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

Subject Code: EXC503 Subject Name: Discrete Time Signal Processing Date:07/12/22

Nov – Dec 2022
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)	Classify given FIR filter impulse responses as minimum, maximum or mixed phase system. $H(Z)=\frac{\left(Z-\frac{1}{2}\right)\left(Z-\frac{1}{4}\right)}{\left(Z-\frac{1}{3}\right)\left(Z-\frac{1}{5}\right)}$	02	CO1	U
ii)	Compare DTFT and DFT.	02	CO2	U
iii)	What are the advantages of digital filter over analog filter?	02	CO3	U
iv)	Write the equations of Hamming window and Rectangular window.	02	CO4	U
v)	What is the effects of aliasing? How it is reduced?	02	CO5	U
vi)	List the various applications of Digital Signal processing.	02	CO6	U
vii)	Find circular convolution of sequence, $x(n) = \{1,2,3,4\}$ and $h(n) = \{2,1,2,1\}$	02	CO2	Ap
viii)	Find the digital transfer function H(z) by using impulse invariant method for the analog transfer function. $H(s) = \frac{1}{s+1}$ Assume T = 1sec	02	CO3	Ap
Q.2	**Solve any four questions out of six.**	**16**		
i)	FIR filter is described by difference equation $y(n) = x(n) + x(n-4)$. Compute and sketch magnitude response.	04	CO1	E
ii)	Compute IDFT of $X(k)= \{10, -2+2j, -2, -2-2j\}$ using FFT algorithms.	04	CO2	E

iii)	Show a mapping from S plane to Z Plane using Bilinear Transformation Technique.	04	CO3	U
iv)	Differentiate FIR and IIR filter.	04	CO4	U
v)	Explain the quantization effects due to truncation and rounding with example.	04	CO5	U
vi)	Explain application of DSP processor in ECG signal analysis.	04	CO6	U

Q.3 Solve any two questions out of three. **16**

i)	A two pole low pass filter has the system function $H(Z) = \frac{b_0}{(1-pZ^{-1})^2}$ Determine the values b_0 and p such that the frequency response H(ω) satisfies the condition H(0) = 1 and $\left\|H\left(\frac{\pi}{4}\right)\right\|^2 = \frac{1}{2}$	08	CO1	U
ii)	An 8 point sequence is given by x(n) = {2,1,2,1,1,2,1,2}. Compute 8 point DFT of x (n) by DIT FFT algorithm. Show the calculations for all the stages.	08	CO3	Ap
iii)	Sketch the frequency response and identify the following filter based on their passband. $h(n) = (0.5)^n u(n)$	08	CO5	U

Q.4 Solve any two questions out of three. **16**

i)	Explain and prove cyclic property of Twiddle Factor. Determine the matrix of Twiddle Factor for 4 point.	08	CO2	Ap
ii)	Design a linear phase FIR high pass filter using Hamming window with cut-off frequency ωc = 0.8 π rad/samples and N = 7.	08	CO4	Cr
iii)	What is DTMF (dual tone multifrequency frequency)? Explain how it works?	08	CO6	U