

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) Time constant of a RC circuit is
(a) C/R (b) R/C (c) RC (d) 1/RC.
- (ii) Nodal method of the circuit analysis is based on
(a) KVL and Ohm's law (b) KCL and Ohm's law
(c) KVL and KCL (d) KVL, KCL and Ohm's law.
- (iii) Superposition theorem is applicable in
(a) linear and bilateral circuit (b) linear and unilateral circuit
(c) non linear circuit (d) none of the above.
- (iv) Which among the following represents the precise condition of reciprocity of ABCD parameters?
(a) $AB - BD = 1$ (b) $AC - BD = 1$
(c) $BC - AD = 1$ (d) $AD - BC = 1$.
- (v) Laplace Transform of unit step function is
(a) $1/s$ (b) s (c) $1/(s+1)$ (d) $1/(s-1)$.
- (vi) The rank of a graph for a network with n nodes and b branches is
(a) $n+1$ (b) $n-1$ (c) $b-n+1$ (d) $b+n-1$.
- (vii) Which variable is independent in Z parameters calculation?
(a) Current (b) Voltage
(c) Both (a) and (b) (d) Power.
- (viii) Inverse Laplace transform of $\frac{s}{s^2+4}$ is
(a) $\sin 2t$ (b) $\sinh 2t$ (c) $\cos 2t$ (d) $\cosh 2t$.

- (ix) A circuit has resistors, capacitors and semi-conductor diodes. The circuit will be known as
 (a) non-linear circuit (b) linear circuit
 (c) bilateral circuit (d) both linear & bilateral circuit.
- (x) Application of Thevenin'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.

Group - B

2. (a) Determine the current through 5Ω resistor of the network shown in figure 2(a).

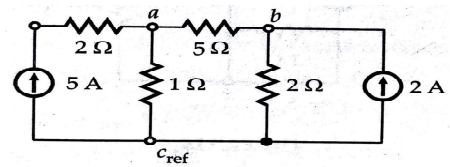


Fig.2(a)

- (b) Find the current through 10Ω resistance of the circuit in figure 2(b) using mesh analysis.

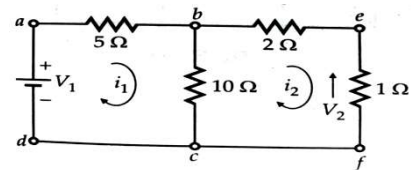


Fig.2(b)

$6 + 6 = 12$

3. (a) What is superposition theorem? Find 'v' of the circuit in figure 3(a) by Superposition Theorem.

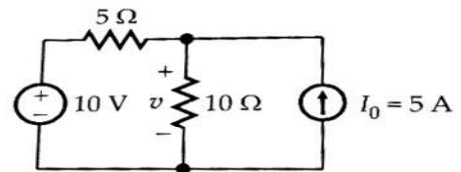


Fig.3(a)

- (b) Find out the current through 5Ω resistor of circuit in figure 3(b) using Thevenin's Theorem.

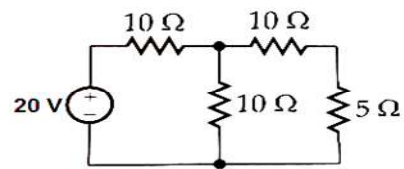


Fig.3(b)

$(1 + 6) + 5 = 12$

Group - C

4. (a) Find Laplace transform of the following signal $tU(t - T)$
 (b) Define ramp signal and step signal.

(c) Find Laplace Transform of given signal shown in figure 4.

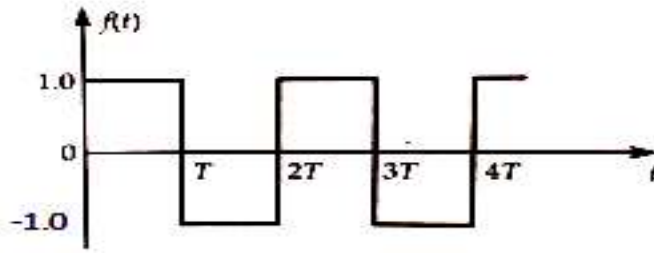


Fig.4

3 + 3 + 6 = 12

5. (a) Obtain the current at $t > 0$, if a.c. voltage v is applied when the switch K is moved to 2 from 1 at $t = 0$ in the figure 5(a). Assume a steady state current of 1A in the RL circuit when the switch was at position 1.

