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

(viii) The dc gain of a system having transfer function $H(s) = \frac{12}{(s+2)(s+3)}$ is
(a) 12 (b) 6 (c) 3 (d) 2.

(ix) '. TRAN' statement in SPICE is use to study the network in
(a) frequency domain (b) time domain
(c) both frequency and time domain (d) none of these.

(x) Active filter consists of
(a) capacitor (b) inductor
(c) op-amp and capacitor (d) op-amp.

Group - B

2. (a) In the circuit of Fig.2(a), find Norton's equivalent circuit looking from terminal A-B.

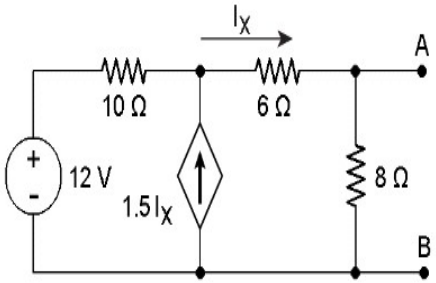

Fig.2(a)

(b) Find mesh currents for the circuit of fig.2(b)

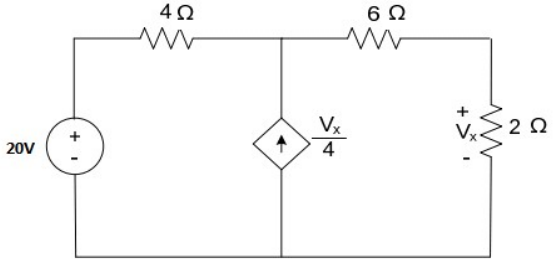

Fig.2(b)

7 + 5 = 12

(c)

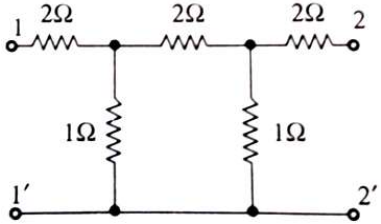

Fig.7(c)

Calculate the y parameters of the given circuit in Fig.7(c) and the equivalent π- circuit.

2 + 4 + (

Group - E

8. (a) Find $\frac{V_{OUT(s)}}{V_{IN(s)}}$ for the circuits shown in Fig.8(a). Determine c frequency and type of the filter.

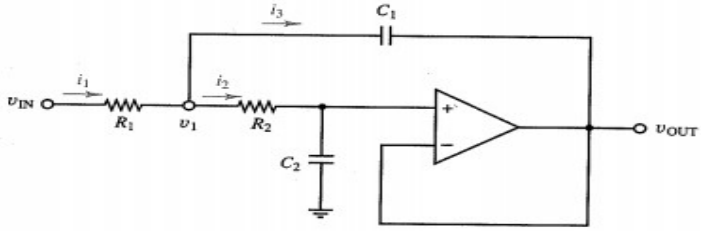

Fig. 8(a)

(b) Design a 1st order active low pass filter with a dc gain of 4 corner frequency of 500Hz.

(6 + 1 + 1) + 4

9. (a) Write the input file in PSPICE for the circuit in Fig.9(a) to obta node voltages.

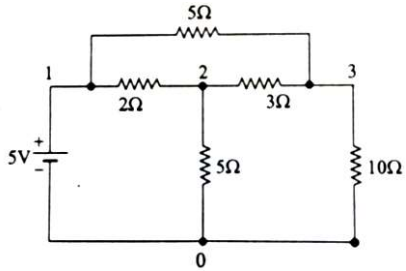

Fig.9(a)

(b) An initially relaxed series RC circuit with R=1kΩ and C=0.1μF is energized with a pulse source v(t) as shown in fig.9(b) below. Write a SPICE input file to plot the voltage across resistor, voltage across capacitor and current response of the circuit.

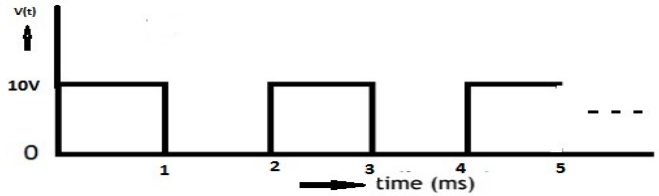

Fig. 9(b)

5 + 7 = 12

CIRCUIT THEORY
(ELEC 2102)

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) Super mesh analysis is used in case of
(a) current source branch is common for two meshes
(b) ideal voltage source is connected between two non -reference nodes
(c) both (a) and (b)
(d) circuit containing only dependent source.

(ii) If two equal resistances connected in series across a certain supply are now connected in parallel across the same supply, the power produced will be _____ of series connection.
(a) one half (b) one fourth
(c) two times (d) four Times.

