B. Tech – $6^{th}$

SS – II

**Time : 3 hrs**

**Full Mark – 70**

(Answer any six questions including question no. 1 which is compulsory)

The figure in the right hand margin indicate marks

1. Answer the following (2X10)
   a. Determine whether or not the following signal is periodic. In case of the periodic signal specify the fundamental period. $x(n) = 3 \cos (5 n + \pi /6)$
   b. If $x (n) \leftrightarrow X (z)$, prove $x (-n) \leftrightarrow X (z^{-1})$ .
   c. How many real multiplication and real additions are required for the computation of N – point DFT ?
   d. Determine the power and energy of the unit step sequence.
   e. Give the direct form-I for third order system.
   f. Show whether the system is
      i. Linear/ nonlinear
      ii. TV/ TIV
      $y(n) = x(n^2)$
   g. Compare circular convolution with linear convolution.
   h. What is twiddle factor?
   i. Write two advantages of FIR filter over IIR filter.
   j. What is periodogram? What is its unity?

2. (a) Determine the zero-input response of the system described by the difference equation $y(n) – 3y(n-1) – 4y(n-2) = 0$ . Take $y(-1) = 5$ and $y(-2) = 0$ (5)

   (b) Determine the particular solution of the difference equation (5)
   $y(n) = 5/6y(n-1) – 1/6y(n-2) + x(n)$ where $x(n) = 2^n$ , $n \geq 0$ .

3. (a) State and explain stability criteria of Z- transform. (5)

   (b) Using long division find the inverse Z- transform of: (5)

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

   If **i**. x (n) is causal and **ii**. x(n) is anti-causal

4. (a) An FIR filter has the unit impulse response sequence, h (n) = {1,0,1}. (5)
Determine the output sequence in response to the input sequence,
X(n) = {-1,2,-1,0,1,3,-2,1,-3,-2,-1,0,-2} using the overlap-add method .

(b) Determine the circular convolution of the sequence: (5)
$x_1(n)$= {1,3,5,2} & $x_2(n)$= {7,3,6,2}
↑ ↑
using the time-domain formula.

5. (a) Derive the radix-2 DIT FFT algorithm and draw the N = 8 flow graph. (5)

(b) Find the DFT of a sequence x(n) = {1,2,3,4,4,3,2,1} using DIT algorithm. (5)

6. (a)
i. Draw and explain magnitude response of a practical low pass filter. (2x2.5)
ii. An ideal digital filter is not realizable physically, justify .

(b) Discuss window based design method for designing of FIR filter. (5)

7. (a ) Formulate Bilinear Transformation. Discuss its mapping characteristic and its advantages and disadvantages. (5)

(b) Design a single pole low pass digital filter with a 3 dB bandwidth of $0.2\pi$, using the bilinear transformation applied to the analog filter (5)
$H(s) = \frac{\Omega c}{s+\Omega c}$

8. (a) Using impulse invariance method, obtain the digital transfer function. (6)
$H_a(s) = \{1/(s+0.5)(s^2+0.5s+2)\}$. Assume T = 1 sec
(b) Draw the corresponding IIR filter structure. (2)
(c) Define ‘analog frequency’ and ‘digital frequency’. (2)

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