

JK Lakshmipat University Jaipur
INSTITUTE OF ENGINEERING AND TECHNOLOGY

End Term Examination, May 2022
B. Tech. (All branches), Semester IV, 2021-22

Roll No.....

ES1109: Computational Engineering Analysis - II

Time: 2 hrs 30min

Max. Marks: 30

Instructions to students:

1. Do not write anything other than your roll number on question paper.
 2. Mention all the assumptions for your answers clearly.
 3. Non-programmable calculators are allowed.
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- Q. 1.1 Compute the Fourier transform of $e^{-\frac{x^2}{2}}$. 1.0
(CO 4)
- Q. 1.2 Compute the Fourier sine transform of e^{-kx} for $x \geq 0$ and $a > 0$. Hence deduce the following integral known as Laplace integral $\int_0^\infty \frac{\alpha \sin \alpha x}{k^2 + \alpha^2} d\alpha$. 2.0
(CO4)
- Q. 1.3 Find the temperature distribution $u(x, t)$ in a semi-infinite bar with $\frac{\partial u}{\partial x} = \mu$ when $x=0$ and with initial temperature 0° . Assume that $\frac{\partial u}{\partial x} \rightarrow 0$ as $x \rightarrow \infty$ and is bounded. 5.0
(CO4)
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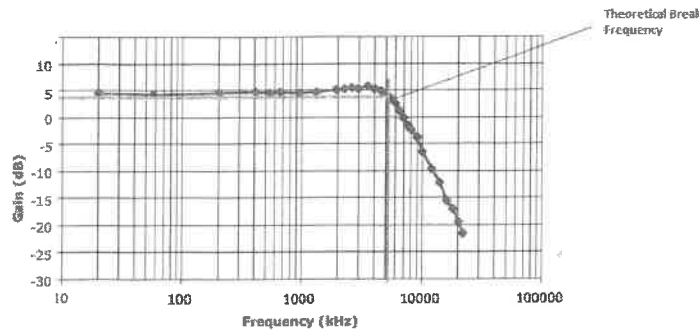
- Q. 2.1 Compute the Z- transform of $u(n) = \frac{1}{n+1}$. 1.0
(CO5)
- Q. 2.2 For given $u_n = n^p$, where p is positive integer, show that $Z(u_n) = -z \frac{d}{dz} [Z[n^{p-1}]]$. 2.0
(CO5)
- Q. 2.3 A feedback digital circuit generates the digital signal $\{x(n)\}=3^n$ according to the following difference equation. 4.0
(CO5)

$$u_{n+2} + 4u_{n+1} + 3u_n = x(n) \text{ with initial conditions } u_0 = 0, u_1 = 1$$

Using Z-transform, solve the difference equation to find the response function u_n .

Q. 3.1 Design a RC filter for below characteristic graph. Assume that all values of capacitor and resistor are available.

2.0
(CO6)



- What is the break frequency of this filter?
- What is output voltage at break frequency?
- Determine the value of the components required for this filter

Q. 3.2 Design a suitable filter for BSNL landline receiver to convert signals in audio range of 3 to 7.5 kHz. Assume nominal characteristics impedance 900Ω .

3.0
(CO6)

Q. 3.3 Design T section and Π section of a constant K type Low pass filter. Take cut off frequency 8 kHz and nominal characteristics impedance 600Ω . Calculate

4.0
(CO6)

- Attenuation constant at a frequency of 5 kHz and 10 kHz
- Phase constant at a frequency of 5 kHz and 10 kHz
- Characteristics impedance (Z_{oT})
- Frequency at attenuation of 19.1 dB

Q. 4.1 Draw the directed graph of a network for below incidence matrix.

2.0
(CO7)

$$\begin{matrix} & \begin{matrix} 1 & 2 & 3 & 4 & 5 & 6 & 7 & 8 & 9 & 10 \end{matrix} \\ \begin{matrix} p \\ q \\ r \\ s \end{matrix} & \begin{bmatrix} 0 & 0 & 1 & 1 & 1 & 1 & 0 & 1 & 0 & 0 \\ 0 & -1 & -1 & 0 & 0 & 0 & -1 & 0 & 0 & -1 \\ -1 & 1 & 0 & 0 & 0 & 0 & 0 & -1 & -1 & 1 \\ 1 & 0 & 0 & -1 & -1 & -1 & 1 & 0 & 0 & 0 \end{bmatrix} \end{matrix}$$

Q. 4.2 In below network, the number inside the brackets indicates branch numbers. Determine following particulars. (a) Draw the graph (b) select a tree with branches a, c, f and write the tie-set matrix and cut set matrix

4.0
(CO7)

