7. (a) Determine complete incidence matrix from the oriented graph given in Fig.9.

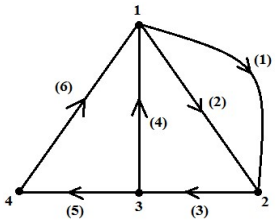

Fig.9

(b) From the above graph select the tree shown in Fig.10 and compute tie-set matrix and cut-set matrix.

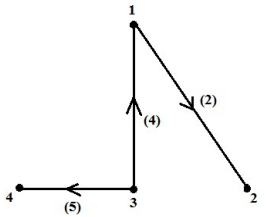

Fig.10

4 + (4 + 4) = 12

Group – E

8. (a) Define h-parameters of a two port network.

(b) Determine the Z-parameters for the circuit shown in Fig.11.

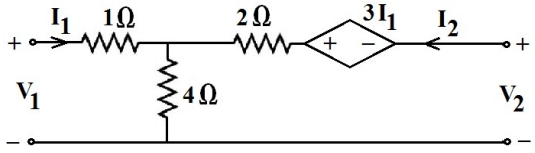

Fig.11

(c) Find out the condition of symmetry for ABCD parameters.

2 + 6 + 4 = 12

9. (a) Draw and analyze the 2nd order high pass filter and also find out the transfer function and cut-off frequency of that filter.

(b) Design a 1st order low pass filter of cut-off frequency 159Hz and pass band gain 10. Take C = 0.047μF.

(2 + 5 + 1) + 4 = 12

CIRCUIT THEORY
(ELEC 3001)

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) How many fundamental cut-sets will be generated for a graph containing 'n' number of nodes and 'b' number of branches?
(a) n + 1 (b) n − 1
(c) b − n + 1 (d) b + n − 1

(ii) In PSPICE Voltage Controlled Current Source is represented by
(a) E (b) F (c) G (d) H.

(iii) A two port network is reciprocal if
(a) AD − BC = 1 (b) A = D
(c) A = C (d) AB − CD = 1.

(iv) Damping constant of an over damped system is
(a) less than 1 (b) greater than 1
(c) 1 (d) 0.

(v) Application of Thevinin'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.

(vi) Input driving point impedance (when output side of a two port network is kept open) is
(a) Z_{11} (b) Z_{12} (c) Y_{22} (d) Y_{21}.

(vii) Laplace transform of a unit impulse function is
(a) $\frac{1}{S}$ (b) $\frac{1}{S^2}$ (c) 1 (d) $\frac{2}{S^3}$.

(viii) The cut-off frequency of a Low Pass Filter with R-C configuration is 600 Hz. Assuming R = 400, what would be the value of C?
(a) 8.14×10^{-4}F (b) 4.17×10^{-6}F
(c) 1×10^{-3}F (d) 6.63×10^{-7}F

(ix) A function in s-domain is given by $F(s) = \frac{s+1}{s(s+2)}$. The initial value of F(s) is
(a) 1 (b) 0 (c) 2 (d) 3.

(x) Condition of symmetry in Z parameter is
(a) $Z_{11} = Z_{22}$ (b) $Z_{12} = Z_{21}$ (c) $Z_{11} = Z_{12}$ (d) $Z_{21} = Z_{22}$.

Group – B

2. (a) Find the current I in the circuit shown in Fig.1 using nodal analysis.

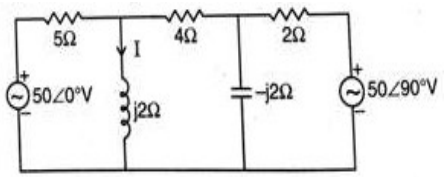

Fig.1

(b) Find the power loss in 5Ω resistor of the circuit in Fig.2 by Superposition theorem.

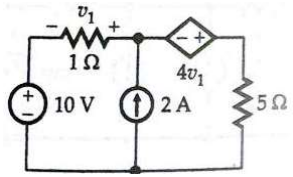

Fig.2

6 + 6 = 12

3. (a) What is a dependent source? How it is different from independent source?

(b) In the circuit shown in Fig.3 calculate the current through 6Ω resistor by Thevenin's Theorem.

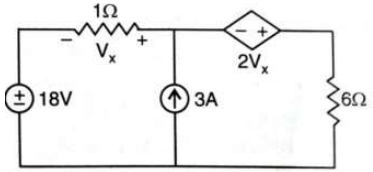

Fig.3

(2 + 2) + 8 = 12

Group – C

4. (a) Define 'step' function and 'delayed step' function. Find Laplace transform of them.

(b) Find Inverse Laplace Transform of : $\frac{S}{(S+5)(S+6)}$.

(c) Find Laplace transform of the given signal shown in Fig.4.

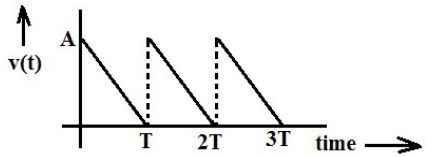

Fig.4

2 + 4 + 6 = 12

5. (a) A DC voltage source of 'V' volt is applied to a series RLC circuit. Derive the condition of over damping for the circuit considering output voltage across the capacitor. Also draw the nature of output signal.

(b) In the circuit shown in Fig.5 given below, the switch is moved from position 1 to 2 at t = 0, a steady state having previously been established at position 1. Solve for the current i(t).

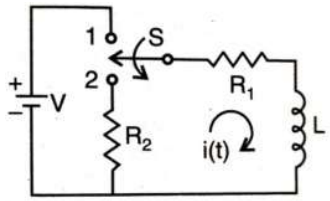

Fig.5

6 + 6 = 12

Group – D

6. (a) Write SPICE program to find the current I and voltage at node 3 of the circuit shown in Fig.6.

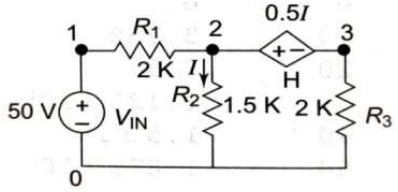

Fig.6

(b) A pulse input as shown in Fig.7 is applied to RLC series circuit of Fig.8. Write a SPICE program to calculate and plot the transient response from 0 to 400μsec with a time increment of 1 μsec. The capacitor voltage and the current through the resistance are to be plotted.

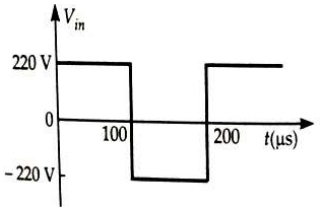

Fig.7

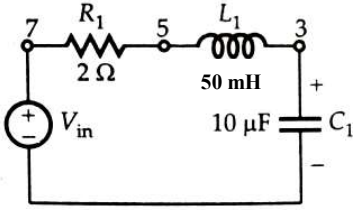

Fig.8

6 + 6 = 12