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Total No. of Questions: [09]

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. List out the key differences between node analysis and mesh analysis.
b. What is duality in network theory? Give a brief example.
c. State the maximum power transfer theorem for AC circuits.
d. Obtain the Laplace transformation of $f(t) = 1 - e^{-\alpha t}$, α being a constant.
e. Define the Fourier transform of a time-domain signal.
f. What are poles and zeros in the context of network functions?
g. State the convolution theorem.
h. Write the properties of RC driving-point function.
i. Define characteristic impedance. Illustrate its significance in filter design.
j. What do you mean by m-derived filters? Summarize their advantages over constant-K filters.

Section – B **(5 marks each)**

Q2. Find the current passing through the 4Ω resistor in the circuit shown in Figure-1, by using Thevenin's theorem.

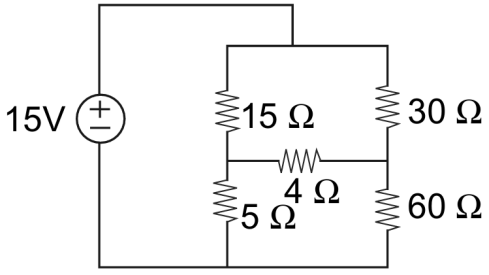


Figure-1

Q3. Design a prototype low pass filter to have a cut-off at 796Hz when terminated in a 600Ω resistance, in both the T and Π configurations.
Q4. Analyze an RC network subjected to a step input without initial conditions to determine the complete response, using Laplace transforms.
Q5. Determine whether the following polynomial is Hurwitz or not.

$$P(s) = s^4 + 7s^3 + 4s^2 + 18s + 6$$

Q6. Explain the difference between driving point functions and transfer functions of Two-port networks.

Section – C **(10 marks each)**

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

$$Z(s) = \frac{8(s^2+4)(s^2+25)}{s(s^2+16)}$$

Obtain the first Foster form of equivalent network.

b. Find the second form of Cauer network for the function:

$$Z(s) = \frac{s^2+5s+4}{s^2+2s}$$

Q8. a. State and discuss the Norton's theorem with suitable diagram.

b. In the network shown in Figure-2, determine I_1 and I_2.

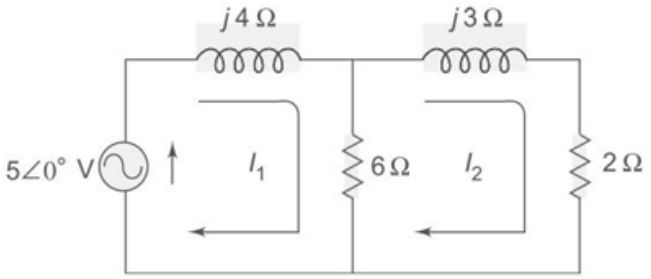


Figure-2

Q9. Write short notes on the following:

a. Steady state response of a network to non-sinusoidal periodic inputs.

b. Behaviour of series and parallel resonant networks.