

# CBCS SCHEME - Make-Up Exam

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BEC502

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

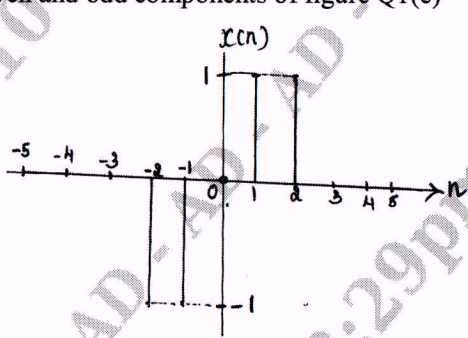
## Digital Signal Processing

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
<b>Q.1</b>	<b>a.</b>	Define signals and systems. Briefly explain any two classifications of signals.	6	L1	CO1
	<b>b.</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
	<b>c.</b>	Determine the even and odd components of figure Q1(c) <div style="text-align: center;">  <p style="text-align: center;">Fig Q1(c)</p> </div>	6	L2	CO1
<b>OR</b>					
<b>Q.2</b>	<b>a.</b>	Define the following with an example causal system, memoryless system and linear system.	6	L1	CO1
	<b>b.</b>	Verify the following system are Linear, time in variant, causal stable $y(n) = ax(n)+b$	6	L2	CO1
	<b>c.</b>	Determine the response of the system if $x(n) = \{1, 2, 3, 1\}$ $h(n) = \{1, \frac{2}{3}, 0, -1\}$ .	8	L2	CO2
<b>Module – 2</b>					
<b>Q.3</b>	<b>a.</b>	Analyze the given function to calculate the Z-transform and indicate ROC. $x(n) = \alpha^{ n };  \alpha  < 1.$	8	L3	CO2
	<b>b.</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
	<b>c.</b>	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