B.TECH/ ECE /3RD SEM/ECEN 2105 (BACKLOG)/2020

CIRCUIT THEORY AND 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) Which of the following is not a reactive circuit element
(a) Capacitor (b) Inductor
(c) Resistor (d) None.

(ii) The voltage can never be exactly in phase with the current in a circuit that contains
(a) Only Capacitor (b) Only Resistor
(c) Inductor & capacitor (d) Inductor, capacitor & resistor.

(iii) The rank of a graph containing n number of nodes is
(a) n-1 (b)n (c) 2n+1 (d) n+1.

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

(v) The centre frequency of a bandpass filter is always equal to
(a) The bandwidth
(b) Arithmetic average of the cut off frequencies
(c) 3dB frequency
(d) The product of bandwidth & quality factor.

(vi) If the Laplace Transform of f(t) is F(s), then the Laplace Transform of f(t-α) is
(a) $e^{-s\alpha}$ F(s) (b) $e^{s\alpha}$ F(s)
(c) F(s-α) (d) F(s+α).

(vii) For steady state in a circuit capacitor should behave as
(a) Short circuit (b) Open Circuit
(c) Voltage Source (d) Current Source.

(viii) The condition for reciprocity of any two port network is
(a) $Z_{12} = Z_{21}$ (b) $Y_{12} = Y_{11}$
(c) AD – BC = 0 (d) $Z_{12} = Y_{12}$.

(ix) The condition for a series RLC circuit to be under-damped when excited with a step input, is
(a) $(R^2/4L^2) > (1/LC)$ (b) $(R^2/4L^2) = (1/LC)$
(c) $(R^2/4L^2) < (1/LC)$ (d) None of these.

(x) If two 6mH inductors are connected in parallel without mutual inductance, then the equivalent inductance is,
(a) 3Mh (b) 12mH (c) 36mH (d)1mH.

Group – B

2. (a) Determine the condition for the maximum power transfer for a purely resistive circuit in which load resistance is variable.

(b) In the circuit of Fig:1 find the power delivered by the current and voltage sources.

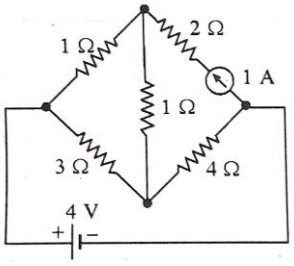

Fig: 1

5 + 7 = 12

3. (a) State the Thevenin's theorem. Find the Thevenin equivalent circuit across the terminals a and b of the following network of Fig:2.

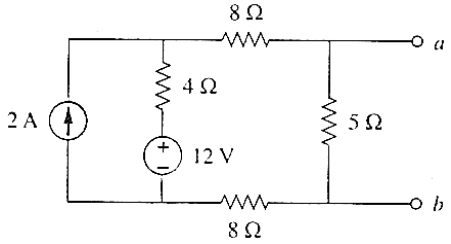

Fig: 2

(b) Use star-delta transformation to find the input resistance offered between the terminals A & C in Fig: 3.

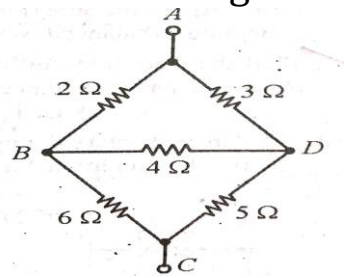

Fig: 3

(2+5) + 5=12

Group – C

4. (a) Derive the current expression for a series R-C network excited by a step input voltage Vu(t) volt considering zero initial condition. Also plot the current.

(b) The circuit of Fig: 4 is in steady state with the switch in position 'a'. The switch is moved to position 'b' at t = 0. Find the current in the inductor for all t.

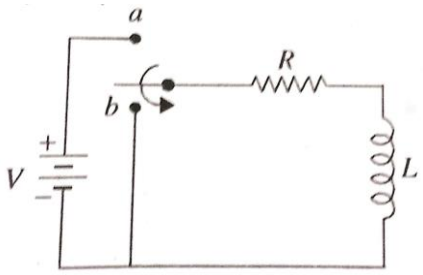

Fig : 4

(5 + 1) + 6=12

5. (a) In the circuit of Fig:5, determine the voltage v(t) and the currents $i_R(t)$ and $i_L(t)$ for t > 0. The circulating current at t = 0 in RL loop is 1A clockwise.

