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

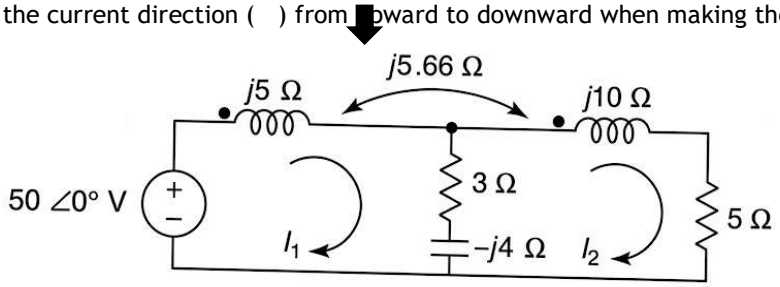
CLASS: BTECH **SEMESTER : III**
BRANCH: ECE **SESSION: MO/2025**

SUBJECT: EC24205 NETWORK THEORY

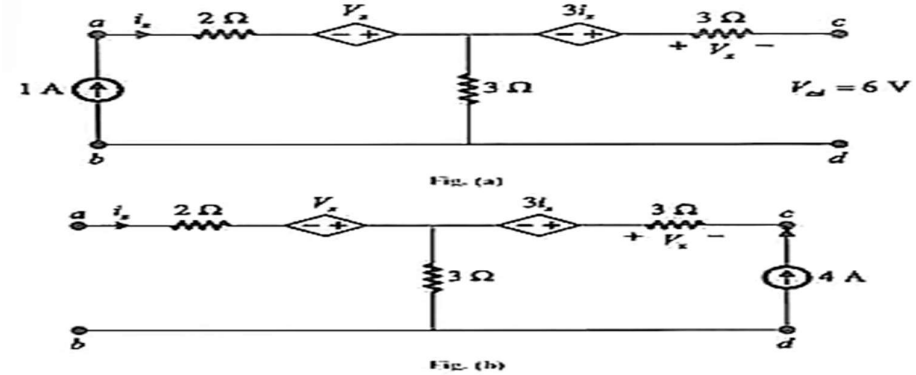
TIME: 3 Hours **FULL MARKS: 50**

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*. 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.

			CO	BL
Q.1(a)	Explain the terms a) Tree b) Isomorphism. Differentiate between the tie set and the cut set matrix. Write the properties of the Incidence matrix.	[5]	1	2
Q.1(b)	For the network shown in the figure below, write down the tie set matrix and derive the network equilibrium equation in matrix form using KVL. For the middle branch, assume the current direction ( ) from downward to downward when making the oriented graph.	[5]	1	2



Q.2(a)	Describe Thevenin's theorem and discuss how to find Thevenin Resistance for (a) when the network contains independent sources, (b) when the network contains only dependent sources, and (c)when the network contains both dependent and independent sources. Explain the Superposition theorem with a suitable example and discuss how to find the response of a circuit when sources have different frequencies.	[5]	2	3
Q.2(b)	Consider a dependent source two-port network; use the data from Figure (a). Compute the voltage Vba of Figure (b) by applying the reciprocity theorem. Before finding this Vba voltage, also verify whether the theorem is applicable	[5]	2	3



Q.3(a)	Analyze the inductor current in a source-free RLC series circuit having the initial inductor current (I_0) and having the initial voltage on the capacitor (V_o) for undamped, underdamped, overdamped, and critically damped systems. Also, plot the current profile versus time. Explore the term' time constant' for standard charging and discharging equations.	[5]	3	4

