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Total No. of printed pages = 6

EE 131302

Roll No. of candidate

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2017

B.Tech. 3rd Semester End-Term Examination

Electrical

CIRCUIT ANALYSIS

Full Marks – 100

Time – Three hours

The figures in the margin indicate full marks
for the questions.

Answer Question No. 1 and any *six* from the rest.

1. Answer ALL questions. (10 × 1 = 10)
- (a) The condition of reciprocity in ABCD parameters is _____.
 - (b) The time constant of a R-L series circuit is _____.
 - (c) The expression for energy stored in an inductor is _____.
 - (d) The expression for equivalent inductance having two coils of inductances L_1 and L_2 respectively connected in negative polarity and M being the mutual inductance between the coils _____.
 - (e) The relationship among the number of links, branches and number of nodes in a graph is _____.

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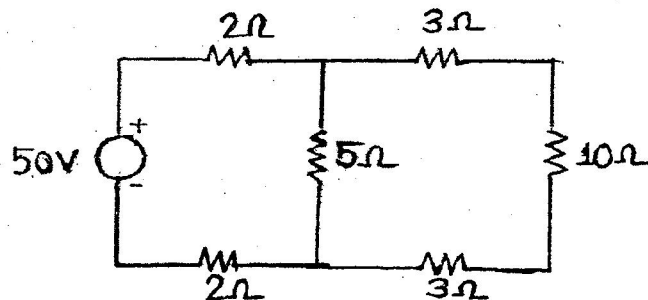
- (f) Time constant for a R-C series circuit having $R = 3\Omega$ and $C = 100\mu F$ is _____.
- (g) The input voltage to a series R-L-C circuit, having $V_R = 3\text{ V}$, $V_C = 103\text{ V}$, and $V_L = 14\text{ V}$ is _____.
- (h) The relationship between Z-parameters matrix [Z] and Y-parameter matrix [Y] is _____.
- (i) The determinant of the incidence matrix of a closed loop in a graph is _____.
- (j) The reactance of a 2 H inductor in D.C supply _____.

2. Write briefly :

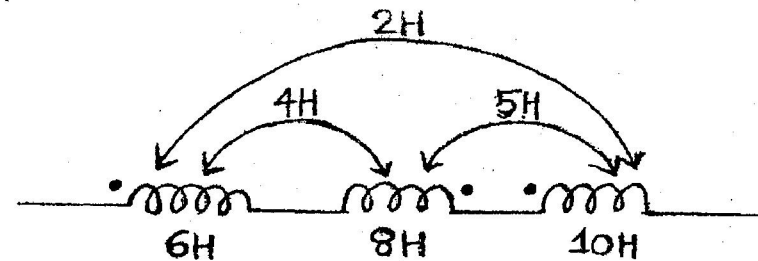
- (a) Temperature stability of resistors.
- (b) Modern dielectric materials.
- (c) Deduce the expression of current for transient response in a R-L series circuit having D.C. excitation.
- (d) Find the expressions of voltage across L and R in the R-L series circuit. (2 + 2 + 8 + 3 = 15)

3. (a) State and prove maximum power transfer theorem in A.C circuits.
- (b) Find the current through 10Ω resistor using Thevenin's Theorem for the circuit shown as.

(8 + 7 = 15)



4. (a) What is self-inductance and mutual inductance?
- (b) Deduce the expression for equivalent inductance for two series connected magnetically coupled coils, where L_1 and L_2 be the self inductances of the coils respectively and M is the mutual inductance between the coils.
- (c) Calculate the total inductance of the three series connected coupled coils. (4 + 6 + 5 = 15)



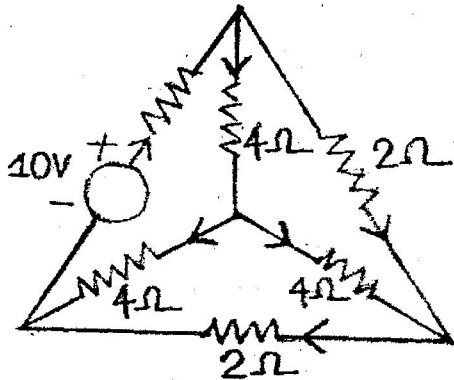
5. (a) The incidence matrix of a graph is given below. Draw the directed graph corresponding to this matrix.

