

Roll No

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J-303[6012A]

[2126]

B.Tech. (Semester - 6th & 7th)

DIGITAL SIGNAL PROCESSING (EC - 308)

Time : 03 Hours



Maximum Marks : 60

Instruction to Candidates:

- 1) Section - A is **compulsory**.
- 2) Attempt any **Four** questions from Section - B.
- 3) Attempt any **Two** questions from Section - C.

Section - A

Q1)

(10 x 2 = 20)

- a) Define a discrete time unit sequence function.
- b) Plot the derivative of the function $x(t) = \sin c(t)$.
- c) Find the signal energy of the signal $x(t) = u(t) - u(10-t)$.
- d) What are the applications of z-transform?
- e) What are the conditions for the region of convergence of a noncausal LTI system?
- f) What is the linearity property of DTFT?
- g) Define transfer function of a system.
- h) Define Radix-2 FFT algorithm.
- i) What is the importance of windowing?
- j) Compare the performance of FIR filter and IIR filter.

Section - B

(4 x 5 = 20)

- Q2) Differentiate between a recursive and non-recursive system. Determine if the recursive system defined by the difference equation $y(n) = ay(n-1) + x(n)$ is linear.

P.T.O.

Q3) Define the stability conditions for a linear time invariant system. Determine the range of values of 'a' for which the LTI system with impulse response $h(n)$ as defined below is stable.

$$h(n) = a^n, n \geq 0, n \text{ even}$$

0, elsewhere.

Q4) Determine the causal signal $x(n)$ if its z-transform $X(z)$ is given by

$$X(z) = \frac{1 + 3z^{-1}}{1 + 3z^{-1} + 2z^{-2}}$$

Q5) State the Goertzel algorithm and give its importance.

Q6) Describe the magnitude and phase response of FIR filters. How is linear phase FIR filter defined?

Section - C

(2 x 10 = 20)

Q7) Determine the cascade and parallel realizations for the system described by the system function

$$H(z) = \frac{10 \left(1 - \frac{1}{2}z^{-1}\right) \left(1 - \frac{2}{3}z^{-1}\right) (1 - 2z^{-1})}{\left(1 - \frac{3}{4}z^{-1}\right) \left(1 - \frac{1}{8}z^{-1}\right) \left[1 - \left(\frac{1}{2} + j\frac{1}{2}\right)z^{-1}\right] \left[1 - \left(\frac{1}{2} - j\frac{1}{2}\right)z^{-1}\right]}$$

Q8) (a) What are quantization errors in FFT algorithms?

(b) Define circular convolution. How can linear convolution be realized using circular convolution?

Q9) What are the limitations of IIR filter design by impulse invariance method?

How are they overcome by bilinear transformation method?

Convert the analog filter with system function

$$H(s) = \frac{s + 0.1}{(s + 0.1)^2 + 16}$$

into digital IIR filter by means of bilinear transformation.

