B.E./B.TECH. Degree Examination, December 2020

Semester – VI

EC16651-DIGITAL SIGNAL PROCESSING

(Regulation 2016)

Time: Three hours Maximum : 80 Marks

Answer **ALL** questions

PART A - (8 X 2 = 16 marks)

1. Which one of the following system is a Dynamic?

   a. $y(n) = \sin x(n)$ b. $y(n) = x^2(n)$ c. $y(n) = \log x(n)$ d. $y(n) = x(n)+x(n+2)$

2. In an N-point sequence, if N=16, the total number of complex additions and multiplications using radix-2 FFT are

   a) 64 and 80

   b) 80 and 64

   c) 64 and 32

   d) 24 and 12

3. In DIT-FFT, input sequence are

   a) Bit Reversed

   b) Not Bit Reversed

   c) Bit Reversed then divided by N

   d) None of the mentioned

4. How many multipliers are required in Linear phase realization of FIR Filter if M is even?

   (a) (M/2)-1 (b) M (c) M/2 (d) (M/2)+1

5. Find Z-transforms of x(n) = {2,4,6,8,1}.

6. What is the significance of FFT in computation of Discrete Fourier Transform?

7. How to digitize the transfer function of an analog filter?

8. What is the fixed point representation of decimal number 0.69?[assume total number of bits = 6]

PART B - (4 X16 = 64 marks)

09. (a) (i) Find Z-transform of the following signal **(8)**

   (a) $x(n)=[3(2^n)-4(3^n)]u(n)$ (b) $x(n)=(1/2)^n u(-n)$

   (ii) Find Inverse Z-transform of **(8)**

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

(OR)

   (b) Check whether the following systems are Static, Causal, Linear and shift Invariant or not. **(16)**

   (a) $y(n) = e^{x(n)}$ (b) $y(n) = x^2(n)$

10. (a) (i) Using FFT-DIF algorithm, find 8-point DFT of **(12)**

$$x(n)=\{0.5, 0.5, 0.5, 0.5, 0, 0, 0, 0\}$$

(ii) Find 4-point IDFT of $X(k) =\{6, -2+j6 ,2, -2-j6\}$ using DIT algorithm **(4)**

(OR)

(b) (i) Find 4-point DFT of $x(n) = \{1,-2,3,4\}$ using analysis equation of DFT. **(8)**

(ii) Find Circular Convolution of $x(n)=\{1,2,0,1\}$ and $h(n)=\{2,2,1,1\}$ **(8)**

11. (a) (i) Convert the following analog function to digital function using Bilinear transformation method **(8)**

$$H(s) = 1 / [(s^2+7s+10)] \text{ with } T=1 \text{ second.}$$

(ii) Determine the system function of IIR digital filter for the analog transfer function using Impulse Invariant method. **(8)**

$$H(s) = 2 / [s^2+3s+2] \text{ with } T=1 \text{ second.}$$

(OR)

(b) Design a Butterworth low pass filter satisfying the following constraints using Bilinear transformation method with T=1 sec. **(16)**

$$0.9 \le |H(e^{j\omega})| \le 1 \quad ; \; 0 \le \omega \le \pi/2$$

$$|H(e^{j\omega})| \le 0.2 \quad ; \; 3\pi/4 \le \omega \le \pi$$

12. (a) Design an ideal low pass FIR filter with following desired frequency using Hanning window for the length of N=9. **(16)**

$$H_d(e^{j\omega}) = 1 , \quad \pi \le |\omega| \le \pi/3$$

$$0 , \quad \text{Otherwise}$$

(OR)

(b) Realize the following FIR filter function with Transversal Form and Linear phase structure. **(16)**

(a) $H(z) = 1+(5/2)z^{-1}+2z^{-2}+2z^{-3}$

(b) $H(z) = 1+2z^{-1}-3z^{-2}+4z^{-3}-5z^{-4}$