CIRCUIT THEORY ANALYSIS
(ELEC 4182)

Time Allotted : 3 hrs **Full Marks : 70**

Figures out of the right margin indicate full marks.

Candidates are required to answer Group A and any 5 (five) from Group B to E, taking at least one from each group.

Candidates are required to give answer in their own words as far as practicable.

Group – A
(Multiple Choice Type Questions)

1. Choose the correct alternative for the following: **10 × 1 = 10**

(i) If there are 7 nodes in the circuit, then how many equations are to be written to solve the network by nodal analysis?
(a) 8 (b) 6 (c) 7 (d) 1.

(ii) Mesh analysis is based on
(a) KVL (b) KCL (c) KVL and KCL (d) none.

(iii) While Thevenizing a circuit between two terminals V_{TH} is equal to
(a) short circuit terminal voltage
(b) open circuit terminal voltage
(c) net voltage available in the circuit
(d) emf of the battery nearest to the terminals

(iv) The incidence matrix of a connected graph is given below

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

This is a
(a) complete incidence matrix (b) reduced incidence matrix
(c) tie set matrix (d) cut set matrix.

(v) Laplace transform of unit impulse function is
(a) 0 (b) 2 (c) infinite (d) 1.

(vi) Inverse Laplace transform of $\frac{1}{s+2}$ is:
(a) e^{-st} (b) e^{st} (c) e^{2t} (d) e^{-2t}.

(vii) Which variable is dependent in Y parameters calculation?
(a) Current (b) Voltage (c) Both a and b (d) Power.

(viii) Application of Norton's theorem to a circuit yields
(a) equivalent current source and impedance in series
(b) equivalent current source and impedance in parallel
(c) equivalent voltage source and impedance in series
(d) equivalent voltage source and impedance in parallel.

(ix) For a two port network to be reciprocal , it is necessary that
(a) $Z_{11} = Z_{22}$ (b) $Y_{11}=Y_{22}$ (c) $h_{11}=h_{22}$ (d) $Y_{12}=Y_{21}$.

(x) Ideal voltage source have
(a) zero internal resistance (b) infinite internal resistance
(c) low value of current (d) large value of emf.

Group – B

2. (a) Calculate the current through 2Ω resistor for the network of Fig.1 by nodal analysis.

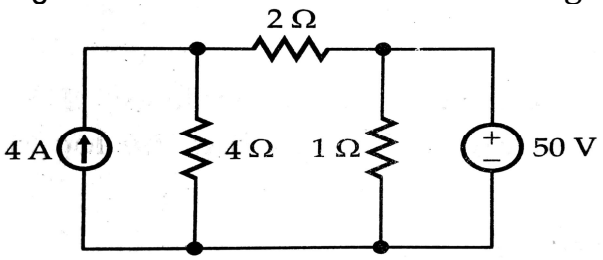

Fig.1

(b) Determine the current through the resistors using mesh analysis method for the network shown in Fig.2

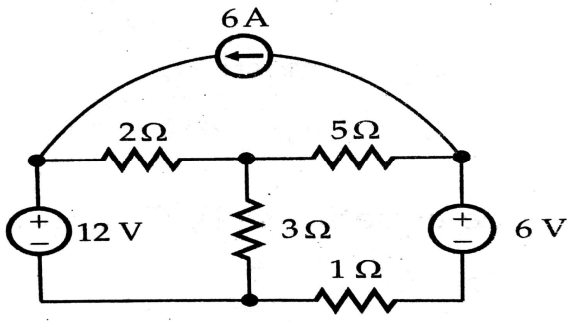

Fig.2

6 + 6 = 12

3. (a) Calculate the current through 5Ω resistor for the network of Fig.3 by Superposition theorem.

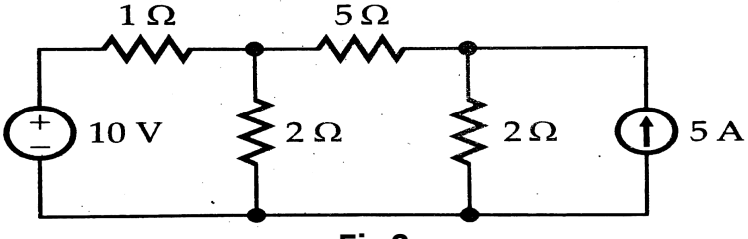

Fig.3

(b) Calculate the current through 6Ω resistor for the network of Fig.4 using Thevenin's theorem.

