B.TECH/AEIE/3RD SEM/AEIE 2102(BACKLOG)/2020

CIRCUIT THEORY AND NETWORKS
(AEIE 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) Norton current (I_N) of a circuit comprising of dependent source and resistive components is
(a) indeterminate (b) $0A < I_N < 1A$
(c) 0A (d) finite value greater than 1A

(ii) The Voltage division rule is valid for
(a) Series circuit (b) Parallel Circuit
(c) Resonant circuit (d) All of these

(iii) In an oriented graph, the reduced incidence matrix is used to find the number of
(a) valid trees (b) KVL equations
(c) KCL equations (d) all of the above.

(iv) The value of coefficient of coupling in a practical magnetically coupled circuit
(a) equal to 0 (b) equal to 1
(c) greater than one (d) greater than zero but less than 1

(v) A reciprocal circuit should have only
(a) one independent source (b) at least two independent sources
(c) dependent source (d) independent and dependent sources

(vi) In an RLC series circuit the power factor at resonance is
(a) lagging (b) leading (c) unity (d) zero

(vii) In a series resonant circuit, increasing inductance to its twice value and reducing capacitance to its half value
(a) will change the maximum value of current at resonance
(b) will change the resonance frequency
(c) will change the impedance at resonance frequency
(d) will alter the bandwidth of the circuit

(viii) Time constant of an RL series circuit is
(a) L/R (b) R/L (c) RL (d) R

(ix) A network, described by ABCD paramaters, will be reciprocal if
(a) A=D (b) (AD-BC)=1 (c) (AC-BD)=1 (d) (AD-BC)=0

(x) The number of links in an oriented graph having 7 branches and 5 nodes is
(a) 3 (b) 4 (c) 5 (d) 7

Group – B

2. (a) Draw the Thevenin's equivalent circuit across the load R2 of the circuit shown in the fig. 1. Find current through the load R2.

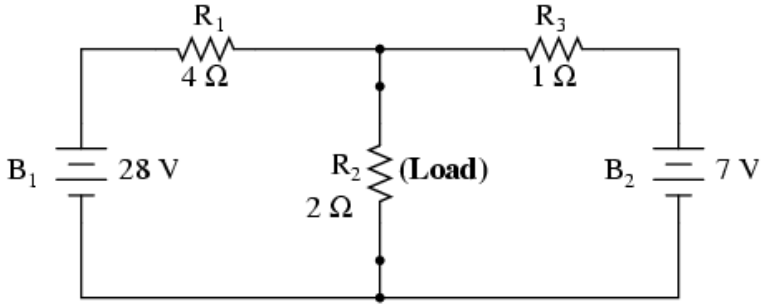

Fig. 1

(b) In the circuit shown in fig. 2, find the values of V_1 and V_2

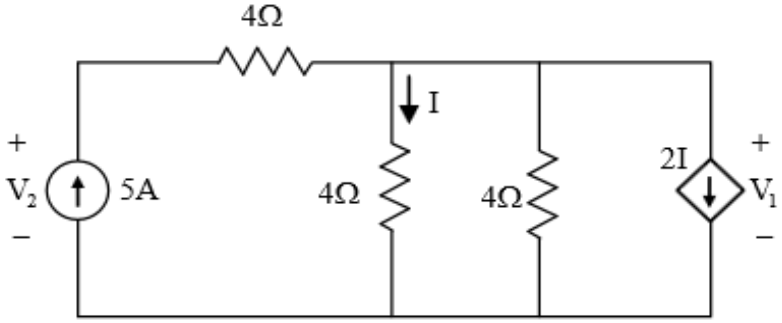

Fig. 2

(4 + 2) + 6 = 12

3. (a) For the circuit in the fig. 3, the following data are given:
(i) 57% of the primary flux gets linked with the secondary
(ii) $i_1(t)= 4 \sin 2t$ A, and
(iii) $i_2=0$ A. Then find (A) the coefficient of coupling and (B) v_1 and v_2.

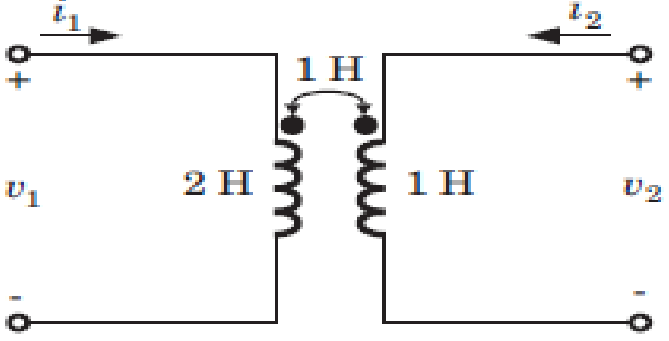

Fig. 3

(b) A series RLC circuit is excited with an ac voltage source as shown in the fig. 4. The quality factor (Q) of the circuit is given as Q= 30. Find the value of R in the circuit.

