



**T.E. (Computer Engineering) (Semester - I) Examination, 2011**  
**DIGITAL SIGNAL PROCESSING**  
**(2008 Pattern) (New)**

Time: 3 Hours

Max. Marks: 100

*Instructions :* 1) Attempt Q. 1 or Q. 2, Q. 3 or Q. 4, Q. 5 or Q. 6 from Section I. Attempt Q. 7 or Q. 8, Q. 9 or Q. 10, Q.11 or Q.12.

2) Answers to the **two** Sections should be written in separate answer books.

3) Neat diagrams must be drawn **wherever** necessary.

4) Black figures to the **right** indicate **full** marks.

5) Assume suitable data, **if** necessary.



SECTION - I

1. a) Calculate linear convolution using graphical method for the given discrete time signals.

$$x(n) = u(n) - u(n - 4)$$

$$h(n) = 2\delta(n) + \delta(n - 2) - 3\delta(n - 3).$$

8

- b) Define impulse response of a system. How stability and causality can be described in terms of impulse response ? Test it for the system having following equation.

$$y(n) = x(n) + 3x(n - 4).$$

8

OR

2. a) The following two inputs are sampled with the sampling frequency of 40Hz. Find the corresponding discrete time signals and comment on the result.

$$x_1(t) = \cos 20\pi t$$

$$x_2(t) = \cos 100\pi t$$

8

- b) Define following discrete time systems with example.

i) Linear

ii) Causal

iii) Stable

iv) Time Invariant.

8



3. a) Explain circular shifting of sequences. Prove that the multiplication of two DFTs of two sequences is equivalent to circular convolution of two sequences in time domain. 8

b) State and prove following properties of Fourier transform 8

i) Time Reversal

ii) Time shifting

OR

4. a) Compare F.T. and D.F.T.

Find the DFT of the sequence

$$x(n) = 0.5^n u(n) \quad 0 \leq n \leq 3. \quad \text{8}$$

b) Write a note on overlap-save and overlap-add algorithms. 8

5. a) Derive first stage of Radix-2 DIT (Decimation In time)FFT algorithm. Draw signal flow graph for  $N = 8$ . 10

b) Obtain z transform of signal  $x(n) = -a^n u(-n - 1)$ . Specify ROC and find out another sequence having the same zT. Comment on the result. 8

OR

6. a) How N point DFT can be obtained using Goertzel algorithm as a response of the system ? Apply it to obtain 4 point DFT for  $x(n) = \{1, 1\}$  10

b) Using power series method for determining Inverse z transform (IzT) of

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

for

i) ROC  $|z| > 1$

ii) ROC  $|z| < 0.5$ . 8