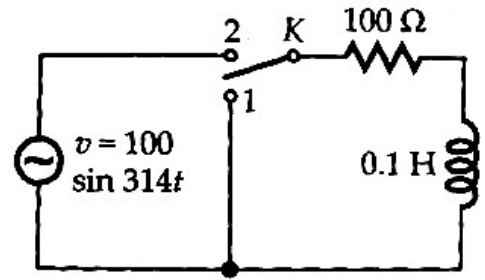


Fig.5(a)

(b) In the circuit figure 5(b), voltage is 10Volts dc. Obtain Transient current $i(t)$ through the circuit. Define time constant of a R-C circuit.

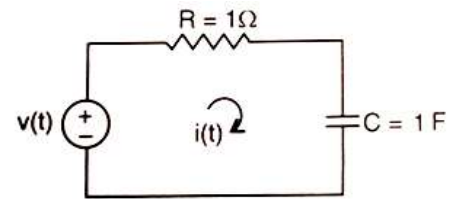


Fig.5(b)

6 + 6 = 12

Group - D

6. (a) What is a tree? Write the properties of a tree. Explain the relation between twig and link.

(b) Develop complete incidence matrix from the directed graph given in figure 6.

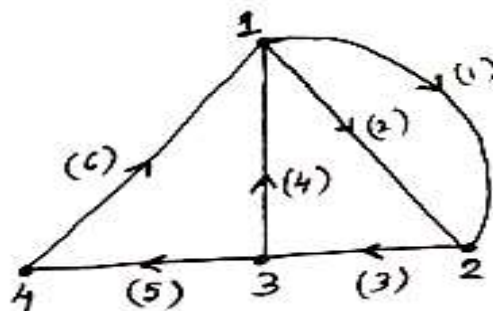


Fig.6

(1 + 4 + 2) + 5 = 12

7. (a) Consider the tree [given in figure 7(b)] of the graph given in Figure 7(a) and compute tie-set matrix and cut-set matrix.

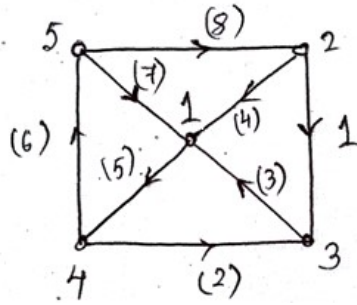


Fig.7(a)

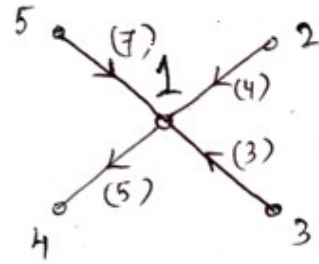


Fig.7(b)

6 + 6 = 12

Group - E

8. (a) Define Z parameters. Find Z parameters of the given network [Fig.8(a)].

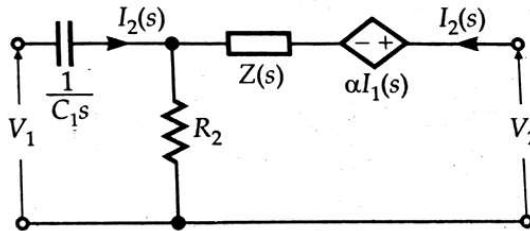


Fig.8(a)

- (b) Find out the condition of symmetry for ABCD parameter.

(2 + 6) + 4 = 12

9. (a) Define Y parameters. Find Y parameters of the following network [Figure 9(a)].

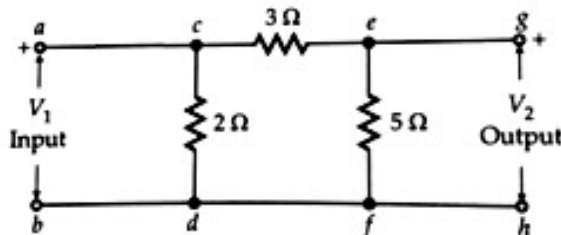


Fig.9(a)

- (b) Obtain ABCD parameters for the following network [Figure 9(b)].

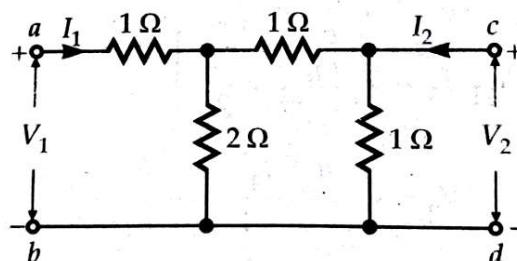


Fig.9(b)

(2 + 4) + 6 = 12