INSTITUTE OF TECHNOLOGY, MESRA, RANCHI
(END SEMESTER EXAMINATION)

CLASS: B.Tech.
BRANCH: EEE

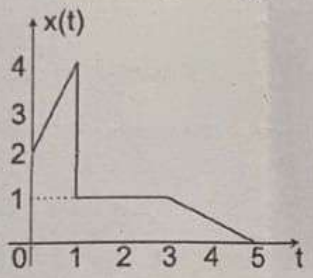
SEMESTER: IV
SESSION: SP/2023

SUBJECT: EE305 DIGITAL SIGNAL PROCESSING

TIME: 3 Hours

FULL MARKS: 50

INSTRUCTIONS:
1. The question paper contains 5 questions each of 10 marks and total 50 marks.
2. Attempt all questions.
3. The missing data, if any, may be assumed suitably.
4. Before attempting the question paper, be sure that you have got the correct question paper.
5. Tables/Data handbook/Graph paper etc. to be supplied to the candidates in the examination hall.

		Marks	CO	BL
Q.1(a)	Consider the signal $x(t) = e^{j120\pi t} + e^{j360\pi t}$. The signal $y(t) = x(5t - 25)$ is formed. Determine the Nyquist sampling rate of $y(t)$.	[2]	01 & 02	03
Q.1(b)	Let $X(\omega)$ is the Fourier transform of signal $x(t)$.  If $\int_{-\infty}^{+\infty} \lvert X(\omega)\rvert^2 d\omega = \alpha$ and $\int_{-\infty}^{+\infty} X(\omega) e^{j0.5\omega}\, d\omega = \beta$. Determine the value of $\alpha + \beta$.	[3]	01, 02 &03	03
Q.1(c)	The transfer function of a causal LTI system is $H(s) = 1/s$. If the input to the system is $x(t) = \left[\frac{\sin(t)}{\pi t}\right] u(t)$. Estimate the system output $y(t)$ as $t \to \infty$? Determine the direct Form II realization for third order IIR transfer function $H(z) = \frac{0.28z^2 + 0.319z + 0.04}{0.5z^3 + 0.3z^2 + 0.17z - 0.2}$.	[5]	03 & 04	04
Q.2(a)	Determine the z-transform of $X(z)$ of the signal. $x(n) = 0.5[n^2 + n](0.5)^{n-1} u(n-1)$	[2]	02 &03	04
Q.2(b)	Let $x(n) = \{2, 5, 0, 4\}$ and $h(n) = \{4, 1, 3\}$. Perform the linear convolution using circular convolution. Consider $Y(k)$ be a 14-point DFT of a length-14 real sequence $y(n)$. The first eight samples are given by $Y(0) = 12, Y(1) = -1 + j3, Y(2) = 3 + j4, Y(3) = 1 - j5, Y(4) = -2 + j2, Y(5) = 6 + j3, Y(6) = -2 - j3$ and $Y(7) = 10$. Evaluate the function $\sum_{n=0}^{13} e^{\frac{j4\pi n}{7}} y(n)$.	[3]	04	05
Q.2(c)	Compute the 8-point DFT of the sequence $x(n) = \cos\left(\frac{n\pi}{2}\right)$ using the DIT-FFT algorithm. Show all the intermediate values.	[5]	03	04
Q.3(a)	Write the comparison between Impulse Invariant and Bilinear Transformation technique.	[2]	01 & 02	02
Q.3(b)	Obtain the recursive relation to determine the Chebyshev polynomial. Write the key properties of Type-1 Chebyshev filter.	[3]	03	04

PTO