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VIVEKANANDHA COLLEGE OF ENGINEERING FOR WOMEN  
 [AUTONOMOUS INSTITUTION AFFILIATED TO ANNA UNIVERSITY, CHENNAI]  
 Elayampalayam – 637 205, Tiruchengode, Namakkal Dt., Tamil Nadu.

**Question Paper Code: 70044**

B.E. / B.Tech. DEGREE END-SEMESTER EXAMINATIONS – JAN. 2025

Fourth / Fifth Semester

Electronics and Communication Engineering  
 U19EC411 - DIGITAL SIGNAL PROCESSING  
 (Common to Biomedical Engineering)  
 (Regulation 2019)

Time: Three Hours

Maximum: 100 Marks

Answer ALL the questions

Knowledge Levels (KL)	K1 – Remembering	K3 – Applying	K5 - Evaluating
	K2 – Understanding	K4 – Analyzing	K6 - Creating

PART – A

(10 x 2 = 20 Marks)

Q.No.	Questions	Marks	KL	CO
1.	If $X(k) = \{5, -5\}$ is the 2-point DFT of a discrete sequence $x(n)$ then determine the sequence $x(n)$ ?	2	K4	CO1
2.	What is the number of complex multiplications and complex additions needed to compute 1024-point DFT using decimation-in-frequency radix-2 FFT algorithm?	2	K4	CO1
3.	State the properties of Butterworth filter.	2	K1	CO2
4.	Write the frequency transformation formula to convert analog lowpass filter into analog bandpass filter.	2	K2	CO2
5.	What are the significant advantages and disadvantages of FIR filter?	2	K1	CO3
6.	What are the desirable characteristics to be considered on the choice of the window function for designing FIR filter?	2	K2	CO3
7.	What is meant by rounding? What is the error that arises due to rounding in floating-point numbers?	2	K2	CO4
8.	What is meant by overflow limit cycle oscillations?	2	K1	CO4
9.	What is pipelining? What are the different stages in pipelining?	2	K2	CO5
10.	What is meant by up sampling process?	2	K2	CO5

PART – B

(5 x 13 = 65 Marks)

Q.No.	Questions	Marks	KL	CO
11. a)	i. Determine the 6-point DFT of the sequence $x(n) = \{1, -3, 2, 5, 6\}$ .	8	K3	CO1
	ii. State and prove circular convolution property of DFT.	5	K2	CO1
	(OR)			
b)	Determine linear convolution of the sequence $h(n)=\{3, -2, 5\}$ with $x(n) = \{1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15\}$ using overlap and save method.	13	K3	CO1
12. a)	Design a digital second order lowpass IIR filter with Butterworth characteristics for the cut-off frequency of 2.6kHz at a sampling frequency of 8kHz. Use bilinear transformation technique.	13	K3	CO2
	(OR)			
b)	Obtain direct form-I, direct form-II, cascade and parallel realizations of the discrete-time LSI system described by the difference equation $y(n)-0.75y(n-1)+0.125y(n-2) = x(n)+ (1/3)x(n-1)$	13	K3	CO2
13. a)	Design a length-13 linear phase FIR bandpass filter using Hamming window function. The lower cut-off frequency and upper cut-off frequency are 1000Hz and 3000Hz, respectively, and assume a sampling frequency of 8000Hz. Realize the filter using direct form structure.	13	K4	CO3
	(OR)			
b)	Design a linear phase FIR lowpass filter with 11 coefficients using frequency sampling method. The cut-off frequency of the filter is 3400 Hz and assume a sampling frequency of 8000Hz. Realize the designed filter using linear phase structure.	13	K4	CO3
14. a)	Determine the effect of coefficient quantization on pole locations for the following system function when it is realized, by considering 4 bits, in	13	K4	CO4
	i. direct form-II realization and ii. cascade realization			

$$H(z) = \frac{1}{1 - 0.65z^{-1} + 0.1z^{-2}}$$

(OR)

