

K. J. Somaiya Institute of Technology, Sion, Mumbai-22
(Autonomous College Affiliated to University of Mumbai)

December 2023

B.Tech Program: Electronics And Telecommunication

Examination: TY Semester: V

Course Code: **EXC503** and Course Name: Discrete Time Signal Processing

Duration: 2.5 Hours

Max. Marks: 60

Instructions:

- (1) All questions are compulsory.
- (2) Draw neat diagrams wherever applicable.
- (3) Assume suitable data, if necessary.

Q. No.	Question	Max. Marks	CO	BT Level
Q 1	Solve any six questions out of eight:	12		
i)	Determine Zeros of following FIR system & Indicate Whether following system is minimum phase, maximum phase or mixed phase system. $H(Z) = 1 - Z^{-1} - 6Z^{-2}$	02	CO1	Evaluate
ii)	Write the proof for circular time shift property of DFT.	02	CO2	Understand
iii)	Compare Symmetric and Anti-symmetric FIR filter	02	CO3	Understand
iv)	Write short note on design of FIR filter	02	CO4	Understand
v)	Write about quantization step size	02	CO5	Understand
vi)	Define sub band coding	02	CO6	Understand
vii)	$x(n) = \{12, 5\}$ Find $X(k)$	02	CO2	Understand
viii)	What is frequency wrapping? How its effect can be eliminated?	02	CO3	Understand
Q.2	Solve any four questions out of six.	16		
i)	Sketch the frequency response and identify the filter based on their passband. $h(n) = (0.5)^n u(n)$	04	CO1	Evaluate
ii)	Compute IDFT of $X(k) = \{10, -2+2j, -2, -2-2j\}$ using FFT algorithms.	04	CO2	Understand
iii)	How to convert S to Z domain in bilinear transformation	04	CO4	Understand

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iv)	Obtain H(z) from H(s) when T= 1 sec and $H(s) = \frac{1}{s^2+2s+1}$, using Bilinear transformation	04	CO3	Evaluate
v)	The output of an A/D converter is applied to a digital filter with the system function $H(z) = \frac{0.45z}{z-0.72}$. Find the output noise power for the digital filter, When the input signal is quantized to 7 bits.	04	CO5	Understand
vi)	Write different applications of DSP and explain any one in detail.	04	CO6	Understand
Q.3	Solve any two questions out of three.	16		
i)	Draw direct form-I and form-II structure of the filter given below. $H(Z) = \frac{2+3Z^{-1}+4Z^{-2}}{1+\frac{16}{63}Z^{-1}+\frac{1}{63}Z^{-2}}$	08	CO1	Create
ii)	Compute DFT of sequence, $x(n) = \{4,3,6,8,10,4,16,0\}$	08	CO3	Apply
iii)	Design Butterworth Digital IIR low pass Filter using Bilinear Transformation by taking T = 0.1 sec to satisfy following specifications. $0.6 \leq H(e^{j\omega}) \leq 1 \quad 0 \leq \omega \leq 0.35\pi$ $ H(e^{j\omega}) \leq 0.1 \quad 0.7\pi \leq \omega \leq \pi$	08	CO5	Evaluate
Q.4	Solve any two questions out of three.	16		
i)	Compute 8-point FFT of the sequence, $x(n) = \{0,2,3,-1,1,2,4,7,-2\}$ using DIT-FFT method.	08	CO2	Evaluate
ii)	Design a linear phase FIR low pass filter using hamming window with cutoff frequency $\omega_c = 0.1 \pi$ rad/samples by taking 9 samples.	08	CO4	Create
iii)	Explain Short Time Spectral Analysis of Speech signal using DSP	08	CO6	Evaluate