

Total No. of printed pages = 6

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2023

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Azara, Guwahati, Assam.  
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B.Tech. 3<sup>rd</sup> Semester End-Term Examination

ELECTRICAL CIRCUIT ANALYSIS

(New Regulation and New Syllabus)

Full Marks – 70

Time – Three hours

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

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

1. Choose the most appropriate option from the given options : (10 × 1 = 10)

(i) Whether to employ nodal analysis or mesh analysis depends on

- (a) Type of circuit (b) Type of sources  
(c) Type of computation (d) All of these

(ii) In mesh analysis technique, the independent variable is

- (a) Mesh currents (b) Branch currents  
(c) Mesh voltages (d) Node voltages

(iii) What is the value of  $j^6$ ?

- (a)  $j$  (b)  $-j$   
(c) 1 (d)  $-1$

(iv) Which of the following components constitute the response of a linear RL or RC circuit?

- (a) Response due to initial condition  
(b) Response due to voltage sources  
(c) Response due to current sources  
(d) All of these

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- (v) In which of the following it is not desired to attain the condition of maximum power transfer?
- (a) Electronic Circuits                      (b) Communication Circuits  
(c) Computer Circuits                      (d) Electric Circuits
- (vi) Which of the following holds good when a sinusoidal voltage is applied to a pure inductance?
- (a) In one half cycle energy is absorbed  
(b) In the next half cycle energy is released  
(c) Continuous exchange of energy  
(d) All of the these
- (vii) Which of the following configurations will not lead to close coupling between two coils?
- (a) Coils are wound on a magnetic core  
(b) Coils are placed side by side  
(c) Coils are placed directly over one another by interleaving  
(d) None of these
- (viii) The orientation of a basic loop is the same as that of a
- (a) Link    (b) Branch  
(c) Path    (d) None of these
- (ix) Which of the following is not a correct correlation for a symmetric two port network?
- (a)  $AD - BC = 1$                               (b)  $A = D$   
(c)  $A' = D'$                                       (d) None of these
- (x) For a polynomial  $D(S)$  to be Hurwitz, which of the following should be satisfied?
- (a) All coefficients must be real              (b) All coefficients must be positive  
(c) No terms should be missing              (d) All of these

2. (a) Verify Reciprocity Theorem for the network shown in Fig. 1. (7)

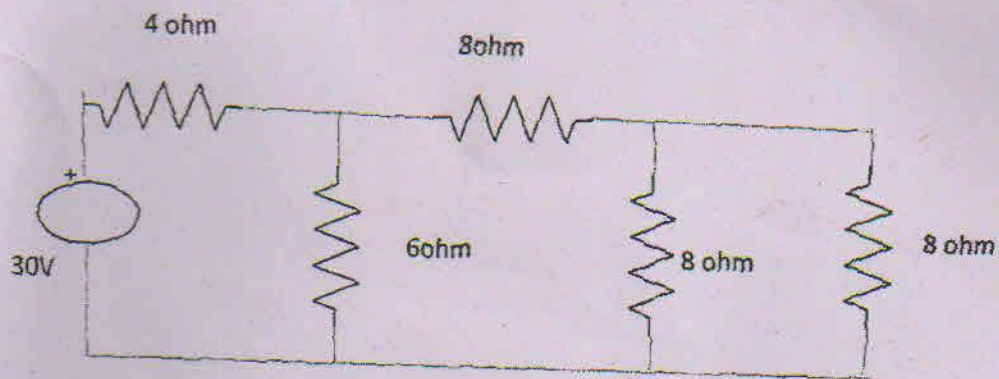


Fig.1

- (b) Using Millman's theorem, determine value of  $R$  for the circuit shown in Fig. 2 such that  $I = 5 \text{ mA}$ . (8)

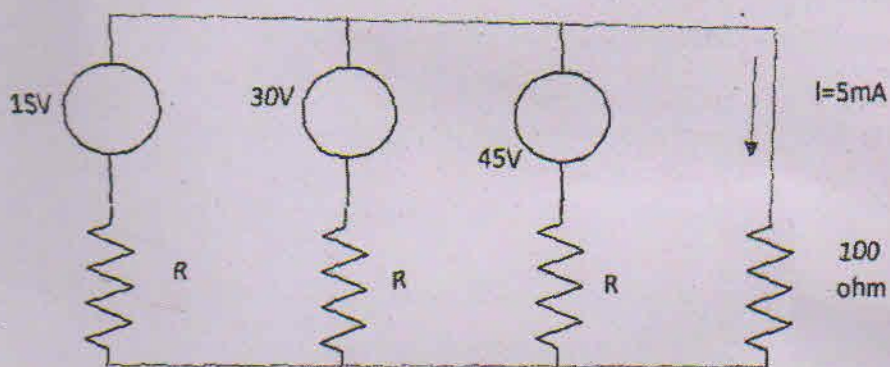


Fig.2

3. (a) The circuit shown in Fig.3 consists of resistance, inductance and capacitance in series with a 200 V constant source. The switch is closed at  $t = 0$ . Estimate current transient. (8)

