

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.

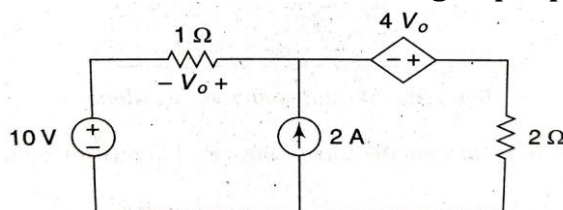
Group – A
(Multiple Choice Type Questions)

1. Choose the correct alternative for the following: **10 × 1 = 10**
- (i) Thevenin's theorem cannot be applied to a network which contains
 - (a) resistors
 - (b) linear impedance
 - (c) non-linear impedance
 - (d) all of these
 - (ii) What should be done, if the dependent current and voltage sources are present in a circuit while applying 'Superposition Theorem'?
 - (a) Replace them by open circuit
 - (b) Replace them by short circuit
 - (c) Keep in their original form without replacing by either open or short circuits
 - (d) Either a or b.
 - (iii) Inverse Laplace transform of $\frac{2}{s^2+4}$
 - (a) $\sin 2t$
 - (b) $\sinh 2t$
 - (c) $\cos 2t$
 - (d) $\cosh 2t$
 - (iv) Which type of filter produces a predictable phase shift characteristics in all frequency
 - (a) All pass filter
 - (b) High pass filter
 - (c) Low pass filter
 - (d) Band pass filter
 - (v) Time constant of a RC circuit is
 - (a) RC
 - (b) R/C
 - (c) 1/RC
 - (d) C/R
 - (vi) Condition for reciprocity of Z parameter is
 - (a) $Z_{12}=Z_{21}$
 - (b) $Z_{11}=Z_{22}$
 - (c) $Z_{22}=Z_{12}$
 - (d) $Z_{11}=Z_{12}$
 - (vii) If a graph has n number of nodes and b number of branches then the number of twig of a tree of the graph is equal to
 - (a) (n-1)
 - (b) (b-1)
 - (c) (b-n+1)
 - (d) (b+n-1)

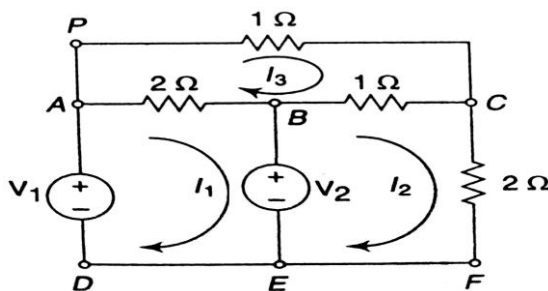
- (viii) Forward transfer admittance of a two port network is
 (a) Y_{11} (b) Y_{12} (c) Y_{21} (d) Y_{22} .
- (ix) .OP command is used in spice for finding
 (a) DC analysis of the circuit (b) transient analysis of the circuit
 (c) Frequency analysis of the circuit (d) all of the a,b,c.
- (x) What is the value of resistor for a high pass RC filter to produce a cut off frequency of 3.4KHz if $C = 0.047\mu\text{F}$?
 (a) 996Ω (b) 1000Ω (c) 996Ω (d) 752Ω

Group - B

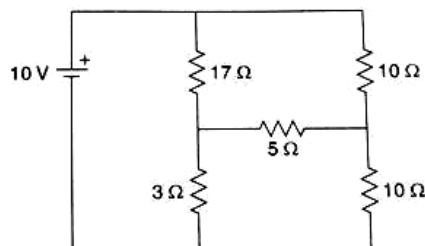
2. (a) Find the power loss in the 2Ω resistor using superposition theorem



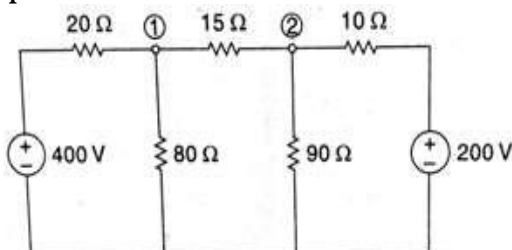
- (b) Using mesh analysis find the individual loop current and also find the power dissipation through the resistor connected between terminals A-B. Consider $V_1=5\text{V}$ and $V_2=10\text{V}$.

**6 + 6 = 12**

3. (a) Using Thevenin's Theorem find the current flowing through 5Ω resistor in the following circuit.

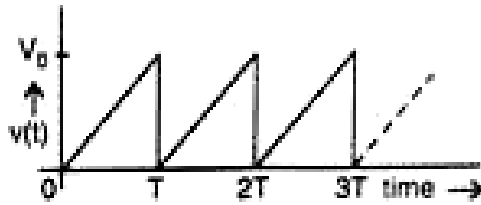


- (b) For the following circuit find the current through 15Ω resistor by Nodal Analysis. Find the power loss across 80Ω and 90Ω resistor.