(iii) In a RLC series circuit R=2Ω, L=2mH and C=1μF and applied voltage is 10V dc. Then what is steady state current value?
(a) 5A (b) 2A (c) 1A (d) 0A.

(iv) The rank of f-cut-set matrix of a connected graph with n number of nodes is
(a) n-1 (b) n (c) 2n+1 (d) n+1.

(v) If a circuit has n number of nodes and b number of branches then the number of mesh equations will be
(a) n-1 (b) b-1 (c) b-n+1 (d) b+n-1.

(vi) The condition for Reciprocity of any two port network is
(a) $Y_{11} = Y_{12}$ (b) $Y_{21} = Y_{12}$ (c) $Y_{11} = Y_{22}$ (d) $Y_{22} = Y_{12}$.

3. (a) A source $V_s(t) = Vcos\ (100\pi t)$ has an internal impedance of (4+j3)Ω. If a purely resistive load connected to this source has to extract the maximum power out of the source, find its value.

(b) Elaborate the statement of the Reciprocity theorem with a proper example.

(c) For the circuit given in fig.3(c) find I_1 and I_2. Assume k=1.

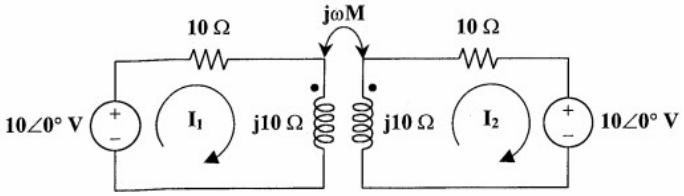

Fig. 3(c)

3 + 3 + 6 = 12

Group - C

4. (a) Find Laplace transform of the following function shown in Fig. 4(a).

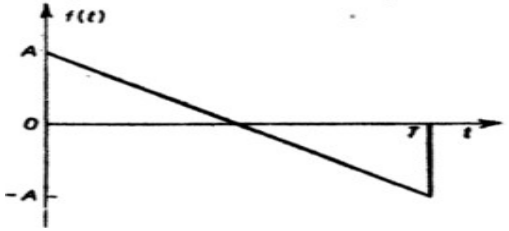

Fig.4(a)

(b) Sketch the unit step response of an underdamped second order prototype system and mark all the time domain specifications on it.

(c) In the circuit of fig. 4(b), the switch 's' is opened at t=0. Determine $i_1(t)$and $i_2(t)$. Assume the circuit was at steady state condition before t = 0.

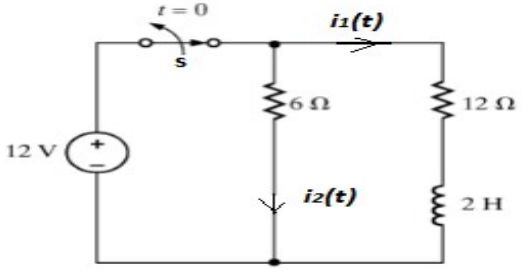

Fig. 4 (b)

4 + 3 + 5 = 12

B.TECH/ECE/EE/3RD SEM/ELEC 2102/2016

3. (a) A source $V_s(t) = Vcos\ (100\pi t)$ has an internal impedance of (4+j3)Ω. If a purely resistive load connected to this source has to extract the maximum power out of the source, find its value.

(b) Elaborate the statement of the Reciprocity theorem with a proper example.

(c) For the circuit given in fig.3(c) find I_1 and I_2. Assume k=1.

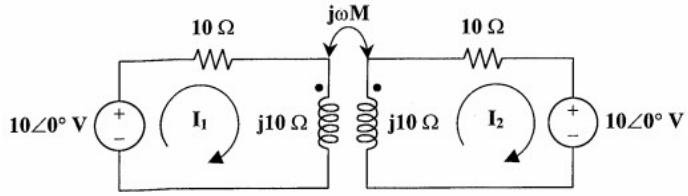

Fig. 3(c)

3 + 3 + 6 = 12

Group - C

4. (a) Find Laplace transform of the following function shown in Fig. 4(a).

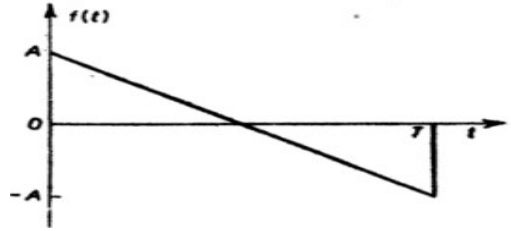

Fig.4(a)

(b) Sketch the unit step response of an underdamped second order prototype system and mark all the time domain specifications on it.

