

BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI
(END SEMESTER EXAMINATION MO/2022)

CLASS: B.TECH.
BRANCH: ECE

SEMESTER: III
SESSION: MO/2022

SUBJECT: EC209 NETWORK THEORY

TIME: 03 Hours

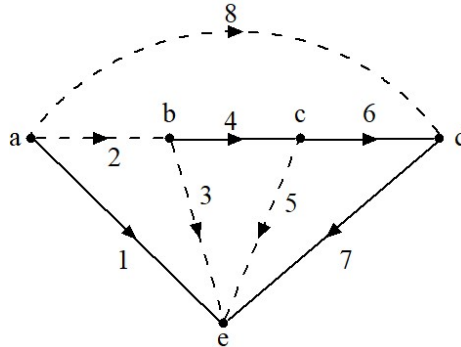
FULL MARKS: 50

INSTRUCTIONS:

1. The question paper contains 5 questions each of 10 marks and total 50 marks.
2. Attempt all questions.
3. The missing data, if any, may be assumed suitably.
4. Tables/Data handbook/Graph paper etc., if applicable, will be supplied to the candidates

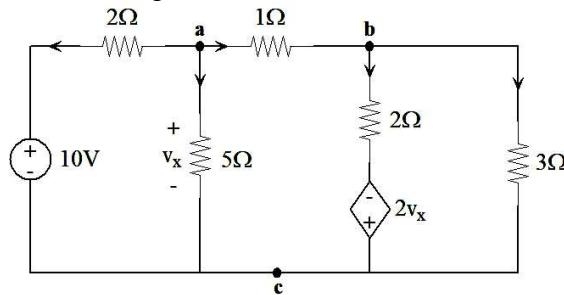
Q.1(a) Write the f-loop and f-cut-set matrices of the oriented graph.

[4] CO1, BL2
CO2



Q.1(b) Sketch the oriented graph of the following circuit. Using graph theory-based node equations, find the current through 3Ω resistor.

[6] CO1, BL3
CO2, CO3, CO4

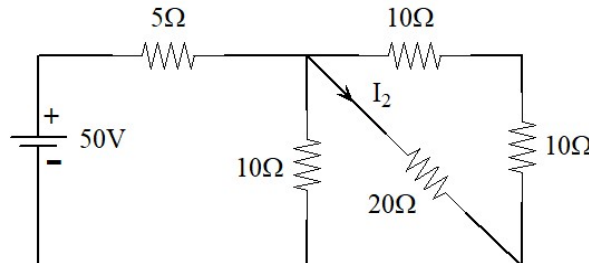


Q.2(a) State Tellegen's theorem.

[2] CO2 BL1

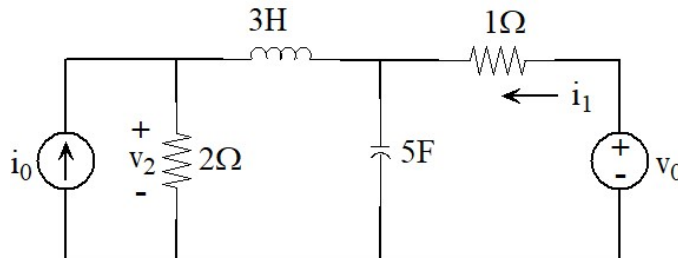
Q.2(b) Verify the Reciprocity theorem in the following circuit with $50V$ as input and I_2 as output.

[3] CO1, BL2
CO2, CO4

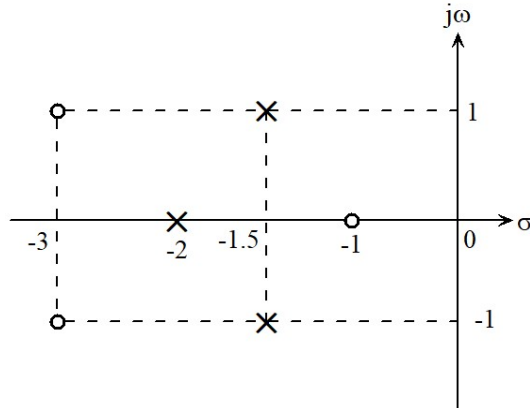


Q.2(c) Formulate the state equations and output equation of the following network. Consider i_1 and v_2 as output. Inputs are i_0 and v_0 .

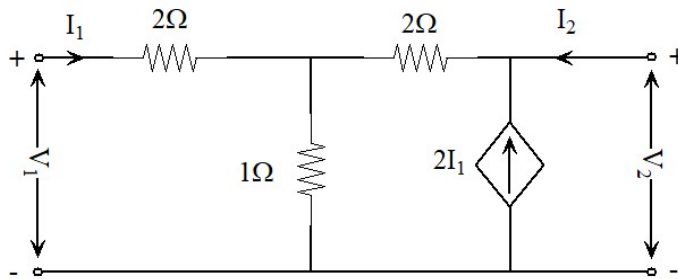
[5] CO1, BL3
CO2, CO4



- Q.3(a) Derive the inter-relationship between the Y-parameters and Z-parameters of a two-port network. [2] CO4 BL2
- Q.3(b) The OCNF and SCNF of impedance function Z(s) is shown below. Find the impedance function if the DC value of Z(s) is 10. [3] CO2 BL4



- Q.3(c) Find the transmission (ABCD) parameters of the following network. [5] CO1, CO2, CO3, CO4 BL3



- Q.4(a) Analyze if the given polynomial is Hurwitz or not. [2] CO4 BL4

$$s^4 + 7s^3 + 4s^2 + 18s + 6$$
- Q.4(b) Diagnose if the following impedance functions represent a LC, RL, or RC network with justification. [3] CO4 BL5
- $Z(s) = (s^2 + 10s + 24) / (s^2 + 8s + 15)$
 - $Z(s) = (12s^4 + 10s^2 + 1) / (3s^3 + 2s)$
 - $Z(s) = 2(s^2 + 4s + 3) / (s^2 + 6s + 8)$
- Q.4(c) Synthesize the given positive real impedance function using an RC network in Foster form I and Cauer form I. [5] CO2, CO5 BL6
- $$Z(s) = (s^2 + 5s + 4) / (s^2 + 2s)$$

- Q.5(a) Compare the Butterworth and Chebychev filters. [2] CO4 BL4
- Q.5(b) A Butterworth low pass filter has a 3dB attenuation at 20 MHz and 60dB loss at 80MHz. Determine the order of the filter. Find the poles of the Butterworth polynomial and transfer function of the realized filter. [8] CO5 BL3

To satisfy the same specifications as above using a Chebychev filter, determine the order of the filter required. Find the pass band ripple in the realized Chebychev filter.