Sardar Patel Institute of Technology

Bhavan's Campus, Munshi Nagar, Andheri (West), Mumbai-400058, India
(Empowered Autonomous College Affiliated to University of Mumbai)

MID Semester Examination

OCTOBER 2023

Max. Marks: 30
Class: M. Tech ELECTRONICS & TELECOMMUNICATION
Course Code: EC501
Name of the Course: Advanced Digital Signal Processing

Duration: 60 Min
Semester: I
Branch: EXTC

Instruction:

(1) All questions are compulsory.
(2) Use of scientific calculator is allowed.
(3) Draw neat diagram.
(4) Assume suitable data if necessary, with justification.

		Max. Marks	CO
Q.1	Answer the Multiple-choice questions:		
	a) A signal x(n) is up sampled by a factor 3, then the output y(n) is i) x(3n) ii) x(n/3) iii) $x(n^3)$ iv) $x(n^{\frac{1}{3}})$	1	CO1
	b) A signal x(n) is down sampled by a factor 2. The output y(n) is i) x(2n) ii) x(n/2) iii) $x(n^2)$ iv) $x(n^{\frac{1}{2}})$	1	CO1
	c) The aliasing due to down sampling a signal by a factor of M is about if and only if the signal x(n) is band limited to i) πM ii) $\pm\frac{\pi}{M}$ iii) $\pm\frac{\pi}{2M}$ iv) $\pm\frac{2\pi}{M}$	1	CO1
	d) If the spectrum of a sequence x(n) is $X(e^{jw})$, then the spectrum of a signal down sampled by a factor 2 i) $X(e^{jw/2})/2$ ii) $X(e^{-jw/2})/2$ iii) $X(e^{-j2w})/2$ iv) $[X(e^{jw/2}) + X(e^{-jw/2})]/2$	1	CO1
	e) The down sampler is a i) Time-invariant systems ii) Time-variant systems iii) Static systems iv) Non linear systems	1	CO1
Q.2	Obtain the Polyphase decomposition of the IIR system with Transfer function: $H(z) = \frac{1 - 4z^{-1}}{1 + 5z^{-1}}$	5	CO1
Q.3	Implement a two-stage decimator for the following specifications: Sampling rate of the input signal = 20,000 Hz M = 100 Passband = 0 to 40 Hz Transition band 40 to 50 Hz Passband ripple = 0.01 Stopband ripple = 0.002	10	CO1

Q.4	Design one-stage and two-stage interpolators to meet the following specifications: I=20 Input sampling rate: 10,000 Hz Passband: $0 \leq F \leq 90$ Transition band: $90 \leq F \leq 100$ Ripple: $\delta_1 = 10^{-2}$, $\delta_2 = 10^{-3}$	10	CO1