

Max. Marks: 100

2. *M*: Marks, *L*: Bloom's level, *C*: Course outcomes.

Module – 1			M	L	C
Q.1	a.	Estimate the signal $x[n]$ in terms of its odd and even components.	4	L2	CO1
	b.	Classify whether each of the following signal is periodic or not. If periodic determine its fundamental period: i) $x_1(n) = \cos(2n)$ ii) $x_2(n) = \sin(3\pi n)$	6	L2	CO1
	c.	Predict whether the given system $y[n] = x[n] + nx[n + 1]$ is static / dynamic, linear or non linear, time invariant or time variant, causal or non causal and stable or unstable. Justify your statements.	10	L3	CO1
<b>OR</b>					
Q.2	a.	Distinguish between continuous and discrete signal. Compute the convolution of two finite sequence $x[n] = [-1, 4, 2, 1]$ and $h[n] = [1, 2, 3, 5]$ .	10	L2	CO1
	b.	Write a program to perform the following operations on i) signal addition and ii) multiplication.	4	L3	CO1
	c.	Interpret whether each of the following signal is energy or power signal: i) $x(n) = 1;  n  \leq 1$ $= 0; \text{ otherwise}$ ii) $x(n) = u(n)$	6	L3	CO1
<b>Module – 2</b>					
Q.3	a.	Calculate Z transform and ROC of the sequence $x(n) = a^n u(n)$ .	5	L2	CO2
	b.	Write a program to compute N-point DFT and plot magnitude and phase spectrum.	5	L2	CO2
	c.	Interpret the process of frequency domain sampling and reconstruction of discrete time signals.	10	L2	CO2
<b>OR</b>					
Q.4	a.	Describe any 5 properties of Z-transform with respect to ROC. Explain the periodicity and linearity DFT property.	10	L2	CO2
	b.	Compute 4-point DFT of the signal $x[n] = [0, 1, 2, 3]$ using matrix method.	4	L2	CO2
	c.	Develop the equation for DFT of multiplication of 2 sequences.	6	L3	CO2

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## Module – 3

Q.5	a.	Explain the circular time shift property.	5	L2	CO3
	b.	Calculate the circular convolution using the following sequences $x_1[n] = [2, 1, 2, 1]$ and $x_2[n] = [1, 2, 3, 4]$ .	5	L2	CO3
	c.	Compute the 8-point DFT of the sequence $x[n] = [1, 1, 0, 0, -1, -1, 0, 0]$ using DIT-FFT algorithm.	10	L2	CO3

## OR

Q.6	a.	Calculate the output $y[n]$ of a filter whose impulse response is $h[n] = [3, 2, 1, 1]$ and the input signal to the filter $x[n] = [1, 2, 3, 3, 2, 1, -1, -2, -3, 5, 6, -1, 2, 0, 2, 1]$ using overlap add method. Assuming the length of block as 7.	10	L3	CO3
	b.	An FIR filter has the impulse response of $h[n] = [1, 2, 3]$ . Determine the response of the input $x[n] = [1, 2]$ . Use DFT and IDFT and verify the result using direct computation of linear convolution.	10	L3	CO3

## Module – 4

Q.7	a.	Determine the filter coefficients $h_d(n)$ and $h(n)$ frequency response of low pass FIR filter for the desired frequency response. $H_d(e^{j\omega}) = e^{-j2\omega} \quad  w  < \pi/4$ $= 0 \quad \frac{\pi}{4} <  w  < \pi$ using the rectangular window with window length $M = 5$ .	10	L3	CO4
	b.	Explain the Gibb's phenomenon.	4	L2	CO4
	c.	Realize the linear phase FIR filter with the following impulse response and give necessary equations $h(n) = \delta(n) + \frac{1}{2}\delta(n-1) - \frac{1}{4}\delta(n-2) + \frac{1}{2}\delta(n-3) + \delta(n-4)$	6	L3	CO4

## OR

Q.8	a.	Develop a high pass FIR filter using Hamming window with cutoff frequency of 1.2 rad/sec and $N = 9$ .	10	L3	CO4
	b.	Construct direct and cascade realization of system function $H(z) = 1 + \frac{5}{2}z^{-1} + 2z^{-2} + 2z^{-3}$	10	L3	CO4

## Module – 5

Q.9	a.	Summarize how the first order analog low pass filter prototype is transformed into a different types of filter.	5	L2	CO2
	b.	Discuss the general mapping properties of Bilinear transformation and show the mapping between the s-plane and z-plane.	5	L2	CO5

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	c.	Build a second order digital Lowpass Butter worth filter with a cutoff frequency of 3.4 kHz at a sampling frequency of 8000 Hz. Draw the direct form – II structure of this filter use bilinear transformation.	10	L3 CO5
OR				
Q.10	a.	Illustrate the following digital systems using direct form – I and direct form – II $y(n) = \frac{3}{4}y(n-1) - \frac{1}{8}y(n-2) + x(n) + \frac{1}{2}x(n-1)$	10	L3 CO5
	b.	The normalized lowpass filter with a cut off frequency of 1 rad/sec is given as $H_p(s) = \frac{1}{s+1}$ use a given $H_p(s)$ and the BLT to design a corresponding digital IIR lowpass filter with a cut off frequency of 50 Hz and a sampling rate of 90 Hz.	10	L3 CO5

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