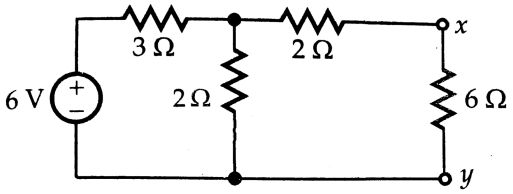

Fig.4

6 + 6 = 12

Group – C

4. (a) Define ramp function, unit impulse function and exponential function and find their Laplace transform.

(b) Obtain the Laplace transform of the square wave shown in Fig. 5.

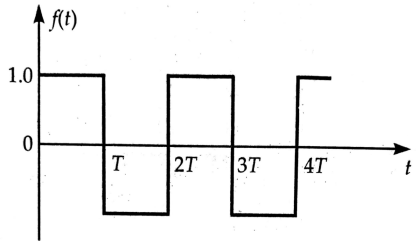

Fig. 5

6 + 6 = 12

5. (a) Find inverse Laplace transform of F(s), where $F(s)=\frac{1}{s^2(s+\phi)^3}$.

(b) A series RL circuit shown in Fig. 6, is energised by a d.c. voltage of 1.0 V by switching it at $t = 0$, If R=1Ω and L=1H, find the expression of the current.

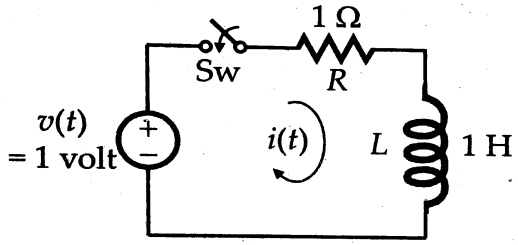

Fig. 6

6 + 6 = 12

Group – D

6. (a) What is Complete Incidence Matrix? What is Reduced Incidence Matrix?

(b) Compute complete incidence matrix of the graph shown in Fig.7.

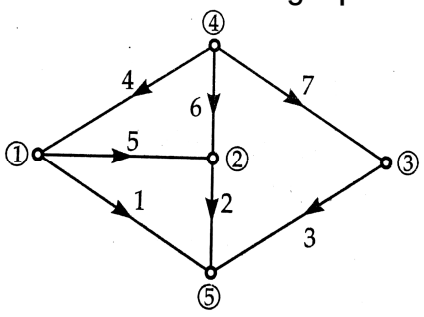

Fig.7

(c) Prove that, in terms of graph theory KVL can be expressed as $[B][V_b]=0$.

2 + 6 + 4 = 12

7. Consider the graph of Fig. 8 and one of its tree shown in Fig. 9, compute tie-set matrix and cut-set matrix.

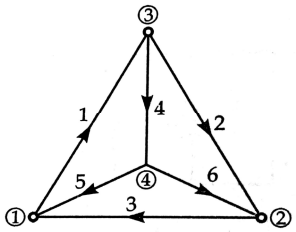

Fig.8

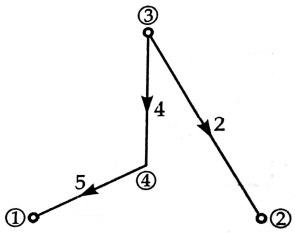

Fig. 9

6 + 6 = 12

Group – E

8. (a) Determine Transmission (ABCD) parameters of the network shown in the Fig. 10.

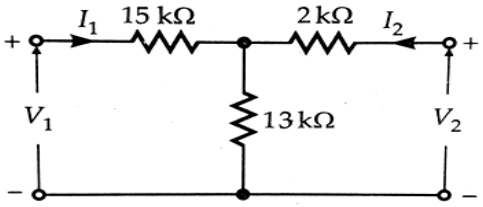

Fig.10

(b) Obtain the interrelationships given below:
(i) Y parameters in terms of ABCD parameters.
(ii) Z parameters in terms of Y parameters.

6 + (3 + 3) = 12

9. (a) Derive the condition of symmetry and condition of reciprocity of Y parameters.

(b) Calculate Z parameter for the network shown in Fig. 11.

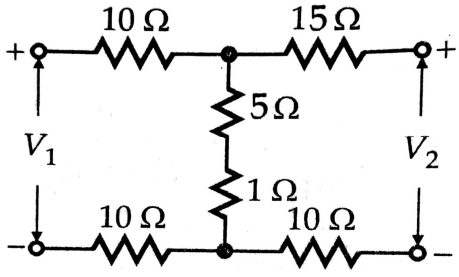

Fig. 11

(3 + 3) + 6 = 12

Department & Section	Submission Link
CE	https://classroom.google.com/c/MTIyOTQ5MTkyNTI5/a/MjcxNDA4MzI3OTQy/details