		Branches →						
Nodes		1	2	3	4	5	6	7
↓	(1)	-1	0	-1	1	0	0	1
	(2)	0	-1	0	-1	0	-1	0
	(3)	1	1	0	0	-1	1	0
	(4)	0	0	1	0	1	0	-1

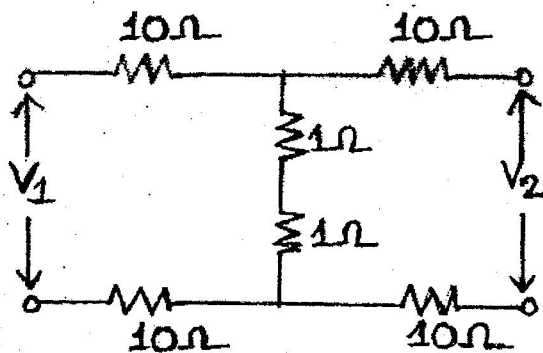
- (b) Obtain the number of possible trees from a reduced incidence matrix of a graph given as

$$[A] = \begin{bmatrix} 1 & 1 & 0 & 0 & 0 & 1 \\ 0 & -1 & 1 & -1 & 0 & 0 \\ -1 & 0 & -1 & 0 & -1 & 0 \end{bmatrix}$$

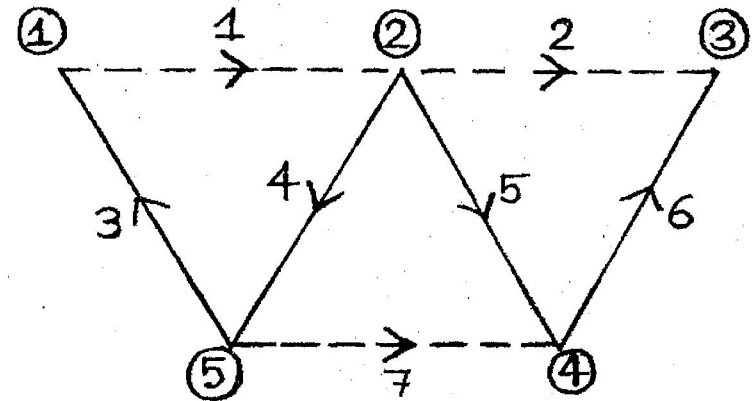
- (c) Write down the fundamental loop matrix of the network shown as



6. (a) What are open-circuit parameters and short circuit parameters in two-port networks?
 (b) Establish the conditions for reciprocity and symmetry in Z-parameter representation.
 (c) Determine the Z-parameters for network shown as (4 + 6 + 5 = 15)



7. A tree of a network is shown in fig.



- (a) Find the tie-set and cut-set matrices.
 (b) Obtain the KVL and KCL equations.
 (c) Write the KCL and KVL equations in matrix form. (8 + 6 + 1 = 15)
8. (a) What are the necessary conditions of stability of a network function?
 (b) Check whether the polynomial expressed as $F(s) = s^3 + 6s^2 + 11s + 6$ is Hurwitz or not.
 (c) Develop the Cauer-I form for a network having the driving point impedance $Z(s) = \frac{2s^5 + 10s^3 + 10s}{s^4 + 4s^2 + 4}$. (4 + 6 + 5 = 15)
9. (a) What do you mean by transient and steady state response of a circuit?
 (b) A resistor R and a $5\mu F$ capacitor are connected in series across a 100 V d.c supply. Calculate the value of the resistor R such that the voltage across the capacitor become 50 V in 5 sec. after the circuit is switched on.

- (c) A $10\ \mu\text{F}$ capacitor in RC circuit as shown in the fig. has initial charge of $100\ \mu\text{C}$ with polarities as shown. At $t=0$, the switch being closed, a d.c. voltage of $100\ \text{V}$ is applied. Find the expression for the moment. $(4 + 4 + 7 = 15)$