(c) In the circuit of fig. 4(b), the switch 's' is opened at t=0. Determine $i_1(t)$and $i_2(t)$. Assume the circuit was at steady state condition before t = 0.

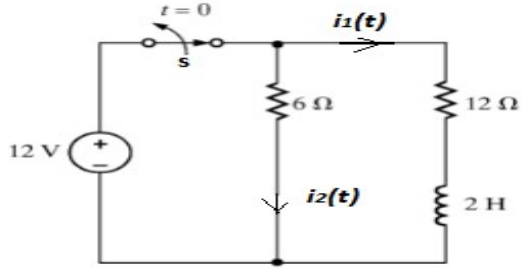

Fig. 4 (b)

4 + 3 + 5 = 12

ELEC 2102 3

5. (a) Given a pulse *f(t)* in Fig.5(a), find its Laplace transform *F(s)*. Find inverse Laplace of $F^2(s)$ and hence draw its waveform.

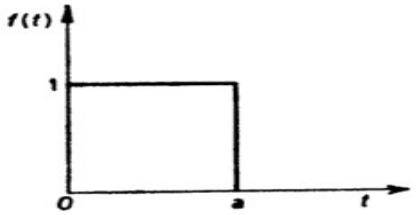

Fig.5(a)

(b) Find the expressions of v and i for the given circuit in Fig. 5(b). for t > 0.

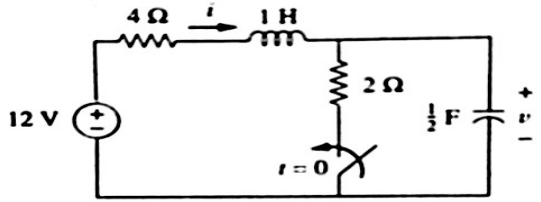

Fig. 5(b)

(1 + 2 + 2) + 7 = 12

Group – D

6. (a) What is 'tree'?

(b) Draw the directed graph for the circuit shown in Fig.6(b1) below. Detarmine Tie-set matrix. Assume the sub-graph shown in Fig.6(b2) below as a tree. Find mesh equilibrium equations for the circuit using graph theory.

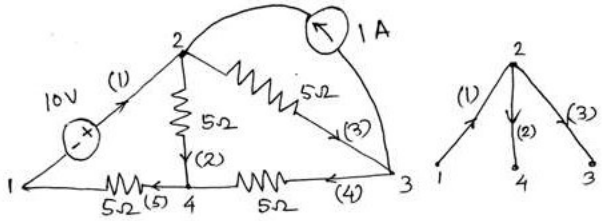

Fig. 6(b1)

Fig.6(b2)

2 + (2 + 2 + 6) = 12

7. (a) Define 'Transmission' parameters.

(b) Prove that for transmission parameters, condition of symmetrical network is A=D.

B.TECH/ECE/EE/3RD SEM/ELEC 2102/2016

5. (a) Given a pulse *f(t)* in Fig.5(a), find its Laplace transform *F(s)* inverse Laplace of $F^2(s)$ and hence draw its waveform.

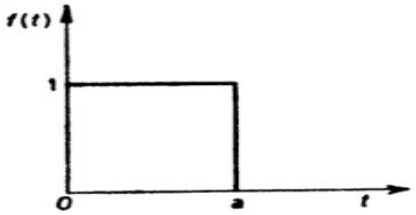

Fig.5(a)

(b) Find the expressions of v and i for the given circuit in Fig. 5(b). for

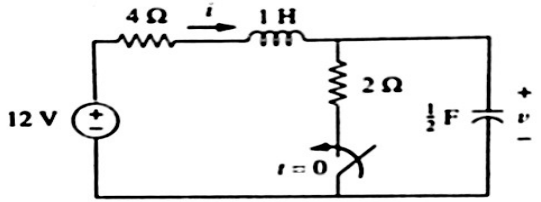

Fig. 5(b)

(1 + 2 + 2) +

Group – D

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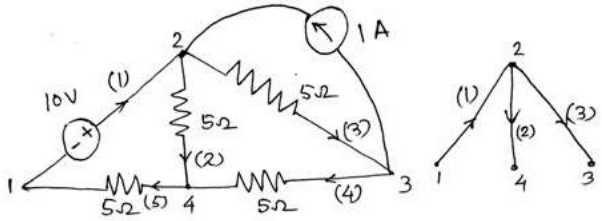

Fig. 6(b1)

Fig.6(b2)

2 + (2 + 2 + 6

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(b) Prove that for transmission parameters, condition of symm network is A=D.