[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 **[Marks: 02 each]**

Q1.

a) Determine the z-transform of the signal

$$x(n) = \alpha^n u(n) + b^n u(-n-1)$$

b) What are the advantages of Digital Signal Processing over Analog Signal Processing?

c) Discuss properties of linear convolution

d) Differentiate between fixed-point and floating-point numbers

e) How do you define causal discrete-time systems?

f) Discuss the properties of the Region of Convergence (ROC) of z-transforms

g) Explain causal and non-causal LTI systems. Give examples of each

h) What is frequency warping in Bilinear transformation?

i) Explain the significance of barrel shifter in ADSP

j) What are the advantages of direct form-II realization over direct form-I realization in IIR filters?

Section – B **[Marks: 05 each]**

Q2. Determine if the following systems are time-invariant or time-variant.

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

(ii) $y(n) = x(-n)$

Q3. Explain impulse invariance method of IIR filter design

Q4. Determine the inverse z-transform of

$$X(z) = \frac{1}{1-1.5\,z^{-1}+0.5z^{-2}}$$

when

(i) ROC: $|z| > 1$

(ii) ROC: $|z| < 0.5$

Q5. Explain the lattice structures of FIR systems

Q6. Determine the zero-input response of the system described by the homogeneous second-order difference equation

$$y(n) - 3\,y(n-1) - 4\,y(n-2) = 0$$

consider $y(-1) = 5$ *and* $y(-2) = 0$

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

Q7. Find the DFT of a sequence x(n) = { 1,2,3,4,4,3,2,1} using DIT algorithm

Q8. 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 $x(n) = \left(\frac{1}{2}\right)^n u(n)$ with the initial conditions $y(-1) = y(-2) = 1$

Q9. Draw and explain block diagram of a TMS series digital signal processor

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