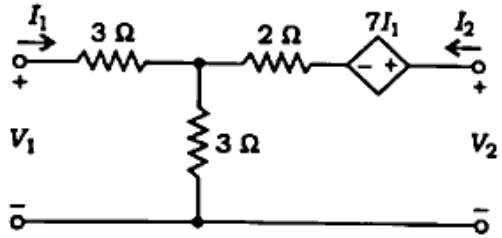

Fig. 13

5. *(a)* Find the Laplace transform of $f(t) = e^{-at}\cos(\omega t)$, $a > 0$. 4

(b) Calculate the inverse Laplace transform of $F(s) = \dfrac{1}{s(s^2 - a^2)}$. 5

(c) In the series *R-C* circuit, the capacitor has an initial charge 2·5 mC. At $t = 0$, the switch is closed and a constant-voltage source $V = 100$ V is applied. Use the Laplace transform method to find the current in the circuit after closing the switch. 5

6. *(a)* Draw the graph for the given incidence matrix : 4

$$[A] = \begin{bmatrix} -1 & 0 & 0 & 0 & 1 & 0 & 1 & 0 \\ 0 & -1 & 0 & 0 & 0 & 0 & -1 & 1 \\ 0 & 0 & -1 & -1 & 0 & -1 & 0 & -1 \\ 0 & 0 & 0 & 0 & -1 & 1 & 0 & 0 \\ 1 & 1 & 1 & 1 & 0 & 0 & 0 & 0 \end{bmatrix}$$

(b) Find the cut-set matrix from the graph as shown in Fig. 14 : 5

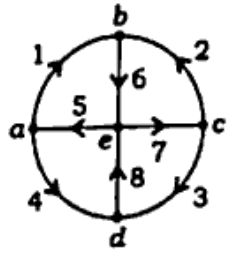

Fig. 14

(c) Consider the network shown in Fig. 15, draw the graph and determine (i) number of links, (ii) rank of the graph and (iii) total number of trees : 5

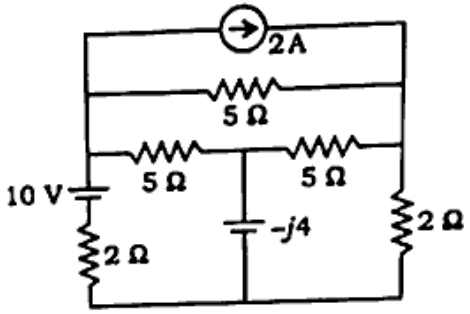

Fig. 15

7. (a) State the characteristics of an ideal transformer. 2

(b) Define r.m.s. value from factor, peak factor, complex power and half power frequency. 5

(c) Calculate the resonant frequency of a series *R-L-C* circuit. 3

(d) Obtain the current in each branch of the network shown in Fig. 16, using the mesh current method : 4

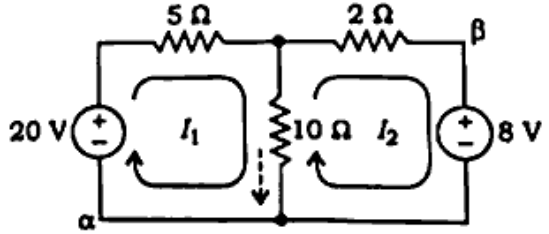

Fig. 16

8. (a) Obtain the total power supplied by the 60 V source and the power absorbed in each resistor in the network of Fig. 17 : 7

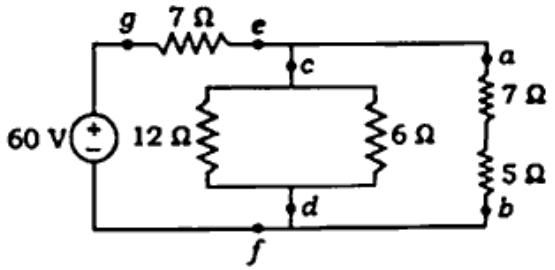

Fig. 17

(b) Compute the mesh currents of Fig. 18 : 5

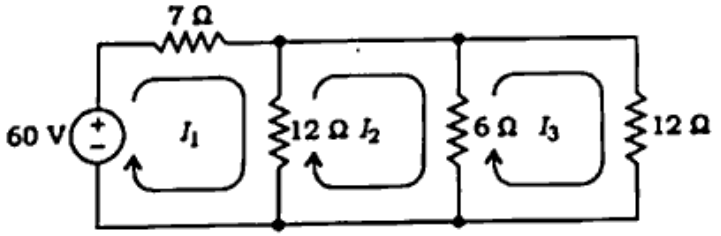

Fig. 18

(c) Define supermesh and supernode. 2

9. (a) Derive step response of a series *R-C* circuit. 5

(b) Define forced response and natural response. 2

(c) For the circuit shown in Fig. 19, the switch K is moved from position 1 to position 2 at $t = 0$ s. Find the current $i(t)$ assuming $i(0_+) = 2$ A and $V_c(0_+) = 2$ V : 7

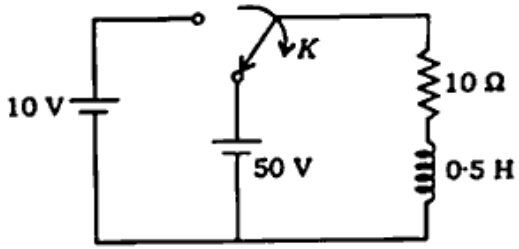

Fig. 19

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