

**BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI
(MID SEMESTER EXAMINATION MO/2025)**

**CLASS: BTECH
BRANCH: ECE**

**SEMESTER : III/ADD
SESSION : MO/2025**

SUBJECT: EC24207 SIGNALS AND SYSTEMS

TIME: 02 Hours

FULL MARKS: 25

INSTRUCTIONS:

1. The question paper contains 5 questions each of 5 marks and total 25 marks.
2. Attempt all questions.
3. The missing data, if any, may be assumed suitably.
4. Tables/Data handbook/Graph paper etc., if applicable, will be supplied to the candidates

- | | | CO | BL |
|--|-------|-----|----|
| Q.1(a) A signal $x(t)$ is depicted in Fig.1. Sketch the signal $y(t)=x(2t) +x(2t-3)$. | [2] | 1,2 | 1 |
| Q.1(b) i) Sketch the even and odd components of the signal given in Fig. 2. | [1.5+ | 1,2 | 1 |
| ii) Determine the energy of the signal $x(t) = e^{-a t }$. | 1.5] | | |

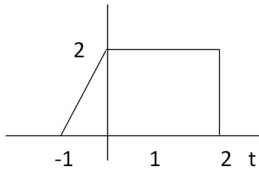


Fig.1

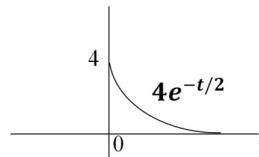


Fig. 2

- | | | | |
|--|-----|-----|---|
| Q.2(a) Determine whether the following signal is periodic and if periodic, find the fundamental period:
$x(t)=\cos(10t)+\sin(4t)$ | [2] | 1,2 | 2 |
| Q.2(b) Determine whether the following system is memoryless, stable and causal:
$y(n)=2x(n)u(n)$ | [3] | 1,2 | 2 |
| Q.3(a) Determine whether the following system is linear and time invariant:
$y(t)=x(2-t)$ | [2] | 1,2 | 1 |
| Q.3(b) Consider the interconnection of LTI systems depicted in Fig.3: | [3] | 1,2 | 3 |

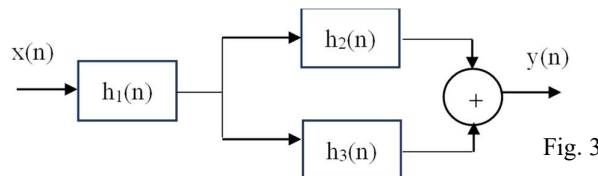


Fig. 3

where, the impulse responses are, $h_1(n)=u(n+2)-u(n-3)$, $h_2(n)=\delta(n)$, $h_3(n) = u(n-1)$. Evaluate the impulse response, $h(n)$ of the overall system.

- | | | | |
|---|-----|-----|---|
| Q.4(a) Draw the Direct Form-I representation of the following difference equation:
$y(n) + \frac{1}{2}y(n-1) - y(n-3) = 3x(n-1) + 2x(n-2)$. | [2] | 1,2 | 1 |
| Q.4(b) The impulse response of a system is given by: $h(n) = 2^n u(-n)$. Determine whether the system is memoryless, stable and causal. | [3] | 1,2 | 2 |
| Q.5(a) Determine the impulse response of an LTI system whose step response is given by,
$s(t)=e^{-2t}u(t)$. | [2] | 1,2 | 2 |
| Q.5(b) Find convolution between $x(n)=(1/2)^n u(n)$ and $h(n)=u(n)$. | [3] | 1,2 | 2 |