Semester:5th	Department of Electronics and Communication Engineering	AY: 2026-27
Course Code: BEC502	Course Name: Digital Signal Processing	

Question Bank

Q.	Module-01	M	L	C
1.	Determine the energy and power of the unit step sequence.	10	L3	CO1
2.	Consider an LTI system with input x(n) & unit impulse response h(n) given below, Compute y(n), x(n) = 2n u(-n) & h(n) = u(n).	10	L3	CO1
3.	Define signal with example. Explain Classification of signals with examples also define Elementary Discrete-Time Signals	10	L2	CO1
4.	Determine the response of the following systems to the input signal x(n) = |n| -3 ≤ n ≤ 3 0 , otherwise a) y(n) = x(n) b) y(n) = x(n-1) c) y(n) = x(n+1) d) y(n) = 1/3 [x(n+1) + x(n)+x(n-1)]	10	L2	CO1
5.	The impulse response of a linear time-invariant system is h (n) = {1, 2, 1, -1}. Determine the response of the system to the input signal x (n) = {1, 2, 3, 1}	10	L3	CO1
6.	Define system with example. Explain Classification of Discrete- Time system with examples	10	L2	CO1
7.	Describe basic elements of a digital signal processing system.	10	L1	CO1
8.	Determine if the system described by the following input-output equations are linear or non linear y(n) = nx(n) y(n)= x(n2) y(n) =x2(n) y(n) = Ax(n) +B	10	L2	CO1
9.	Explain the analysis of discrete-time linear time -invariant systems.	10	L1	CO1
10.	Explain the response of LTI systems to arbitrary inputs : the convolution sum.	10	L3	CO1
	Module-02			
11.	Determine the z-transform of the signal x(n) = α n u(n) = n , n ≥ 0 , n < 0 x(n) = - α n u(-n-1) = 0, n > 0 - α n , n ≤ -1	10	L2	CO2
12.	Determine the z-transforms of the following finite-duration signals. x1(n) = {1, 2, 5, 7, 0, 1} (b) x2(n) = {1, 2, 5, 7, 0, 1} ↑ ↑	10	L3	CO2
13.	Mention the properties of Z transform with equations	10	L2	CO2
14.	Perform Circular convolution of the following sequences using concentric circle method: x1(n) = {2, 1, 2, 1} , x2(n) = {1, 2, 3, 4}.	10	L3	CO2
15.	Find the DFT of the sequence x(n) = δ(n) + 2δ(n − 2) + δ(n − 3).	10	L3	CO2
16.	Explain Frequency Domain Sampling and Reconstruction of Discrete Time Signals with the help of necessary equations.	10	L2	CO2
17.	Compute 4-point DFT of the sequence given by x(n)=cos(nπ/4)	10	L3	CO2
18.	1. Linearity Property 2. Circular Time shift property 3.Periodicity Property	10	L2	CO2
19.	1. Circular Frequency shift property 2. Time Reversal Property	10	L2	CO2
20.	Show that multiplication of the DFTs of two sequences is equivalent to the circular convolution of the two sequences in the time – domain	10	L2	CO2
	Module-03			

