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[Total No. of Questions: 09]

[Total No. of Pages: 02]

Uni. Roll No. .....

Program/ Course: B.Tech. (Sem. 5th)
Name of Subject: Digital Signal Processing
Subject Code: BTEC – 502
Paper ID: A2104

Time Allowed: 03 Hours

Max. Marks: 60

NOTE:

1) **Section-A** is **compulsory**
2) Attempt any **four** questions from **Section-B** and any **two** questions from **Section-C**
3) Any missing data may be assumed appropriately

Section – A

Q1. **[Marks: 02 each]**

a) Check whether the following system is linear and time invariant.

$$F[x(n)] = a[x(n)]^2 + bx(n)$$

b) Differentiate between linear and circular convolution.

c) Discuss one advantage and one disadvantage of digital signal processing.

d) Define the Region of Convergence of z-transforms ?

e) What do you mean by the one sided z-transforms ? What is use of these transforms in DSP ?

f) Derive the system function expression of a general LTI system described by the following equation:

$$y(n) = -\sum_{k=1}^{N} a_k y(n-k) + \sum_{k=0}^{M} b_k x(n-k)$$

g) Explain the importance of serial form structures used for IIR digital systems.

h) Compare FIR filters with IIR filters.

i) What do you mean by finite precision effects ?

j) How digital signal processors differ from general purpose processors ?

Section – B

[Marks: 05 each]

Q2. Find the unit step response of a linear time-invariant system having unit impulse response *h(n)* defined as

$$h(n) = a^n, \qquad |a| < 1 \quad and \quad n \geq 0$$

Q3. Derive the Radix-2 decimation-in-time FFT algorithm for calculating the DFT of an 8-point sequence.

Q4. Determine the z-transform and ROC of signal *x(n)* defined as

$$x(n) = \left(\frac{1}{3}\right)^n u(n) - \left(\frac{1}{2}\right)^n u(-n-1)$$

Q5. Explain window method of FIR filter design.

Q6. Determine the causal signal *x(n)* having the z – transform

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

Section – C

[Marks: 10 each (05 for each sub-part, if any)]

Q7. Find the total response of the system described by the difference equation

$$y(n) + 2y(n-1) + y(n-2) = x(n) + x(n-1)$$

for the input signal $x(n) = (1/2)^n u(n)$, with initial conditions $y(-1) = y(-2) = 1$.

Q8. Determine H(z) using the impulse invariant technique for the analog system function

$$H(s) = \frac{1}{(s+0.5)(s^2+0.5s+2)}$$

Q9. Draw and explain the architecture of a digital signal processor of ADSP series.

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