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Total number of printed pages – 2

B. Tech  
CPEC 5302

## Fifth Semester (Special) Examination – 2013

### DIGITAL SIGNAL PROCESSING

BRANCH CODE : EC

QUESTION CODE : D 274

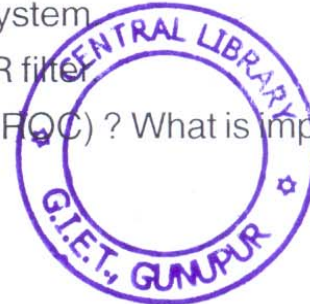
Full Marks – 70

Time : 3 Hours

Answer Question No. 1 which is compulsory and any **five** from the rest.

The figures in the right-hand margin indicate marks.

1. Answer the following questions : 2×10
- (a) What is aliasing effect ? How it can be avoided ?
  - (b) Express  $x(n)$  in terms of impulse function  $\delta(n)$  when  $X(n) = \{1, 3, 2, 1\}$ .
  - (c) State the conditions of stability for causal LTI system
  - (d) Draw the basic structure of 1<sup>st</sup> order digital FIR filter.
  - (e) What do you mean by region of convergence (ROC) ? What is importance in discrete time system ?
  - (f) Why FIR filters are inherently stable ?
  - (g) State time shifting property of DFT.
  - (h) How many real multiplication and addition is required for computation of 8-point DFT using decimation in time algorithm ?
  - (i) Find the impulse response the LTI system shown below :  
 $Y(n) = 0.5x(n-1) + 2x(n)$
  - (j) What are different bands in a digital filter ? At which band an ideal filter is distortion less ?
2. (a) Determine the transient and steady state response of the system described by 5  
 $x(n) = y(n-1) + 2y(n-2)$   
When a unit step function is applied to the system.



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- (b) Find out auto correlation of the following signal 5  
 $x(n) = a^n u(n) \quad 0 < a < 1$   
 Where  $u(n)$  the unit step is applied to the discrete time system.
3. (a) Find inverse Z-transform of 5  
 $X(z) = \log(1 - 2z) \quad |z| > |a|$
- (b) Determine the range values of parameter  $a$  for which the LTI system with impulse response 5  

$$x(n) = \begin{cases} a^n & n \geq 0, \\ 0 & \text{otherwise} \end{cases}$$
 $n$  is even  
 $n$  is odd  
 Is stable
4. (a) Convert the analog filter with the system function 6  

$$H(s) = \frac{s+0.1}{(s+0.1)^2 + 9}$$
 Into a digital IIR filter using impulse invariance method. The digital filter is to have resonant frequency of 0.2.
- (b) Establish the relation between  $\omega$  and  $\Omega$  using bilinear transformation. And then, bring out a mapping between them. 4
5. (a) Consider the casual system 6  
 $Y(n) = 0.75y(n-1) - 0.125y(n-2) + x(n) + 0.3x(n-1)$   
 Obtain direct form I and form II structure of the system.
- (b) Explain how the IIR filter is designed from analog filter using bilinear transformation method. 4
6. (a) Establish the inverse Z-transform of  $X(Z)$  using Contour integration. 5  
 (b) State and prove scaling property of Z-transform. 5
7. (a) Explain Decimation in Time FFT algorithm. 5  
 (b) Prove that convolution of two signals in discrete time domain is equal to multiplication in discrete frequency domain. 5
8. Write short notes on any **two** of the following : 5×2  
 (a) System Modeling  
 (b) Linear phase FIR filter by frequency sampling method  
 (c) Adaptive Line Enhancer  
 (d) Minimum Mean Square Error Criterion.