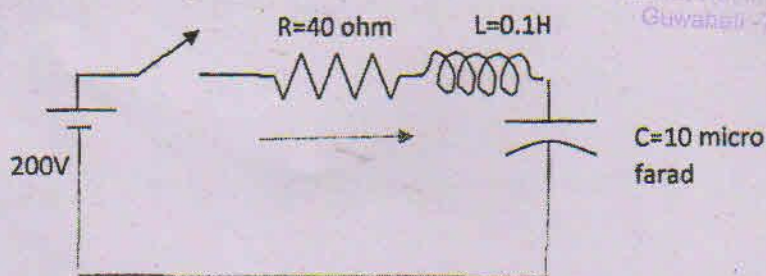


Fig. 3

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- (b) For the network shown in Fig.4, the switch is opened at  $t = 0$ . Estimate  $i(t)$  for  $t > 0$ . (7)

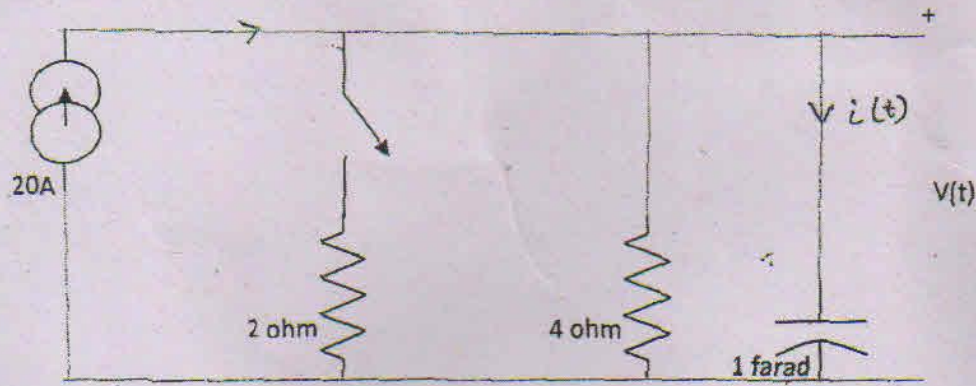


Fig.4

4. (a) What is a port? How many terminals does a two ports network have? Distinguish between active and passive ports. Name the various sets of parameters used to describe a two ports network. (4)
- (b) Estimate Y parameters for the network shown in Fig.5. (6)

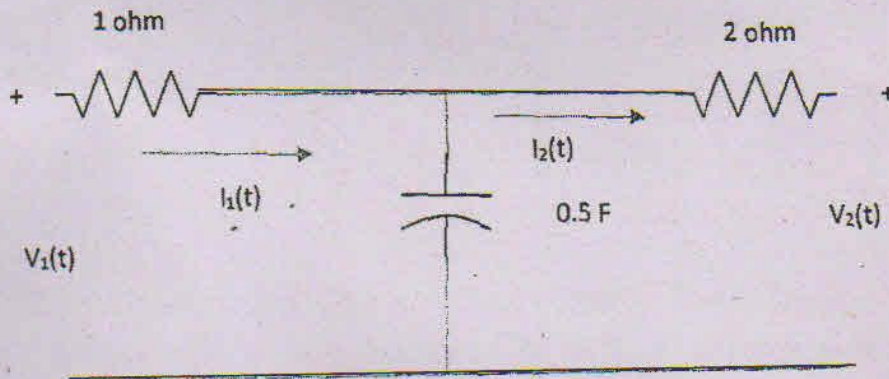


Fig. 5

- (c) Check whether the following polynomial is Hurwitz or not. (5)
- $$H(S) = S^4 + S^3 + 7S^2 + 4S + 6.$$
5. (a) Synthesize the following impedance function in suitable Foster form. (5)
- $$Z(S) = [6(S+3)(S+9)]/[S(S+6)]$$
- (b) Test whether  $F(S) = (S^2 + 9)/(S^3 + S)$  is a positive real function. (5)

- (c) For the following pole – zero configuration write the R-L impedance function and synthesize it in a suitable form. (5)

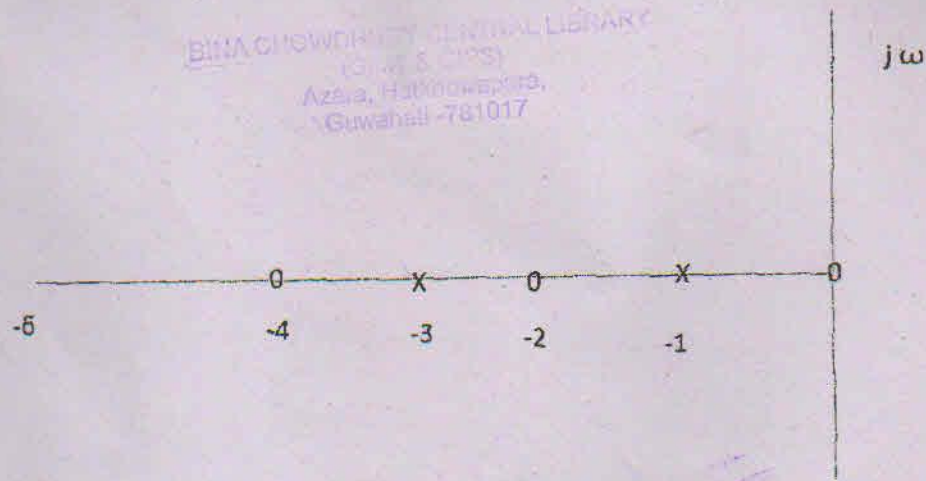


Fig.6

6. (a) Distinguish between the followings : (3 × 2 = 6)
- (i) Planar and non planar graph
  - (ii) Incidence matrix and reduced incidence matrix
  - (iii) Loop matrix and cut set matrix.
- (b) Obtain cut set matrix for the graph shown in Fig.7 (5)