**6 + 6 = 12**

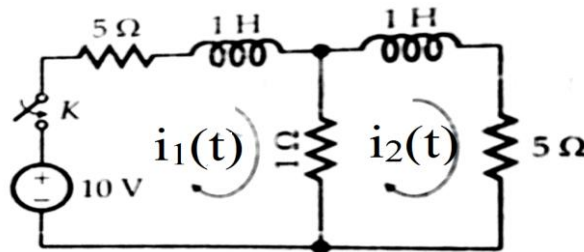
Group – C

4. (a) Define Impulse signal and find it's Laplace Transform.
 (b) Find Laplace Transform of the following circuit.



- (c) Find inverse Laplace Transform of the following function $F(S) = \frac{5}{S(S+3)(S+8)}$.
 $2 + 5 + 5 = 12$

5. (a) Sketch the current response curve of RC series circuit.
 (b) If a step signal is passing through a differentiator circuit then what output you will get. Sketch it and find Laplace transform of the waveform.
 (c)



Find $i_2(t)$ at $t=0+$ following switching at $t=0$ of switch K. Assume the network previously not energized.

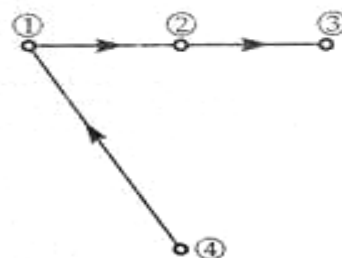
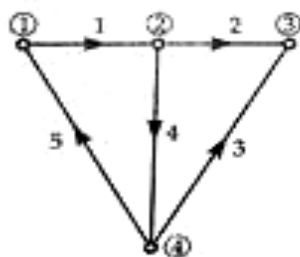
$2 + 3 + 7 = 12$

Group – D

6. (a) Define branch, node, degree of a node and loop in a graph of a network.
 (b) Draw the oriented graph for the given incidence matrix.

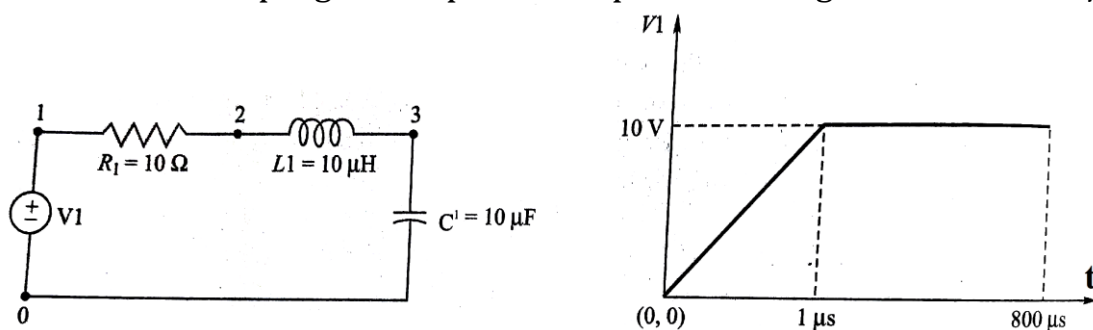
$$A_i = \begin{bmatrix} -1 & 0 & -1 & 1 & 0 & 0 & 1 \\ 0 & -1 & 0 & -1 & 0 & -1 & 0 \\ 1 & 1 & 0 & 0 & -1 & 1 & 0 \\ 0 & 0 & 1 & 0 & 1 & 0 & -1 \end{bmatrix}$$

- (c) Form the fundamental cut-set matrix for the given tree of the graph.



$4 + 4 + 4 = 12$

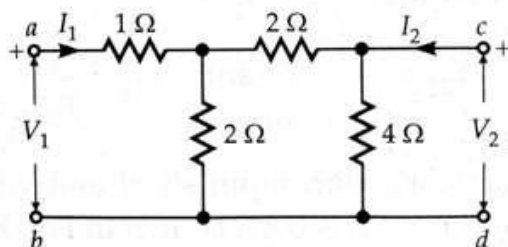
7. (a) Explain the function of the following commands in PSPICE:
(i) .OP , (ii) .PLOT , (iii) .TRAN
- (b) Write a PSPICE program to plot the capacitor voltage from 0 to 800 μsec .



$$(3 \times 2) + 6 = 12$$

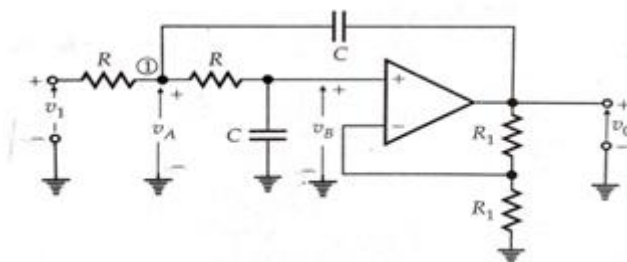
Group - E

8. (a) Derive the condition of symmetry and reciprocity for Z parameters
- (b) Find the Y parameters for the following network.



$$(3 + 3) + 6 = 12$$

9. (a) Analyze the circuit and find out the cut off frequency. Hence comment which type of filter is shown in figure.



- (b) Explain under what condition a RC circuit behaves as a Low pass filter.

$$(6 + 1 + 1) + 4 = 12$$

Department & Section	Submission Link
CSE	https://classroom.google.com/c/MjI2MjE5NDQ2MDMy/a/MzY4NDkxNDQyMjg4/details