BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI
(MID SEMESTER EXAMINATION)

CLASS: B.Tech **SEMESTER : V/ADD**
BRANCH: ECE **SESSION : MO/2025**

SUBJECT: EC305 SIGNAL PROCESSING TECHNIQUES

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)	Prove that the cascade of a system and its inverse is an identity system	[2]	1	2
Q.1(b)	Determine the inverse of the system with impulse response $h(n = \left(\frac{1}{2}\right)^n\ u(n)$	[3]	1	2,3
Q.2(a)	Determine the z-transform and the ROC of the discrete time signal $x(n) = 0.8^n\ u(-n-1)$	[2]	1	2,3
Q.2(b)	Using the DFT-IDFT technique and not otherwise, determine the circular convolution of $x_1(n) = \{2, 1, 2, 1\}$ with $x_2(n) = \{1, 2, 3, 4\}$. Both sequences start at n = 0.	[3]	1	2,3
Q.3(a)	Calculate the percentage saving in calculation in a 512-point radix-2 FFT, when compared to direct DFT.	[2]	1	2
Q.3(b)	Sketch the direct form-II structure for the system described by the following difference equation: $$y(n) = \frac{3}{4}y(n-1) - \frac{1}{8}\,y(n-2) + x(n) + \frac{1}{3}\,y(n-1)$$	[3]	2	2
Q.4(a)	Obtain the Direct form-I realization for the system $y(n) = -0.1\,y(n-1) + 0.2\,y(n-2) + 3x(n) + 3.6\,x(n-1) + 0.6\,x(n-2)$	[2]	2	2,3
Q.4(b)	Given the system function $H(z) = \frac{2+8z^{-1}+6z^{-2}}{1+8z^{-1}+12z^{-2}}$ Realize using a ladder structure	[3]	2	2,3
Q.5(a)	Why do FIR filters have inherent linear phase characteristics?	[2]	2	2
Q.5(b)	Find the inverse z-transform of $X(z) = \frac{z^2+1}{z^2\,(z-\frac{1}{3})}$	[3]	1	2,3

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