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BEC502

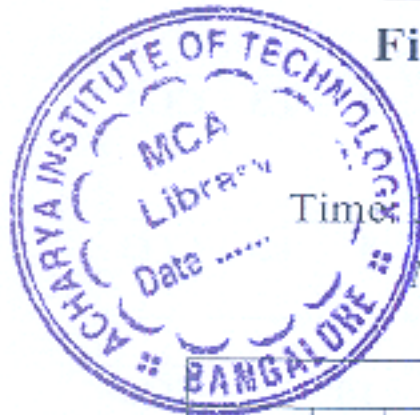
Fifth Semester B.E./B.Tech. Degree Examination, June/July 2025

Digital Signal Processing

Time: 3 hrs.

Max. Marks: 100

Note: 1. Answer any FIVE full questions, choosing ONE full question from each module.
2. M : Marks, L: Bloom's level, C: Course outcomes.



Module – 1				M	L	C
Q.1	a.	Define signals and systems. Briefly explain any two classifications of signals.		6	L1	CO1
	b.	Determine whether the following signals are periodic or not? If periodic determine the fundamental period. i) $x(n) = \cos \frac{\pi n}{2} \cos \frac{\pi n}{4}$ ii) $x(n) = \cos(100\pi n) + \sin(5\pi n)$		8	L2	CO1
	c.	Determine the even and odd components of figure Q1(c)		6	L2	CO1
Fig Q1(c)						
OR						
Q.2	a.	Define the following with an example causal system, memoryless system and linear system.		6	L1	CO1
	b.	Verify the following system are Linear, time in variant, causal stable $y(n) = ax(n)+b$		6	L2	CO1
	c.	Determine the response of the system if $x(n) = \{1, 2, 3, 1\}$ $h(n) = \{1, 2, 0, -1\}$.		8	L2	CO2
Module – 2						
Q.3	a.	Analyze the given function to calculate the Z-transform and indicate ROC. $x(n) = \alpha^n; \alpha < 1$.		8	L3	CO2
	b.	Write a program to compute N-point DFT of a given sequence (without using built in function) and to plot the magnitude and phase spectrum.		8	L3	CO3
	c.	Find the DFT of the sequence $x(n) = \cos\left(\frac{n\pi}{4}\right)$.		4	L2	CO3

OR				
Q.4	a.	Find the Z-transform of the signal $x(n) = n\left(\frac{1}{3}\right)^n u(n)$	8	L2 CO2
	b.	Write a program to compute linear and circular convolution of any two sequences using DFT and IDFT.	8	L3 CO3
	c.	Compute the IDFT of sequence $x(k) = \{10, -2 + 2j, -2, -2 - 2j\}$	4	L3 CO3
Module – 3				
Q.5	a.	State and prove the multiplication property of DFT.	10	L2 CO3
	b.	Let $h(n) = \{1, 1, 1\}$ and $x(n) = \{3, -1, 0, 1, 3, 2, 0, 1, 2, 1\}$. Obtain the output $y(n)$ using overlap save method.	10	L3 CO3
OR				
Q.6	a.	State and prove the property of Parseval's theorem.	10	L2 CO3
	b.	Compute the 8-point DFT of the sequence $\{1, 2, 3, 4, 4, 3, 2, 1\}$ using DIT FFT.	10	L3 CO3
Module – 4				
Q.7	a.	For the given system function. Draw the direct form and cascade form. $H(z) = 1 + 5/2z^{-1} + 2z^{-2} + 2z^{-3}$	10	L2 CO4
	b.	Design a high pass FIR filter using hamming window. Give $W_c = 1$ rad/sec and $M = 7$.	10	L3 CO4
OR				
Q.8	a.	The linear phase FIR filter frequency response is $H[e^{jw}] = e^{j3w} [2 + 1.8 \cos 3w + 1.2 \cos 2w + 0.5 \cos w]$. Find impulse response sequence of the filter.	10	L3 CO4
	b.	With the equations, sketch the spectrum of following windows. i) Rectangular ii) Bartlett iii) Hanning	10	L2 CO4
Module – 5				
Q.9	a.	From the given difference equation obtain the equation for $H(z)$ and Also, realize it using Direct form – I and Direct form – II $y(n) = -0.1y(n-1) + 0.2y(n-2) + 3x(n) + 3.6x(n-1) + 0.6x(n-2)$.	10	L2 CO5
	b.	Explain the Analog filters translation using Low pass prototype transformation.	10	L2 CO5
OR				
Q.10	a.	Write a program to Design and Implement i) IIR Butterworth low pass filter ii) IIR Butterworth high pass filter	10	L3 CO5
	b.	Design a digital Butterworth filter with the following specifications. $0.707 \leq H(e^{jw}) \leq 1; 0 \leq w \leq 0.5\pi$ $ H(e^{jw}) \leq 0.2; 0.75\pi \leq w \leq \pi$ Determine system function $H(z)$ for a Butterworth filter using bilinear transformation.	10	L3 CO5