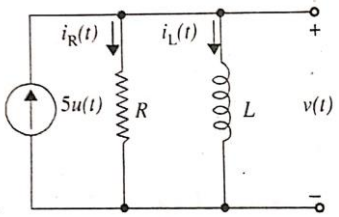

Fig: 5

(b) Determine the Laplace transform of the periodic function in Fig:6.

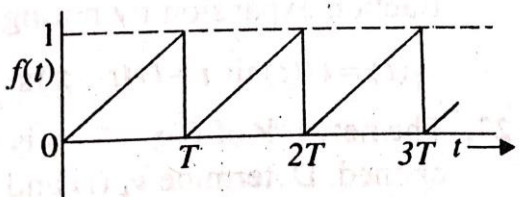

Fig: 6

6 + 6=12

Group – D

6. (a) Find the tie-set and f-cut-set matrices using the given graph of Fig:7.

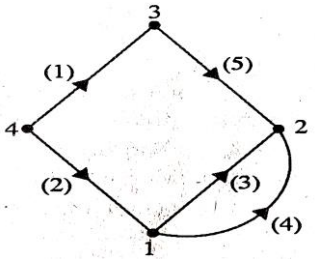

Fig:7

(b) How many trees are possible for the graph of the network of Fig : 8.

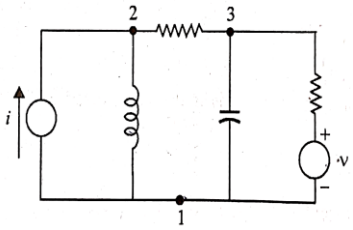

Fig: 8

6 + 6=12

7. (a) What do you mean by driving point impedance of a network? Two four terminal networks are connected in cascade, show that the transmission parameter matrix of the overall network is the sum of the transmission parameter matrices of the individual network.

(b) Determine the z-parameters for network of Fig:9.

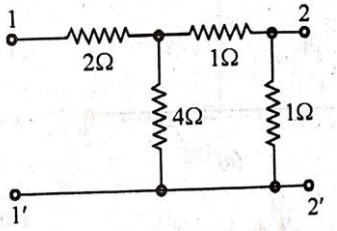

Fig : 9 **(2+4) + 6=12**

Group – E

8. (a) Derive the transfer function of the circuit of Fig:10. Find the passband gain. Sketch the proper frequency response and identify the filter.

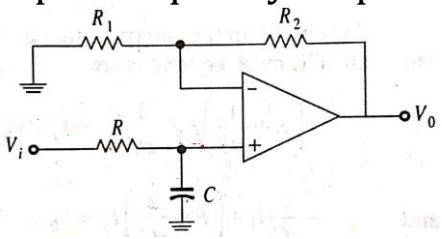

Fig : 10

(b) Design a 1st order low pass filter having a dc gain of 5 and corner frequency of 1000Hz using ideal OPAMP.

(4+2+2) + 4=12

9. (a) Write the input file in PSPICE for the following circuit of Fig:11 to find the node voltages.

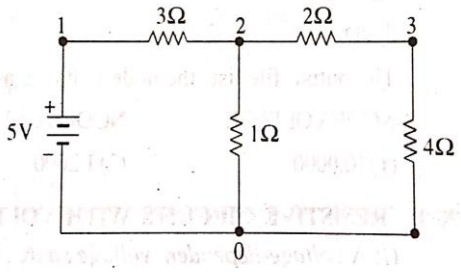

Fig: 11

(b) Write the input file in PSPICE to determine i and v for the given circuit of Fig: 12 which is initially relaxed. The switch S is closed at time t = 0.

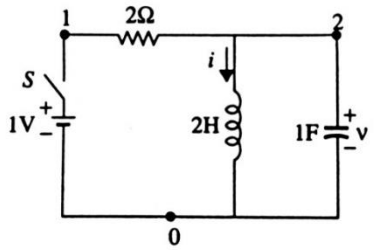

Fig: 12

6 + 6=12

Department & Section	Submission Link (for Backlog)
ECE	https://classroom.google.com/c/Mjc0NDM1ODA0MDA4?cjc=vpbpst5