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Total No. of Printed Pages: 2

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B. Tech. ECE (Semester: 3rd)
NETWORK THEORY: ANALYSIS & SYNTHESIS
SUBJECT CODE: BECES1304
PAPER ID: [18111313]

Time: 03 Hours

Maximum Marks: 60

Instruction for candidates:

1. Section A is compulsory. It consists of 10 parts of two marks each.
2. Section B consist of 5 questions of 5 marks each. The student has to attempt any 4 questions out of it.
3. Section C consist of 3 questions of 10 marks each. The student has to attempt any 2 questions.

Section – A

(2 marks each)

Q1. Attempt the following:

- a. What is the significance of Compensation theorem in circuit analysis?
- b. Compare and contrast: independent and dependent voltage sources.
- c. State the maximum power transfer theorem for DC circuits.
- d. Briefly describe the Fourier transform and its importance in network analysis.
- e. Define power factor in the context of AC circuits.
- f. What do you mean by transfer function? Also, state its significance in the analysis of system behavior.
- g. Differentiate between series resonance and parallel resonance in AC circuits.
- h. Test whether the following polynomial is Hurwitz or not.

$$P(s) = s^4 + s^3 + 5s^2 + 3s + 4$$

- i. Write the properties of RC impedance function.
- j. Design a low-pass filter (T-network) having a cut-off frequency of 1KHz to operate with a terminated load resistance of 200Ω.

Section – B

(5 marks each)

Q2. Write the mesh equations for the circuit shown in Fig. 1 and determine the current in the 5Ω resistor.

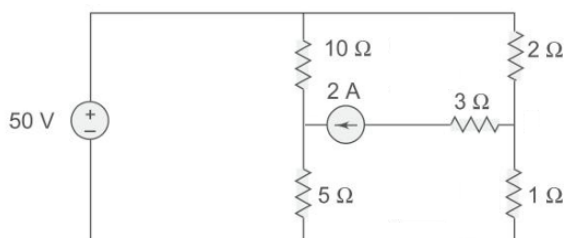


Fig. 1

- Q3. Explain the steady-state and transient response of an electrical network with suitable diagrams.
- Q4. State the convolution theorem. Also, find the Inverse Laplace Transform of the following function using the same:

$$F(s) = \frac{1}{(s^2+1)(s^2+9)}$$

Q5. For the given network function, draw pole-zero diagram and hence, obtain the time-domain response of current:

$$I(s) = \frac{3s}{(s+1)(s+3)}$$

Q6. Derive the expression for characteristic impedance in a pure reactive network (symmetrical π -network).

Section – C

(10 marks each)

Q7. The driving-point impedance of a one port LC network is given by:

$$Z(s) = \frac{2(s^2+1)(s^2+9)}{s(s^2+4)}$$

Obtain the Foster-I and Cauer-I forms of equivalent network.

Q8. What are m-derived filters? Design an m-derived high-pass filter with a cut-off frequency of 10 kHz, design impedance of 5Ω and $m = 0.4$.

Analyze an RL network subjected to a step input without initial conditions to determine the complete response, using Laplace transforms.

Q9. State and discuss the Norton's theorem with suitable diagram.

In the network shown in Fig.-2, write node equations.

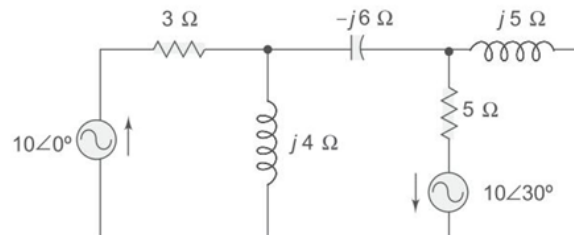


Fig. 2