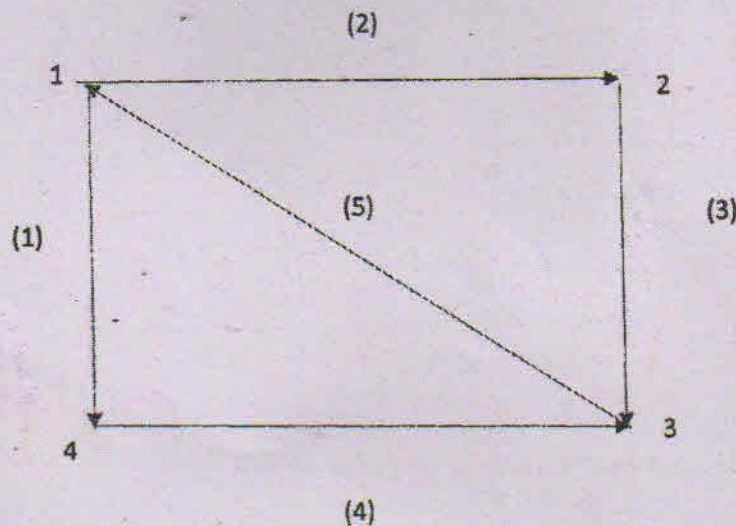


Fig.7

(c) Following short circuit currents and voltages are obtained experimentally for a two port network.

(i) With output short-circuited :  $I_1 = 5 \text{ mA}$ ,  $I_2 = -0.3 \text{ mA}$ ,  $V_1 = 25 \text{ V}$

(ii) With input short-circuited  $I_1 = -5 \text{ mA}$ ,  $I_2 = 10 \text{ mA}$ ,  $V_2 = 30 \text{ V}$

Determine Y-parameters. (4)

7. (a) In the network shown in Fig.8, at  $t = 0$ , switch is opened. Calculate  $v'(t)$ ,  $dv/dt$  and  $d^2v/dt^2$  at  $t = 0^+$ . (8)

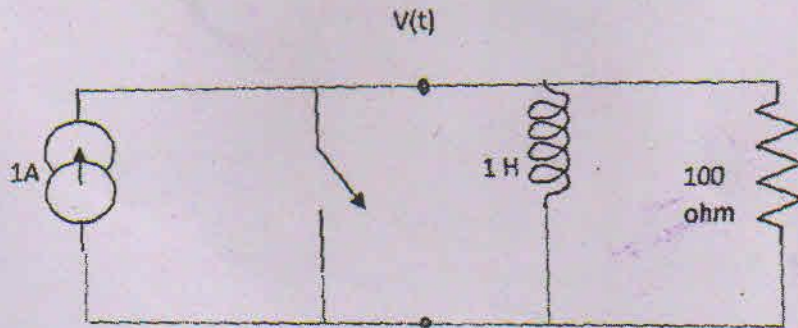


Fig.8

(b) Determine the voltage  $V$  which causes the current  $I_1$  to be zero. Use any suitable method. (7)

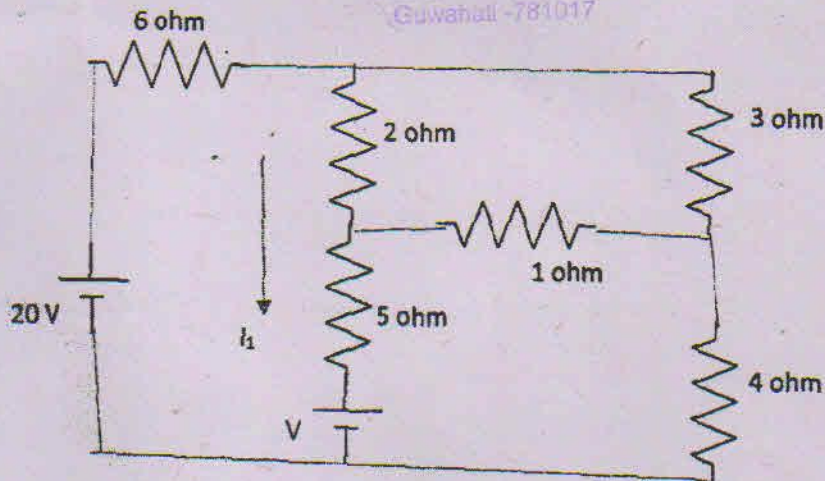


Fig. 9