Total No. of Questions :12]

SEAT No. :

P2946

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T. E. (Computer)

DIGITAL SIGNAL PROCESSING

(2008 Course) (Semester - I)

Time : 3 Hours] *[Max. Marks :100*

Instructions to the candidates:

1) ***Answers to the two sections should be written in separate answer books.***
2) ***Answer any three questions from each section.***
3) ***Neat diagrams must be drawn wherever necessary.***
4) ***Figures to the right side indicate full marks.***
5) ***Use of Calculator is allowed.***
6) ***Assume Suitable data if necessary.***

SECTION - I

Q1) a) Explain the ADC process as sampling, quantization and coding. **[9]**

b) Define $\partial(n)$ and u(*n*). Prove that $u(n)=\sum_{k=0}^{\infty}\partial(n-k)$. **[4]**

c) With example explain stability property of DT system. **[5]**

OR

Q2) a) Obtain a linear convolution of DT signal **[8]**

$x_1(n)=\{1, 0, -\underset{\uparrow}{2}, 1\}$ and $x_2(n)=\{-\underset{\uparrow}{1}, 2, -1, 1\}$

b) State and explain the sampling theorem. **[8]**

c) Define analog and digital signal. **[2]**

Q3) a) State DFT, IDFT and describe any two important properties of the same. **[12]**

b) Sketch the fourier transform of $\delta(n)$ and find the 5-point DFT of $\delta(n)$. **[4]**

OR

P.T.O.

Q4) a) Write a note on overlap-save and overlap-add algorithm. **[12]**

b) Find $x((n+2))_5$ and $x((-n))_5$ for the sequence $x(n) = \{1, 2, 3, 4\}$. **[4]**

Q5) a) Find the inverse z of: $X(z) = \frac{z}{z-1}$ $|z| > 1$. **[8]**

b) Derive the first stage of DIT FFT algorithm. **[8]**

OR

Q6) a) Obtain the inverse z transform using partial fraction expansion method

$$X(z) = \frac{1}{(z-1)(z-3)}.$$ **[8]**

b) Determine the z - transform and ROC of the signal: **[8]**
$x(n) = [3.\ (4^n) - 4.\ (2^n)]\ u(n)$.

SECTION - II

Q7) a) Determine the output $y(n)$ of a system with impulse response $h(n) = (0.5)^n\ u(n)$ to input signal $x(n) = u(-n)$. **[8]**

b) The system function of a causal LTI system is, $H(z) = \frac{1-z^{-1}}{1+\frac{3}{4}z^{-1}}$. **[8]**

Find the impulse response of the system. Also check is the system stable or not?

OR

Q8) a) Explain the method of simple geometric interpretation to obtain the frequency response of DT system. **[8]**

b) Determine H(z) and draw a pole zero plot for **[8]**

$$y(n) = x(n) - x(n-1) - \frac{1}{2}y(n-1).$$

Q9) a) Explain Gibb's phenomenon associated with FIR filter design. What are the desirable features of window function to improve the frequency response? **[8]**

b) Explain the relationship of s-plane to z-plane. What are the disadvantages of impulse invariance method. **[8]**

OR

Q10)a) Explain the design steps of FIR filter using rectangular window. State the advantages of windowing method. **[8]**

b) A digital filter has frequency specification as: **[8]**

Passband frequency = $\omega_p = 0.2\pi$.

Stopband frequency = $\omega_s = 0.3\pi$ and sampling time = $T_s = 1$.

What are the corresponding specifications for passband and stopband frequencies in analog domain if,

i) Impulse invariance techniques is used for designing

ii) Bilinear transformations is used for designing.

Q11)a) Explain the direct form structure of FIR filter. **[8]**

b) Explain cascade form structure for IIR systems and realize the following system function for the same. **[10]**

$$H(z) = \frac{1 + \frac{1}{5}z^{-1}}{\left(1 - \frac{1}{2}z^{-1} + \frac{1}{3}z^{-2}\right)\left(1 + \frac{1}{4}z^{-1}\right)}.$$

OR

Q12)a) Explain desirable features of DSP processor. **[6]**

b) Explain parallel form structure for IIR systems and realize the following system function for the same. **[12]**

$$H(z) = \frac{3z(5z-2)}{\left(z + \frac{1}{2}\right)(3z-1)}.$$