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

CLASS: B. TECH. **SEMESTER : IV**
BRANCH: EEE **SESSION : SP/2024**

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 hand book/Graph paper etc. to be supplied to the candidates in the examination hall.

			CO	BL
Q.1(a)	Determine the Fourier transform of $f(t) = e^{-a\|t\|}\,\mathrm{sgn}(t)$.	[2]	3	5
Q.1(b)	With the help of block diagram, explain the process of analog-to-digital conversion.	[3]	1	2
Q.1(c)	Obtain the cascade and parallel realization for the system function given by $H(z) = \dfrac{1+\frac{1}{4}z^{-1}}{\left(1+\frac{1}{2}z^{-1}\right)\left(1+\frac{1}{2}z^{-1}+\frac{1}{4}z^{-2}\right)}$	[5]	2	3
Q.2(a)	Define and explain (a) Convolution (b) Correlation.	[2]	3	1,2
Q.2(b)	Find the IDFT of $X(k) = \{1, 2, 3, 4\}$	[3]	3	5
Q.2(c)	Using DIT-FFT algorithm, compute the 8-point DFT of the sequence $x(n) = 2^n$. Show all the intermediate values.	[5]	3	2,5
Q.3(a)	Comment on passband and stopband characteristics of Butterworth filter.	[2]	4	2
Q.3(b)	Convert the analog filter into a digital filter whose system function is given by $H(s) = \dfrac{s+0.2}{(s+0.2)^2+9}$. Use impulse invariant method. Assume T=1 Sec.	[3]	4	3
Q.3(c)	Design a digital Butterworth IIR filter that satisfies the following constraint using bilinear transformation. Assume T= 1 Sec. $0.9 \le \left\|H(e^{j\omega})\right\| \le 1 \quad , 0 \le \omega \le \pi/2$ $\left\|H(e^{j\omega})\right\| \le 0.2 \quad , 3\pi/4 \le \omega \le \pi$	[5]	4	6
Q.4(a)	Explain Gibb's phenomenon.	[2]	4	2
Q.4(b)	Define phase delay and group delay. Compare FIR and IIR filters.	[3]	4	1,4
Q.4(c)	Design a causal FIR digital BPF of unity gain using rectangular window whose upper and lower cut-off frequencies 1 and 2 rad/sample respectively, and length of the window M=7.	[5]	4	6
Q.5(a)	Differentiate between fixed point and floating point processors.	[2]	5	2
Q.5(b)	Explain the desirable features in a digital signal processor.	[3]	5	2
Q.5(c)	Explain Von Neumann and Harvard architectures.	[5]	5	5

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