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

Supplementary / ~~Regular~~ Examination: TY (B. Tech.) Program: EXTC Scheme :- II ~~Nov / Dec 2024~~ Jan/Feb 2025
Course Code: EXC503 and Course Name: Discrete Time Signal Processing Semester: V
Date of Exam: ~~02/12/2024~~ 08/02/2025 Duration: 02.5 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 **two** questions out of three: (05 marks each)	10		
a)	Sketch the frequency response and identify the following filters based on their pass band. $H(Z)=\frac{z-1}{z+1}$		CO1	U
b)	An analog filter transfer function is $H(s)=\frac{2}{s^2+3s+2}$ Determine H(Z) using Bilinear Transformation technique for T=1 second.		CO3	A
c)	Explain DTMF analysis.		CO6	U
Q 2	Solve any **two** questions out of three: (05 marks each)	10		
a)	Calculate DFT of x(n)={2,4,5,3,6,8,0,12}		CO2	U
b)	Differentiate FIR and IIR filter with		CO3	A
c)	For second order IIR filter, $H(z)=\frac{1}{(1+0.5z^{-1})(1-0.45z^{-1})}$ Study the effect of shift in pole location with 3-bit coefficient representation in direct form.		CO5	A
Q.3	Solve any **two** questions out of three. (10 marks each)	20		
a)	Draw direct form-I and form-II structure of the filter given below. $H(Z)=\frac{0.1768-0.5305Z^{-1}+0.5305Z^{-2}-0.1768Z^{-3}}{1-0.0732Z^{-1}+0.3348Z^{-2}-0.0067Z^{-3}}$		CO4	A

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b)	Explain application of DSP processor in bio medical applications.		CO6	U
c)	A discrete time invariant linear system is described by the difference equation, $y(n) = 2\,x(n) + x(n-1)$ obtain Impulse Response, Frequency Response, Sketch Magnitude and Phase Response		CO1	U
Q.4	Solve any **two** questions out of three. (10 marks each)	20		
a)	An LTI system is characterized by the difference equation $y(n)=0.68\,y(n-1)+0.15x(n)$. The input signal $x(n)$ has a range of -5V to +5V, represented by 8-bits. Find the quantization step size, variance of the error signal and variance of quantization noise at the output.		CO5	A
b)	Design a linear phase FIR high pass filter using hamming window with cutoff frequency $\omega c = 0.8\,\pi$ rad/samples by taking 7 samples.		CO2	U
c)	Design a Butterworth digital IIR low pass filter using Bilinear Transformation by taking T = 0.5 second, to satisfy following specifications. $0.707 \le \lvert H(e^{j\omega})\rvert \le 1 \qquad 0 \le \omega \le 0.45\pi$ $\lvert H(e^{j\omega})\rvert \le 0.2 \qquad 0.65\,\pi \le \omega \le \pi$		CO3	A

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