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

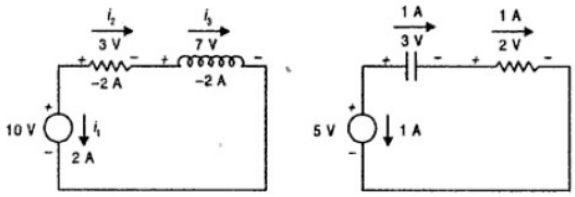
CLASS: BE **SEMESTER : III**
BRANCH: EEE/ECE **SESSION : MO/18**

SUBJECT: EE3205-NETWORK THEORY

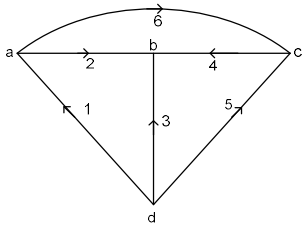
TIME: 03:00 HRS. **FULL MARKS: 60**

INSTRUCTIONS:
1. The question paper contains 7 questions each of 12 marks and total 84 marks.
2. Candidates may attempt any 5 questions maximum of 60 marks.
3. The missing data, if any, may be assumed suitably.
***4*. Before attempting the question paper, be sure that you have got the correct question paper.**
5. Tables/Data hand book/Graph paper etc. to be supplied to the candidates in the examination hall.

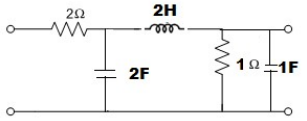
Q.1(a) State substitution theorem. [2]
(b) State reciprocity theorem. [4]
(c) State Tellegen's theorem. Mention the properties of Tellegen's theorem. Verify the theorem in respect of the two networks having identical graphs for the following network. [6]



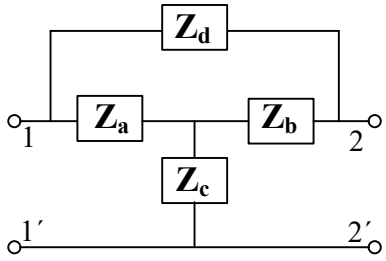
Q.2(a) Define tree and path. Show example. [2]
(b) State properties of the incidence matrix of a graph. Prove $AB_f^T=0$. [4]
(c) For the following graph, consider the tree formed by branches (2,3,4). Construct incidence matrix, fundamental cut set matrix and tie set matrix. [6]



Q.3(a) What do you understand by a port of a network? Compare a 4-terminal network with a 2-port network. [2]
(b) Design the ABCD parameters for the ladder network. [4]



(c) Estimate the open-circuit and short-circuit impedances of the network shown in the figure, where Z_a=2 ohm, Z_b=6 ohm, Z_c=4 ohm and Z_d=8 ohm. [6]



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Q.4(a) Discuss the concept of poles and zeros in a network function. [2]

(b) Calculate the range of ß (beta)such that the polynomial $P(s) = s^4 + s^3 + 4s^2 + \beta s + 3$ is Hurwitz. [4]

(c) Realize the network in Foster-I form and Cauer-II form whose impedance function is given by [6]

$$Z(s) = \frac{8(s^2+1)(s^2+3)}{s(s^2+2)(s^2+4)}$$

Q.5(a) Draw transformed representation in terms of impedance for inductor with initial current. [2]

(b) Discuss the restrictions on pole and zero locations for driving point functions and transfer functions. [4]

(c) Compare the order of the LP filter under both Butterworth and Chebyshev approximations with the following specifications: [6]

$$\alpha_p \le 3dB \quad \text{for} \quad \Omega \le 1 rad/\sec$$
$$\alpha_s \ge 40dB \quad \text{for} \quad \Omega \ge 4.095 rad/\sec$$

Q.6(a) What is the importance of frequency transformation in filter design? [2]

(b) Discuss frequency transformation function required to transform a low pass prototype (symmetric about zero frequency) to a high pass filter. [4]

(c) Discuss the location of poles of transfer function of a low pass Butterworth filter assuming the pass-band edge at 3dB point. [6]

Q.7(a) Differentiate active and passive elements. [2]

(b) Realize a second order low-pass filter with Butterworth approximation using op-amp. [4]

(c) Describe all pass filter, notch filter and gyrator. [6]

********28.11.18******E**