



Reg. No. :

Name :

**Seventh Semester B.Tech. Degree Examination, November 2013
(2008 Scheme)**

08.703 : DIGITAL SIGNAL PROCESSING (E)

Time : 3 Hours

Max. Marks : 100

PART – A



(40 Marks)

Answer all questions.

1. Test the periodicity of the following signals. If periodic, obtain the fundamental period.

i) $y(t) = \sin \frac{\pi}{4} t + \cos \frac{\pi}{5} t$

ii) $x[n] = \sin \frac{1}{5} n.$

2. Obtain the DTFT of the sequence

$x[n] = \{1, 2, 1, -2, -1\}$
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3. Explain the process of sampling of a continuous time signal. What is meant by aliasing in a band limited signal ? How can it be avoided ?

4. Explain the significance of region of convergence of z transforms. How does the ROC influence the conversion of a discrete time signal from z domain to time domain.

5. State initial value theorem of z transforms. $x[n]$ is a causal sequence with

$X(z) = \frac{3z^{-1} + 2z^{-2}}{3 - z^{-1} + z^{-2}}$. Find $x[0]$.

6. What is meant by frequency domain sampling ?

7. Explain divide and conquer approach for the computation of DFT using FFT.

8. Compare IIR and FIR filters.



9. Why do we design digital filters, through analog filter transfer function rather than directly ?
10. Compare the impulse invariance and bilinear transformation techniques, on the design of IIR digital filters. **(10×4=40 Marks)**

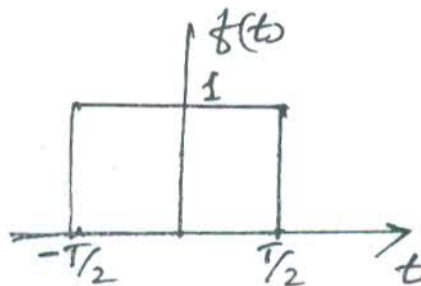
PART – B

Answer **any one** full question from **each** Module.

Module – I

11. a) Differentiate between Fourier Series and Fourier Transform, Obtain the Fourier transform of the gate function given below.

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- b) Define the following properties of a discrete time system. Also check for the property of the system given along with it.

i) Linearity : $y[n] = x[n - nd]$ $nd > 0$

ii) Time Invariance : $y[n] = n(x[n])^2$

iii) Causality : $y[n] = \sum_{k=n}^{\infty} x[k]$.

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OR

12. a) Obtain DTFT of the sequence

$$x[n] = \frac{1}{2} \left[\left(\frac{1}{2} \right)^n + \left(\frac{1}{4} \right)^n \right] u[n]$$



- b) The sequence, $x[n] = \cos\left(\frac{\pi}{4}n\right)$ for $-\infty < n < \infty$ is obtained by sampling $x(t) = \cos \omega t$, $-\infty < t < \infty$ at a sample rate of 1000 samples/sec. What are the two possible values of ω that would have resulted in $x[n]$.
- c) Determine the output sequence of a LTI system, whose impulse response is given by $h[n] = \{1, 2, 1; -1\}$ for an input sequence $x[n] = \{1, 2, 3, 1\}$.
- d) Test the stability of the system described by $y[n] = x[n] + k y[n - 1]$.

(5x4=20 Marks)

Module – II

13. a) Find the z transform and region of convergence

i) $x[n] = n^2 u[n]$

ii) $x[n] = n$ for $n = 0, 1, 2$ and $x[n] = -n$ for $n \geq 3$

iii) $x[n] = \begin{cases} (0.5)^n \cdot n & n \geq 0 \\ 0 & n < 0 \end{cases}$



10

b) Obtain the inverse z transform

i) $X_{(z)} = \frac{1}{1 - 1.2z^{-1} + 0.2z^{-2}}$ for ROC $|z| > 1$ and $|z| > \frac{1}{5}$.

ii) $X_{(z)} = \frac{z}{3z^2 - 4z + 1}$ for ROC $|z| > 1$, $|z| < \frac{1}{2}$ and $\frac{1}{3} \leq z \leq 1$.

10

OR

14. a) Develop the signal flow graph of N-point decimation – In – Time, Radix – 2 FFT algorithm for $N = 8$, giving all relevant steps involved.

10

b) Obtain the DFT of the sequence $x[n] = \{0, 1, -1, 1, -1, 1, -1, 0\}$ using the above signal flow graph, giving all intermediate results.

10



Module – III

15. a) Obtain the direct form I, direct form II, cascade and parallel realization structures for the system described by

$$y[n] = 0.1 y[n-1] + 0.2 y[n-2] + 3x[n] + 3.6x[n-1] + 0.6x[n-2] \quad 16$$

- b) Obtain the realization of the linear phase FIR system given by 4

$$H(z) = 1 + \frac{2}{3}z^{-1} + \frac{15}{8}z^{-2} + \frac{2}{3}z^{-3} + z^{-4}$$

OR

16. a) Explain the properties of any two types of window functions used in the design of FIR filters. 8

- b) Design an ideal low pass filter whose desired frequency response given by

$$H_d(e^{j\omega}) = \begin{cases} 1 & \frac{\pi}{3} \geq \omega \geq -\frac{\pi}{3} \\ 0 & \pi \geq |\omega| \geq \frac{\pi}{3} \end{cases}$$

- using Hanning Window and determine (i) the impulse response for $N = 9$ and (ii) $H(z)$. 12