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21.	State and prove the following properties: i) Circular Time shift Property ii) Circular Frequency shift Property iii) Parsevals theorem iv) Complex conjugate property v) time reversal of a sequence	10	L2	CO3
22.	Use the 8 point radix-2 DIT-FFT algorithm to find the DFT of the sequence x(n)={1,1,1,1,0,0,0,0}.	10	L3	CO3
23.	Illustrate the Inverse Decimation in Time FFT algorithm with the help of necessary equations and signal flow representation	10	L2	CO3
24.	Using linear convolution find y(n)= x(n) h(n) for the sequences x(n)={1, 2, -1, 2, 3, -2, -3, -1, 1, 1, 2, -1} & h(n)={1, 2}. Compare the result by solving the problem using overlap save & overlap add method	10	L3	CO3
25.	Develop radix – 2, DIT – FFT algorithm and write signal flow graph for $N = 8$.	10	L2	CO3
26.	Find the 8-point DFT of the sequence $x(n)$ = {-1, 0, 2, 3, -4, -2, 0, 5} using Radix-2 DIT – FFT algorithm.	10	L3	CO3
27.	Given X(k) = {1, j4, 1, -j4}, find x(n) using Radix-2 DIT – FFT algorithm	10	L3	CO3
28.	What do you mean by computational complexity? Compare the direct computation and FFT algorithms. In the direct computation of 32-point DFT of x(n), How many i) Complex multiplications (ii) Complex additions ii) Real multiplications. iv) Real Additions v) Trigonometric function evaluations are required	10	L2	CO3
29.	Given X(k)= [0, j4, 0, -j4]. Find x(n) using Radix 2 DIT FFT algorithm	10	L3	CO3
30.	Comparison between computation of DFT using direct method and using FFT algorithms	10	L3	CO3
	Module-04			
31.	The desired frequency response of a low pass filter is given by Hd(ejω) = Hd(ω) = e-j3ω , |ω| < 3π/4 0 , 3 π /4 < | ω | < π Determine the frequency response of the FIR filter if Hamming window is used with M=7.	10	L3	CO4
32.	Mention different windows with equations used in design of FIR filters Realize the system function H(z) = 1 + 3/2 z−1 + 4/5 z−2 + 5/9 z−3+	10	L2	CO4
33.	1/9 z−4 using direct form . A filter is to be designed with the desired frequency response Hd(ejω)	10	L2	CO4
34.	= Hd(ω) = 0 , - π/4 < ω < π/4 e-j2ω , π /4 < | ω | < π. Find the frequency response of the FIR filter designed using a rectangular window defined below: wR(n) = 1 , 0 ≤ n ≤ 4 , otherwise	10	L3	CO4
35.	Mention the Design steps followed in design of Linear Phase FIR Filter.	10	L2	CO4
36.	Realize a cascade form FIR filter for the following system function. H(z) = (1+ ¼ z−1+ z−2) (1+⅛ z−1+ z−2).	10	L3	CO4
37.	The frequency response of the linear phase FIR filter is given by H(ejw)= ejw [2+1.8cos3w + 1.2cos2w + 0.5cosw]. Find the impulse response sequence of the filter	10	L3	CO4
38.	Explain the characteristics of practical frequency selective filter.	10	L3	CO4
39.	Explain symmetric and asymmetric FIR filter.	10	L3	CO4
40.	The frequency response of the linear phase FIR filter is given by H(ejw)= e-3jw [5+3.2 cos3w + 4.8 cos2w + 1.6 cosw]. Find the impulse response sequence of the filter	10	L3	CO4
	Module-05			
41.	Design a digital lowpass Butterworth filter with the following specifications: 1. 3	10	L3	CO5

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	dB attenuation at the passband frequency of 1.5 kHz 2. 10 dB stopband attenuation at the frequency of 3 kHz 3. Sampling frequency of 8,000 Hz.			
42.	The normalized low pass filter with a cutoff frequency of 1 rad/sec is given as: HP(s) = 1/(s+1) Use the given Hp(s) and the BLT to design a corresponding digital IIR lowpass filter with a cutoff frequency of 15 Hz and a sampling rate of 90 Hz.	10	L3	CO5
43.	Explain Bilinear Transformation design procedure in designing IIR filters.	10	L2	CO5
44.	Obtain analog lowpass prototype transformation to the low pass, high pass, band pass filter, band stop filters.	10	L2	CO5
45.	Obtain direct form I and direct form II for the system described by y (n) = −0.1y (n − 1) + 0.2y (n − 2) + 3x(n) + 3.6 x(n − 1) + 0.6 x(n-2)	10	L3	CO5
46.	Given the following IIR filter: y(n) = 0.2x(n) +0.4x(n-1)+0.5y(n-1), Determine the transfer function, nonzero coefficients, and impulse response	10	L2	CO5
47.	Design a Butterworth filter using bilinear transformation for the following specification: $0.8 \leq \lvert H(ejw)\rvert \leq ;0 \leq w \leq 0.2 \lvert H(ejw)\rvert \leq 0.2;0.6 \leq w \leq \pi$	10	L2	CO5
48.	Compare analog with digital filter	10	L2	CO5
49.	The system function of the order normalized low pass filter is H(s) =3/S+5. Obtain the system function of second order band pass filter having pass band from 1 kHz to 3.5kHz	10	L2	CO5
50.	Compare IIR and FIR filters. Explain impulse invariance method of designing IIR filter. Hence show that mapping results in many-to-one-mapping on unit circle	10	L2	CO5

***Note:**

1. All modules should contain a minimum of **10** questions each and the total number of questions must be **50**.
2. Questions can carry marks of 06, 07, 08, 09, 10 and for problems: 04 or 05.
3. Follow the RBTL as per the keywords used to frame the questions.
4. Maintain the Course Outcomes (COs) as per the syllabus.
5. M: Marks, L: RBTL, C:COs.

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