

**B.E/B.TECH DEGREE EXAMINATIONS: NOV /DEC 2024**

(Regulation 2014)

Fifth Semester

**U14ECT511: DIGITAL SIGNAL PROCESSING**

(COMMON TO EIE / CSE / IT)

**COURSE OUTCOMES****CO1:** Understand and analyze the characteristics of discrete signals and systems**CO2:** Apply mathematical tools for signal / system analysis**CO3:** Design digital filters**CO4:** Learn the architecture and features of P-DSPs**Time: Three Hours****Maximum Marks: 100****Answer all the Questions:-  
PART A (10 x 1 = 10 Marks)**

1. Match the Signals in List I with their Z Transforms in List II

CO1 [K<sub>3</sub>]

List I	List II
A. Impulse sequence	i. $z/z-1$
B. Step signal	ii. 1
C. $x(-n)$	iii. $1/1-az^{-1}$
D. $a^n u(n)$	iv. $X(z^{-1})$

	A	B	C	D
a)	i	ii	iii	iv
b)	iv	iii	ii	i
c)	ii	i	iv	iii
d)	ii	iii	i	iv

2. A real valued signal  $x(n)$  is said to be symmetric if,CO1 [K<sub>2</sub>]

- |                    |                    |
|--------------------|--------------------|
| a) $x(n) = -x(n)$  | b) $x(x+N) = x(n)$ |
| c) $x(-n) = -x(n)$ | d) $x(-n) = x(n)$  |

3. The symmetric and antisymmetric impulse response of the linear phase FIR filters is/are CO3 [K<sub>2</sub>]
- (i)  $h(n) = -(M-1-n)$   
(ii)  $h(n) = (M-1-n)$   
(iii)  $h(n) = -(M+1-n)$   
(iv)  $h(n) = (M+1-n)$
- a) i,ii b) ii,iii  
c) iii,iv d) iii only
4. The number of multiplications needed in FFT for 64 point sequence is CO3 [K<sub>3</sub>]
- a) 192 b) 164  
c) 132 d) 64
5. Assertion (A): The Laplace Transform reduces to Fourier Transform on the imaginary axis in the S-Plane CO2 [K<sub>2</sub>]  
Reason (R): Z Transform reduces to Fourier Transform on the unit circle in the complex Z-Plane
- a) Both A and R are Individually true and R is the correct explanation of A b) Both A and R are Individually true but R is not the correct explanation of A  
c) A is true but R is false d) A is false but R is true
6. In DFT if N is large, then \_\_\_\_\_ CO3 [K<sub>2</sub>]
- a) resolution in time and frequency is high b) resolution in time and frequency is low  
c) resolution in frequency is high d) resolution in time is high
7. Consider the following statements and arrange the sequence of steps to sketch the signal  $x(-n+5)$  CO1 [K<sub>2</sub>]
1. time shifting  
2. draw the signal  $x(n)$   
3. fold  $x(n)$  about  $n=0$
- a) 1-3-2 b) 3-2-1  
c) 2-1-3 d) 2-3-1

8. The Multiply Accumulate with Data Shift operation requires \_\_\_\_\_ number of memory access per instruction cycle. CO4 [K<sub>2</sub>]
- a) one b) two  
 c) three d) four
9. Assertion (A): The filters using finite samples of  $h(n)$  are called FIR filters CO3 [K<sub>2</sub>]  
 Reason (R): FIR filters are unstable systems
- a) Both A and R are Individually true and R is the correct explanation of A b) Both A and R are Individually true but R is not the correct explanation of A  
 c) A is true but R is false d) A is false but R is true
10. Decimator is used to \_\_\_\_\_ CO4 [K<sub>2</sub>]
- a) Increase the sampling rate b) Decrease the sampling rate  
 c) Multiply the sampling rate d) Divide the sampling rate.

**PART B (10 x 2 = 20 Marks)**  
**(Answer not more than 40 words)**

11. Calculate the average power of the signal,  $x(n) = u(n)$  CO1 [K<sub>3</sub>]
12. How the even and odd components of a signal are mathematically expressed? CO1 [K<sub>2</sub>]
13. State the relationship between Z transform and Discrete Time Fourier Transform CO2 [K<sub>2</sub>]
14. Define ROC. List down the properties of ROC CO2 [K<sub>2</sub>]
15. Write the forward and backward analysis equation of DFT CO3 [K<sub>2</sub>]
16. How many multiplications and additions are required to compute N-point DFT using radix 2 FFT? CO3 [K<sub>2</sub>]
17. Explain Gibb's phenomenon in Digital Filters CO3 [K<sub>2</sub>]
18. Distinguish between IIR and FIR filter CO3 [K<sub>2</sub>]
19. Recall the advantage of multirate signal processing CO4 [K<sub>2</sub>]
20. Mention the types of special addressing modes used in DSP architectures CO4 [K<sub>2</sub>]

**Answer any FIVE Questions:-**  
**PART C (5 x 14 = 70 Marks)**  
**(Answer not more than 300 words)**

**Q.No. 21 is Compulsory**

21. Explain Sampling theorem. Summarize how sampling can be done with an impulse function. Draw the spectrum of sampled signal and explain aliasing. Also explain the process of reconstructing the signals from its samples. CO1 [K<sub>2</sub>]
22. Check whether the following system is Linear, Time invariant, Static, Causal and Stable system. CO2 [K<sub>3</sub>]
- (i)  $y(n) = nx(n)$                       (ii)  $y(t) = x^2(t)$
23. a) State and prove the Multiplication property of Z Transform (7) CO2 [K<sub>2</sub>]  
b) Find the inverse Z Transform of  $X(Z) =$  (7) CO2 [K<sub>3</sub>]
24. Compute the DFT for the sequence  $x(n)=\{1, 2, 3, 4, 4, 3, 2, 1\}$  using DIT-FFT algorithm and plot the magnitude and phase spectrum CO3 [K<sub>3</sub>]
25. The desired response of a LPF is CO3 [K<sub>3</sub>]
- $$H_d(e^{j\omega}) = \begin{cases} e^{-j3\omega}, & -3\pi/4 \leq \omega \leq 3\pi/4 \\ 0, & 3\pi/4 \leq |\omega| \leq \pi \end{cases}$$
- Determine the frequency response of the FIR filter for  $M=7$ , using Rectangular window
26. a). Realize the system given by difference equation (8) CO3 [K<sub>3</sub>]  
 $y(n) = -0.1y(n-1) + 0.72y(n-2) + 0.7x(n) - 0.252x(n-2)$  in Direct form II  
b). If  $H(S) =$  , find  $H(Z)$  using impulse invariance method for  $T=1$  sec (6) CO3 [K<sub>3</sub>]
27. a). Explain Von Neumann and Harvard architecture for the computer. Which architecture is preferred for DSP applications? Why? (7) CO4 [K<sub>2</sub>]  
b). What is instruction pipelining? With an example explain how pipelining increases the throughput (7) CO4 [K<sub>2</sub>]

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