(b) Find the voltage drop equations for the oriented graph shown in the Fig.9.

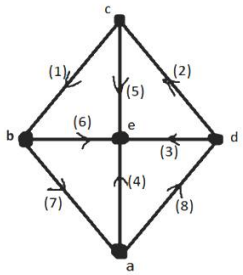

Fig. 9

6 + 6 = 12

7. (a) What are the impedance parameters and transmission parameters? Express impedance parameters in terms of transmission parameters.

(b) Determine the y-parameters for the following two port network of the circuit shown in the Fig.10.

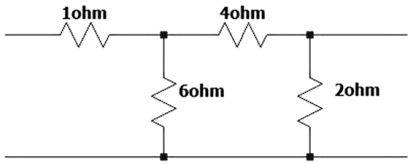

Fig.10

(2 + 4) + 6 = 12

Group – E

8. (a) Design a 1st order low pass filter having a dc gain of 4 and corner frequency of 1000Hz using ideal OPAMP.

(b) Derive the transfer function of the following filter as shown in the Fig.11. Comment on the type of the filter.

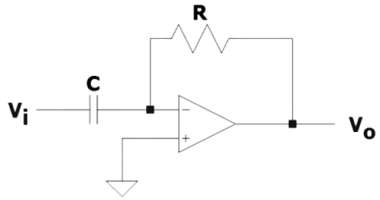

Fig.11

6 + 6 = 12

9. (a) Write a short note on ac analysis using PSPICE.

(b) Write the source file for the following circuit shown in Fig.12 to find the voltage between the nodes (1, 2) and current through 1V source.

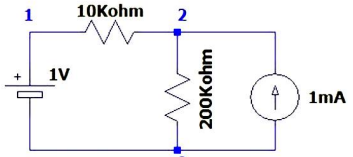

Fig.12

6 + 6 = 12

CIRCUIT THEORY & FILTERS
(ECEN 2105)

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 reciprocity theorem is applicable for a network containing
(a) independent sources only
(b) dependent sources only
(c) both dependent and independent sources
(d) any one of dependent and independent sources.

(ii) Superposition theorem is not applicable for
(a) current calculation (b) voltage calculation
(c) power calculation (d) none of (a), (b) and (c).

(iii) In steady state inductor should behave as
(a) short circuit (b) open circuit
(c) voltage source (d) current source.

(iv) Time constant of series RL circuit is
(a) RL (b) R/L (c) L/R (d) R+L.

(v) For a network having N nodes and B branches, the number of links will be
(a) N (b) N-1 (c) B-N+1 (d) B+N-1.

(vi) In a series RC circuit, if the output is measured across the resistor, the circuit can be considered as a
(a) Band Pass Filter (b) Band Reject Filter
(c) Low Pass Filter (d) High Pass Filter.

(vii) The condition for reciprocity any two port network is
(a) $Z_{12} = Z_{21}$ (b) $Y_{22} = Y_{11}$ (c) $A - BC = 1$ (d) $Z_{12} = Y_{21}$.

(viii) Four capacitors each of 40 μF are connected in parallel, the equivalent capacitance of the system will be
(a) 40 μF (b) 10 μF (c) 20 μF (d) 80 μF.

(ix) If the Laplace transform of f(t) is F(s), then the Laplace transform of $e^{-at}f(t)$ is
(a) F(s+a) (b) F(s-a) (c) F(s/a) (d) F(sa).

(x) The 3dB frequency of a bandpass filter is calculated at
(a) peak power point (b) half power point
(c) quarter power point (d) none of (a), (b) and (c).

Group – B

2. (a) Determine the condition for the maximum power transfer to a resistive load in a resistive network.

(b) Using superposition theorem find out the current I for the network shown in Fig:1.

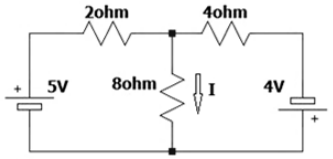

Fig.1

(c) Find the equivalent resistance across the terminals a, b of the network shown in Fig. 2.

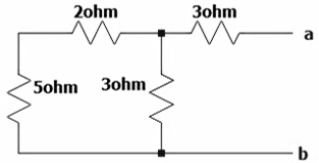

Fig.2

4 + 5 + 3 =12

3. (a) Find the Thevenin equivalent of the circuit shown in the Fig.3 across the terminals a, b.

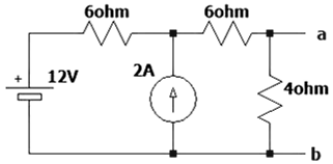

Fig.3

(b) Find the value of i_0 and v_0 for the following circuit shown in the Fig.4.

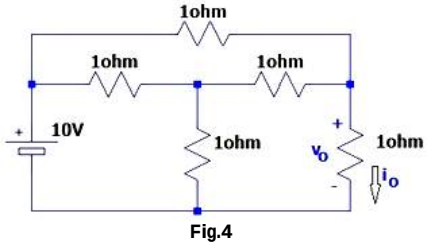

Fig.4

6 + 6 = 12

Group – C

4. (a) Derive the current expression for a series R-C network excited by a step voltage of height V considering zero initial condition. Also plot the current.

(b) Determine the inductor current $i_L(t)$ for both t < 0 and t > 0 for the circuit shown in the Fig. 5.

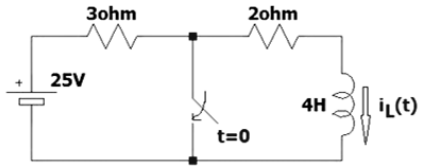

Fig.5

(5 + 1) + 6 = 12

5. (a) The switch S in the network shown in the Fig.6 is opened at t = 0. Calculate the current i(t) for t> 0.

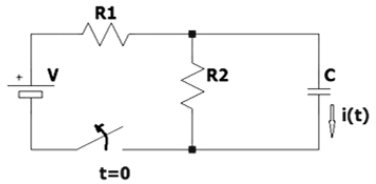

Fig.6

(b) Calculate the Laplace transform of the given periodic function as shown in the Fig.7.
$g(t) = \sin(\pi t)$, for $0 < t < 1$
0, for $1 < t < 2$.

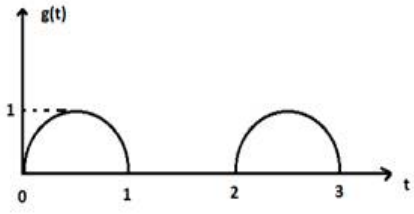

Fig.7

6 + 6 = 12

Group – D

6. (a) Derive the Tie-set matrix for the network shown in the Fig.8.

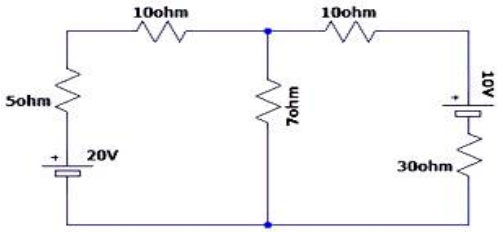

Fig.8