Hall Ticket No | | | | | | | | | | |

Question Paper Code: AECC33

INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)
Dundigal-500043, Hyderabad

B.Tech VI SEMESTER END EXAMINATIONS (REGULAR) - JULY 2023
Regulation: UG-20
DIGITAL SIGNAL PROCESSING

Time: 3 Hours **ELECTRONICS AND COMMUNICATION ENGINEERING** **Max Marks: 70**

Answer ALL questions in Module I and II
Answer ONE out of two questions in Modules III, IV and V
All Questions Carry Equal Marks
All parts of the question must be answered in one place only

MODULE – I

1. (a) Summarize the classifications of systems with example. Enumerate the properties of LTI system. [BL: Understand| CO: 1|Marks: 7]

   (b) Find the cascade realization of the system described by the difference equation
   $y(n) + \frac{1}{16}y(n-1) + \frac{1}{6}y(n-2) - \frac{1}{24}y(n-3) - \frac{1}{16}y(n-4)$ [BL: Apply| CO: 1|Marks: 7]

MODULE – II

2. (a) State and prove circular convolution property in DFT. Write the differences between DFT and FFT. [BL: Understand| CO: 2|Marks: 7]

   (b) A 8 point sample in which output is bit reversed and the computation block in the butterfly diagram has two inputs which are combined to give two outputs. The twiddle factors are computed for 8 point sample. Design a suitable FFT architecture to interconnect the 2-point, 4-point and 8-point DFT. [BL: Apply| CO: 2|Marks: 7]

MODULE – III

3. (a) Write the properties of bilinear transformation. Develop an expression for transfer function of Chebyshev filter. [BL: Understand| CO: 3|Marks: 7]

   (b) Design a Chebyshev high pass filter using bilinear transformation for the following specifications $\omega_p = 0.2\pi\ rad/sec$, $\omega_s = 0.01\pi\ rad/sec$, $\alpha_p = -1dB$, $\alpha_s = -10dB$. [BL: Apply| CO: 3|Marks: 7]

4. (a) Obtain the relationship between analog and digital filter in impulse invariant transformation. [BL: Understand| CO: 4|Marks: 7]

   (b) Design a Butterworth digital low pass filter using impulse invariant technique with pass band frequency 200 Hz, stop band frequency 500 Hz. The pass band and stop band attenuation are -5dB and -12dB. The sampling frequency is 5000 Hz. [BL: Apply| CO: 4|Marks: 7]

MODULE – IV

5. (a) Enumerate the design procedure for designing FIR filter using Parks-McClellan algorithm. [BL: Understand| CO: 5|Marks: 7]

(b) Build an ideal differentiator with frequency response H($e^{j\omega}$)=jω, $|\omega| \leq \pi$ using rectangular window with N=9. [BL: Apply| CO: 5|Marks: 7]

6. (a) Determine the expression for anti-symmetric impulse response with the length of the filter be odd. [BL: Apply| CO: 5|Marks: 7]

(b) Develop a MATLAB code to determine the impulse response of FIR bandpass filter using Hamming window and plot the frequency response. [BL: Understand| CO: 5|Marks: 7]

MODULE – V

7. (a) Obtain an expression for round-off noise power due to product quantization. [BL: Understand| CO: 6|Marks: 7]

(b) Calculate the dead band of the filter characterized by the difference equation $y(n) = 0.95y(n-1) + x(n)$. The system is excited by an input x(n)=0.75 for n=0 and x(n)=0 for $n \neq 0$. [BL: Apply| CO: 6|Marks: 7]

8. (a) Summarize the methods to prevent overflow limit cycle. List the applications of multirate DSP. [BL: Understand| CO: 6|Marks: 7]

(b) An LTI system is characterized by the difference equation $y(n) = 0.68y(n-1) + 0.15x(n)$. The input signal has a range of -5V to +5V, represented by 8-bits. Find the quantization step size, variance of the error signal and variance of quantization noise at the output. [BL: Apply| CO: 6|Marks: 7]

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