

**Gandhi Institute of Engineering and Technology University, Odisha, Gunupur
(GIET University)**



M.Tech. (First Semester – Regular/Supplementary) Examinations, January – 2026
**24MVLPE11021 – Real Time Signal Processing Systems
(ECE-VLSI)**

Time: 3hrs

Maximum: 60 Marks

Answer ALL questions

(The figures in the right hand margin indicate marks)

PART – A

(2 x 5 = 10 Marks)

	CO #	Blooms Level
Q.1. Answer ALL questions		
a. State any two properties of the DFT.	CO1	K1
b. State the need for efficient computation of DFT.	CO2	K2
c. Write the difference equation of an FIR filter of order M.	CO3	K2
d. Define bilinear transformation method.	CO4	K2
e. Define interpolation.	CO5	K1

PART – B

(10 x 5 = 50 Marks)

Answer ALL the questions

	Marks	CO #	Blooms Level
2. a. Compute the DFT of a given discrete-time sequence and interpret the magnitude spectrum (procedure-oriented answer).	5	CO1	K3
b. Explain the relationship between DFT and Z-transform. Show how DFT can be obtained from Z-transform evaluations on the unit circle. (OR)	5	CO1	K4
c. Explain circular convolution using DFT. Derive how linear convolution can be obtained using zero-padding and DFT.	5	CO1	K5
d. Discuss practical issues in DFT-based spectral analysis: picket-fence effect, leakage, scalloping loss, and mitigation methods.	5	CO1	K5
3.a. Explain linear filtering using DFT: overlap-add and overlap-save methods. Mention when each method is preferred.	5	CO2	K4
b. Explain the Goertzel algorithm and show how it efficiently computes selected DFT bins. Discuss advantages and limitations. (OR)	5	CO2	K4
c. Design a procedure to compute the N-point FFT of a sequence, including bit-reversal and stage-wise butterflies.	5	CO2	K6
d. Discuss fixed-point implementation issues of FFT (scaling, overflow, quantization noise) and typical remedies.	5	CO2	K5
4.a. Explain linear-phase FIR filter structures and show how symmetry/antisymmetry reduces multiplications.	5	CO3	K4
b. Explain frequency sampling realization of FIR filters. Provide steps to implement using sampled frequency response. (OR)	5	CO3	K4
c. Given H(z), design an appropriate realization (direct/cascade/parallel) and justify based on stability and numerical issues.	5	CO3	K6
d. Discuss implementation concerns in discrete-time systems: overflow, limit cycles, coefficient quantization, and scaling.	5	CO3	K5

5.a.	Design a digital IIR filter using bilinear transformation for given specifications (procedure-based explanation).	5	CO4	K6
b.	Explain FIR filter design using the window method. Derive $h[n]$ from the ideal response and apply windowing.	5	CO4	K4
	(OR)			
c.	Compare IIR and FIR filter design methods in terms of phase, stability, complexity, and implementation suitability.	5	CO4	K5
d.	Discuss trade-offs in window method (main-lobe width vs side-lobe level). Compare Rectangular, Hamming, and Blackman windows.	5	CO4	K5
6.a.	Describe DSP device architecture concepts (TMS320C6x): pipelining, memory hierarchy, and MAC operations relevant to real-time DSP.	5	CO5	K3
b.	Explain the steps in real-time system development: requirements, algorithm, fixed-point considerations, testing, and deployment.	5	CO5	K4
	(OR)			
c.	Discuss programming and debugging flow using Code Composer Studio and DSP/BIOS for a real-time DSP application.	5	CO5	K4
d.	Propose a mini project for real-time DSP (e.g., audio equalizer, tone detection, ECG denoising). Provide block diagram and implementation plan.	5	CO5	K6

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