

B.TECH
(SEM III) THEORY EXAMINATION 2022-23
BASIC SYSTEM ANALYSIS

Time: 3 Hours**Total Marks: 100****Note:** Attempt all Sections. If require any missing data; then choose suitably.**SECTION A****1. Attempt all questions in brief.****2 x 10 = 20**

- a. Represent the unit impulse signal, and state its properties.
- b. Differentiate the terms 'SIGNAL' and 'SYSTEM'.
- c. What are the applications of Countinuous Finite Fourier Transform (CTFT) for network analysis?
- d. Differentiate 'Fourier Series' and 'Fourier Transform'.
- e. Find the Laplace transform of $u(t-5)$, where $u(t)$ is unit step signal.
- f. Find the Laplace transform of $u(3t)$, where $u(t)$ is unit step signal.
- g. Explain the properties of State Transmission Matrix (STM).
- h. Explain the terms- *state*, *state trajectory* and *state variables*.
- i. Justify the statement '*bilateral Z-transform of 1 doesn't exists*'.
- j. Obtain the Z-transform of $x[n] = [1, 1, 1, 1, 1]$.

SECTION B**2. Attempt any three of the following:****10x3=30**

- a. State and differentiate Force-voltage and force-current analogy.
- b. Sate and prove convolution property of Fourier transform.
- c. State and prove Initial and Final Value theorems of Laplace transform.
- d. What is STM? How to find forced response using STM? Derive the response using STM.
- e. Discuss the relation between Discrete Time Fourier Transform (DTFT) and Z-Transform.

SECTION C**3. Attempt any one part of the following:****10x1=10**

- a. For the given system $y(t) = e^{x(t)}$, examine whether it is casual, stable, linear, and time invariant system.
- b. Model the armature controlled dc motor. Convert it into one simple block.

4. Attempt any one part of the following:**10x1=10**

- a. Find the CTFT of $y(t) = e^{-at}u(t)$, where $u(t)$ denotes unit step signal and $a > 0$. Draw amplitude and phase responses.

- b. Derive the necessary relations for exponential and compact trigonometric Fourier series form.

5. Attempt any *one* part of the following:

10x1=10

- a. Find the Inverse Laplace transform of

$$Y(s) = \frac{1}{s^3 + 5s^2 + 3s + 1}$$

- b. State and prove time shifting and frequency shifting property of Laplace transform.

6. Attempt any *one* part of the following:

10x1=10

- a. Give the state space representation of the transfer function given below

$$Y(s)/X(s) = \frac{(s + 1)}{4s^3 + 15s^2 + 83s + 1}$$

- b. Explain the applications of State-Variable technique to analyze linear systems.

7. Attempt any *one* part of the following:

10x1=10

- a. Find the zero input response and zero state response for the given difference equation

$$y[n - 2] - 5y[n - 1] - 6y[n] = x[n]$$

Given $y[0]=y[-1]=y[-2]=1$

- b. Find the Z-transform of the input $y[n] = \cos\left(n\frac{\pi}{2}\right)u[n]$, where $u[n]$ denotes unit step signal.