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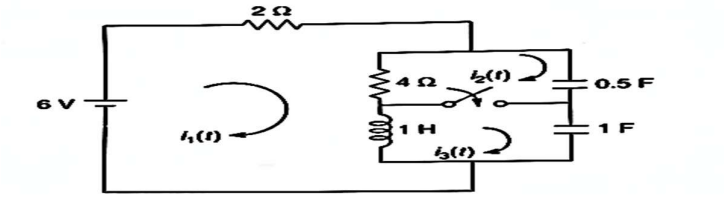
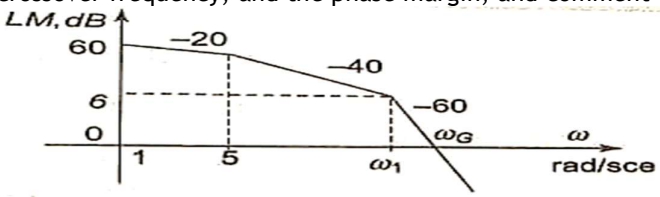
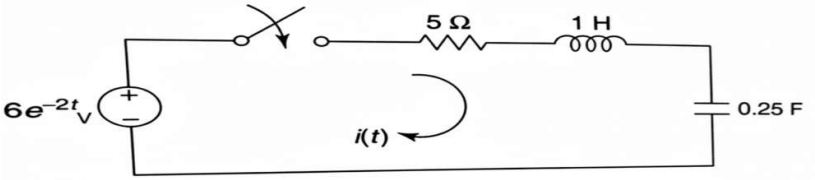
Q.3(b) In the network shown in the figure below, a steady state is reached with switch k open. At t=0, switch k is closed. Evaluate the three loop currents i_1(t), i_2(t), & i_3(t), at t = 0 +. [5] 3 4



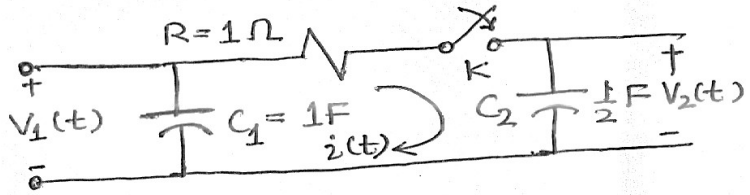
Q.4(a) The sketch of the Logarithmic Magnitude plot is given below for the open-loop transfer function G(s)H(s) of a negative feedback system. Determine the transfer function, the gain crossover frequency, and the phase margin, and comment on stability [5] 3 4



Q.4(b) For the network illustrated below, the switch closes at t = 0. Evaluate the current i(t), assuming the network elements start with zero initial conditions [2] 4 5



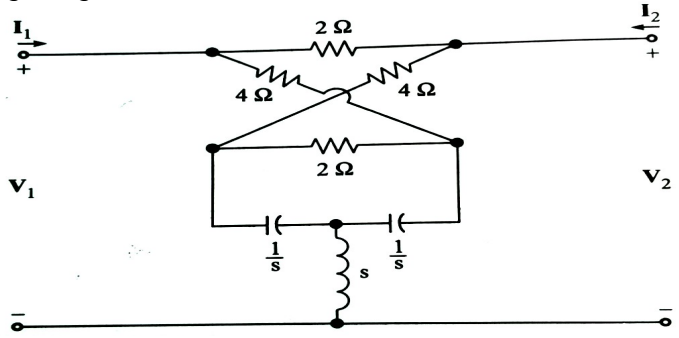
Q.4(c) The initial voltage on C_1(1F) is 2 volts, and on C_2 (0.5F) is 1volt. At t = 0, the switch 'k' is closed in the circuit below. (a) Evaluate i(t) for all time and the Energy dissipated in the resistor. (b)Compute v_1(t) and v_2(t) for t > 0. [By using the Laplace Transform] [3] 4 5



Q.5(a) Design the practical band-pass passive filter with a frequency response curve (Magnitude as well as phase) and explore the relationship between bandwidth and time constant. Determine the rise time and delay time of a high-pass RC filter with R = 10 KΩ and C = 0.001μf [3] 5 6

Q.5(b) Model the network equations in h-parameter form for an ideal transformer with a turns ratio of n:1 and find all the values of the h-parameters. Comment on symmetrical or reciprocal regarding this [2] 5 6

Q.5(c) Evaluate the Z-parameters of the circuit below. Comment on symmetrical or reciprocal regarding this. [5] 5 6



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