T/K/TY

Reg. No: [redacted]

Final Assessment Test – November 2025

VIT Vellore Institute of Technology

Course: BECE202L - Signals and Systems

Class NBR(s): 0449 / 3482 / 3484 / 3485 / 3493

Slot: B2+TB2

Time: Three Hours

Max. Marks: 100

- KEEPING MOBILE PHONE/ANY ELECTRONIC GADGETS, EVEN IN 'OFF' POSITION IS TREATED AS EXAM MALPRACTICE
- DON'T WRITE ANYTHING ON THE QUESTION PAPER

COs	CO Statements
CO1	Differentiate between various types of signals and understand the implication of operation on signals
CO2	Understand terms like causal, dynamic, linear, time invariant and stability of systems. Also, students will be able to compute impulse response of both continuous time and discrete time systems.
CO3	Perform the transformation of CT and DT signals from time domain to frequency domain and understand the concept of distribution of energy as a function of frequency
CO4	Convert the CT signals to DT signals and vice versa and understand their consequences
CO5	Processing of Bandpass signals through bandpass systems
CO6	Solve differential and difference equations, with initial conditions using Laplace and Z transforms respectively.

BL – Blooms Taxonomy Level (1 – Remember, 2 – Understand, 3 – Apply, 4 – Analyse, 5 – Evaluate, 6 – Create)

Answer ALL Questions

(10 X 10 = 100 Marks)

1. a) Two continuous time signals $x_1(t)$ and $x_2(t)$ are shown in figure 1. Perform graphical addition and multiplication between those two signals. **[5] CO1 BL3**

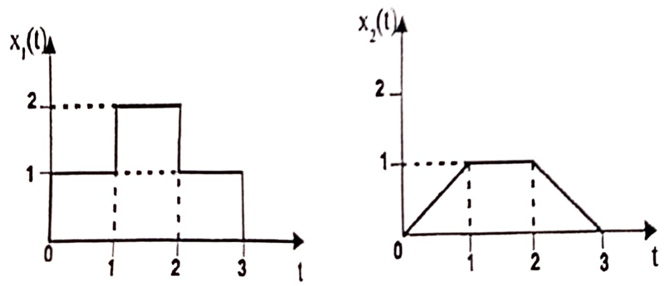


Fig.1

b) Find whether the given signal x(t) is energy signal or power signal. **[5]**

$$x(t) = \begin{cases} t-2 & ,-2 \le t \le 0 \\ 2-t\ , & 0 \le t \le 2 \\ 0\ , & otherwise \end{cases}$$

Also find the energy and power of the signal.

2. Test the Causality, Linearity, stability, Memory and Time Variance of the continuous system given below: **[10] CO2 BL2**

7|6

$$y(t) = x^2(t)$$

3. Given that, $x(t) = e^{-at}; for\ 0 \leq t \leq T\ and\ h(t) = 1; for\ 0 \leq t \leq 2T$. Find out y(t) using graphical convolution. **[10] CO2 BL3**

5

4. Sketch and find the trignometric Fourier Series of the following signal $f(x) = x^2$, over the interval $-\pi < x < \pi$ and has the period of 2π. **[10] CO3 BL3**

4|5

5.(a) An LTI system with input $x(t)$ and output $y(t)$ is characterized by the differential equation **[10] CO3 BL4**

5

$$\frac{d^2y(t)}{dt^2} + 5\frac{dy(t)}{dt} + 6y(t) = \frac{dx(t)}{dt} + x(t)$$

Find the frequency response $H(j\omega)$. Also obtain the impulse response $h(t)$ of the system.

OR

5.(b) Consider a discrete-time LTI system defined by **[10] CO3 BL4**

$$y[n] - \frac{5}{6}y[n-1] + \frac{1}{6}y[n-2] = x[n]$$

Determine the frequency response $H(e^{j\omega})$ and impulse response $h[n]$ of the above system.

6. Determine the Continuous-Time Fourier Transform (CTFT) of the following signals using suitable properties **[10] CO3 BL5**

(i) $x(t) = \frac{2}{\pi t}$ (ii) $x(t) = sgn(t-1)$

(iii) $x(t) = tsgn(t)$ where $sgn(t) = \begin{cases} +1 & if \quad x > 0 \\ 0 & if \quad x = 0 \\ -1 & if \quad x < 0 \end{cases}$

7. Determine the pre-envelope $x_+(t)$ corresponding to the signal $x(t) = sinc(t)$ where $sinc(t) = \frac{sin\pi t}{\pi t}$. **[10] CO4 BL5**

8. Consider the analog signal, $x(t) = 2\cos 2000\pi t + 5\sin 4000\pi t + 12\cos 12000\pi t$ **[10] CO5 BL4**

2

a) Determine the minimum sampling frequency required to properly reconstruct the signal at the receiver

b) Determine the discrete time signal obtained if the above signal is sampled at 5000 Hz.

c) Which effect is encountered if under-sampling is performed? Can you comment on this based on the discrete signal that you obtained in part-b.

9. a) Find the Laplace transform of the following and find the ROC? [5] CO6 BL3

$$x(t) = te^{-2|t|}$$

b) A system described by the differential equation [5]

$\frac{d^2\, y(t)}{dt^2} + 6\frac{d\, y(t)}{dt} + 8\, y(t) = \frac{d\, x(t)}{dt} + x(t)$ with initial conditions as $\frac{d\, y(0)}{dt} = 3, y(0) = 1,\ x(t) = u(t)$. Find the Transfer function and the output signal y(t).

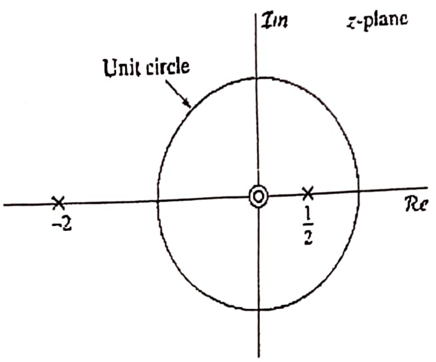
10.(a) Determine $x[n]$ of $X(z) = \frac{-1+5z^{-1}}{1-\frac{3}{2}z^{-1}+\frac{1}{2}z^{-2}}$ via inverse Z-transform with ROC [10] CO6 BL4

4+3

6 i) $|z| > 1$ ii) $|z| < \frac{1}{2}$ iii) $\frac{1}{2} < |z| < 1$.

OR

10.(b) Consider a system with impulse response $h[n]$ for which the z – transform $H(z)$ has the pole zero plot shown in the following figure. Determine the possible ROC's associated with this system and determine the stability and causality for the associated possible ROC's of the system. [10] CO6 BL4



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