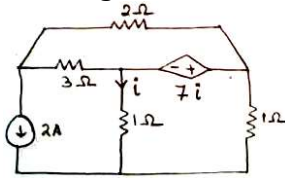


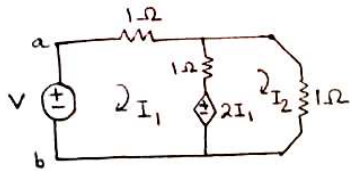
- (ix) Short circuit forward transfer admittance is
 (a) Y_{11} (b) Y_{12} (c) Y_{22} (d) Y_{21} .
- (x) Active filter does not contain
 (a) inductor (b) capacitor
 (c) resistor (d) op-amp.

Group - B

2. (a) Using mesh analysis, find the magnitude of the current dependent source and the current through 3Ω resistor.

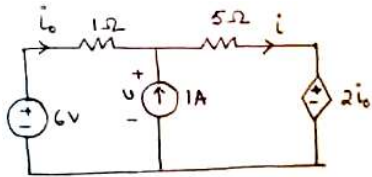


- (b) Find the Thevenin's equivalent circuit parameters for the network shown at the right side of terminal a-b.

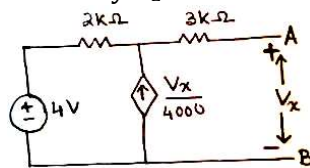


7 + 5 = 12

3. (a) Find the value of currents i_0 and i as shown in the given circuit using Superposition Theorem.



- (b) Determine the value of R_L to be connected across terminal AB as shown in figure below for maximum power transfer. Also calculate the maximum power absorbed by R_L .

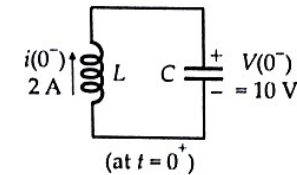


6 + 6 = 12

Group - C

4. (a) Define 'impulse' function. If the impulse signal is passed through an integrator circuit what will the response be? Find the Laplace transform of that response.
 (b) Find the Laplace transform of the half-wave rectified sine wave.
 (c) Find initial value and final value of the function: $\frac{1}{s(s+2)(s+3)}$.
(2 + 1 + 1) + 6 + 2 = 12

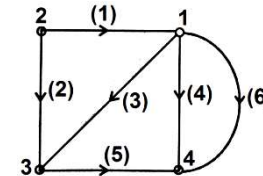
5. (a) A DC voltage source of 'V' volt is applied to a series RLC circuit. Derive the condition of under damping for the circuit considering output voltage across the capacitor. Also draw the nature of output signal.
 (b) In an LC series circuit shown below, the initial current through the inductor being 2A, the initial voltage is 10V across capacitor. Assume $L=1H$ and $C= \frac{1}{2} F$. Find the voltage across the capacitor at $t=0+$.



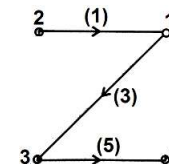
6 + 6 = 12

Group - D

6. (a) Compute complete incidence matrix from the directed graph given in the following figure.



- (b) Consider the tree, of the above graph, given in the following figure and compute tie-set matrix and cut-set matrix.

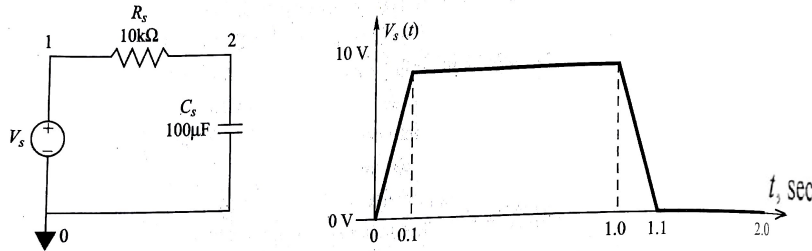


4 + (4 + 4) = 12

7. (a) Explain the function of the following commands in PSpice:

- (i) .OP (ii) .PLOT (iii) .TRAN

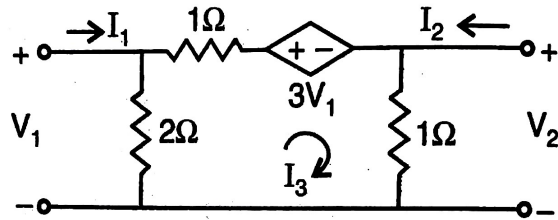
(b) Write the PSpice program for the pulsed source in the circuit shown below.



6 + 6 = 12

Group - E

8. (a) Obtain Z and Y-parameters for the following network.



(b) Determine the condition of reciprocity for ABCD-parameter.

8 + 4 = 12

9. (a) Draw and analyze a second order high pass filter and also find the transfer function of this filter.

(b) Design a first order high pass filter with cut off frequency of 10 KHz and pass band gain of 2. Given C = 0.01 μF.

(2 + 6) + 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) The condition for the maximum power to be transferred in an AC circuit is
 (a) $Z_L = Z_S^*$ (b) $Z_L = Z_S$ (c) $Z_L = -Z_S$ (d) $Z_L = -Z_S^*$
 Here Z_L is the load impedance and Z_S is the source impedance
 - (ii) Inverse Laplace transform of $\frac{s}{s^2+4}$ is
 (a) $\sin 2t$ (b) $\sinh 2t$
 (c) $\cos 2t$ (d) $\cosh 2t$
 - (iii) Network theorems are applicable to a circuit which is
 (a) active, nonlinear, unilateral (b) linear, passive, bilateral
 (c) linear, active, bilateral (d) linear, active, unilateral.
 - (iv) Damping constant of a critically damped system is
 (a) less than 1 (b) greater than 1
 (c) 1 (d) 0.
 - (v) Time constant of an RL circuit is
 (a) L / R (b) RL (c) $1 / RL$ (d) R/L .
 - (vi) How many fundamental tie-sets will be generated for a graph with 'n' number of nodes and 'b' number of branches?
 (a) $n + 1$ (b) $n - 1$ (c) $b - n + 1$ (d) $b + n - 1$.
 - (vii) In PSpice Current Controlled Voltage Source is represented by
 (a) E (b) F (c) G (d) H.
 - (viii) A two port network is reciprocal if
 (a) $Z_{11} = Z_{22}$ (b) $Y_{12} = Y_{21}$
 (c) $Y_{12} = Y_{22}$ (d) $Y_{11} = Y_{21}$.