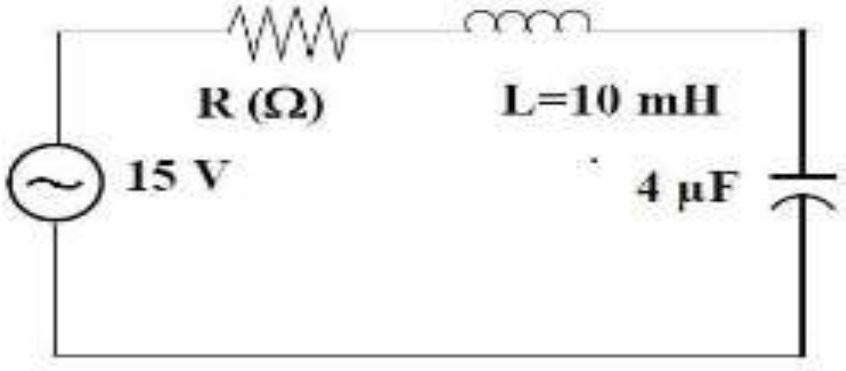

Fig. 4

(2 + 6) + 4 = 12

Group – C

4. (a) An impulse voltage excites an RC circuit. Derive an expression of voltage across the capacitor using the concepts of Laplace transform. Assume that the circuit is initially relaxed.

(b) In an RLC circuit, find the condition of the critically damped response.

6 + 6 = 12

5. (a) Find the inverse Laplace transform of the following function $F(s)=\frac{(s+3)}{(s+1)(s+2)}$

Using the initial value theorem, find the value of the above function at t=0

(b) Write the Laplace transforms of the following time domain functions:
(i) Unit impulse (ii) unit step (iii) exponentially decaying and (iv) unit parabola.

(5 + 3) + 4 = 12

Group – D

6. (a) Consider the electrical circuit shown in the fig. 5. Obtain the reduced incidence matrix.

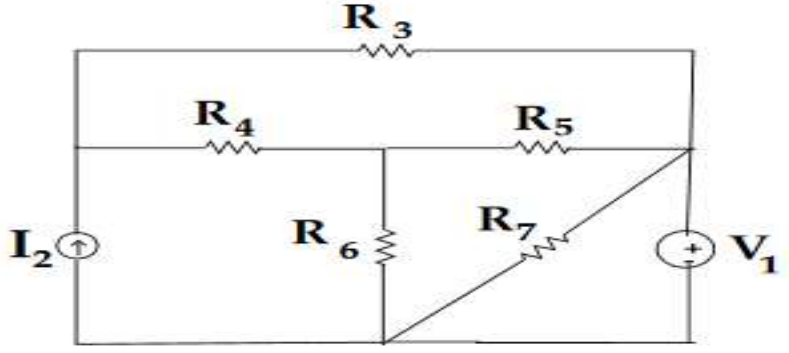

Fig. 5

(b) Find the total number of valid trees that may be obtained from the graph.

6 + 6 = 12

7. (a) A series RL circuit is excited at t = 0 by closing a switch (Sw) as shown in the fig. 6. Find (i) $iL(0^+)$ (ii) $v_L(0^+$, (iii) $i_L(\infty)$ (iv) $v_L(\infty)$.

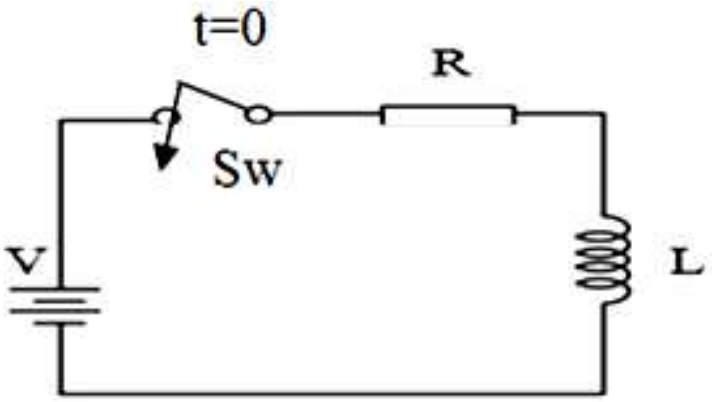

Fig. 6

(b) Express the Z-parameters in terms of the Y-parameters.

4 + (6 + 2) = 12

Group – E

8. (a) Draw the ideal and practical characteristics of a band-pass and a stop-band filter.
The driving point impedance of a circuit is given by $Z(s)=\frac{(s+1)}{s(s+2)}$

(b) Realize a circuit using Cauer form-I.

(2 + 2) + 8 = 12

9. (a) The driving point impedance of a circuit is given by $Z(s)=\frac{(s+1)}{s(s+2)}$
Realize a circuit using any one of the Foster's forms (I or II).

(b) A filter circuit, as shown in the fig. 7, receives a signal from a rectifier having certain frequency. Analyse the circuit to know the type of the filter.

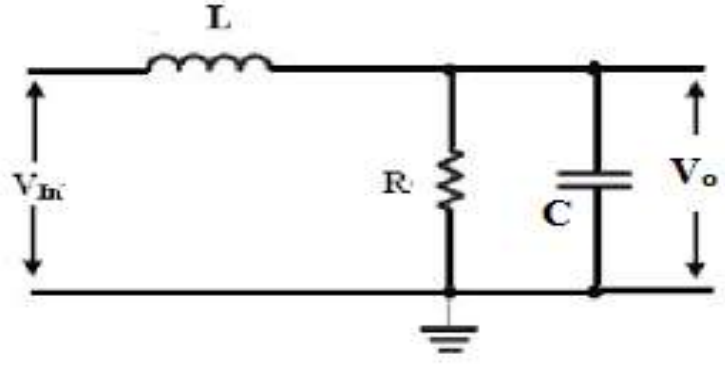

Fig. 7

8 + 4 = 12

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AEIE	https://classroom.google.com/c/Mjc0MDY4MTQxNTc3/a/Mjc0MDY4MTQxNTkx/details