JAYPEE UNIVERSITY OF INFORMATION TECHNOLOGY, WAKNAGHAT

TEST - 3 EXAMINATION- DECEMBER 2018

B.Tech V Semester

COURSE CODE: 10B11EC512

COURSE NAME: Digital Signal Processing

MAX. MARKS: 35

COURSE CREDITS: 04

MAX. TIME: 2 Hrs

Note: All questions are compulsory. Assume the data wherever necessary.

Q1. (a) A discrete time system is described by the following input-output relationship
$y[n] = \alpha + \sum_{k=-4}^{4} x[n-k]$ where α is a non-zero constant.
Check whether the above system is linear and time-invariant. CO1 [4]

(b) Explain how FFT is computationally more efficient than DFT for computing of N – point DFT. CO2 [3]

Q2. (a) What is meant by linear phase FIR filter ? What conditions are to be satisfied by the impulse response of FIR filter to have linear phase ? CO2 [3]

(b) Obtain the cascade and linear phase realization of the following system function:
$$H(z) = \left(\frac{1}{2} + z^{-1} + \frac{1}{2}z^{-2}\right)\left(1 + \frac{1}{3}z^{-1} + z^{-2}\right)$$
CO2 [4]

Q3. Design a digital low pass Butterworth filter satisfying the following constraints:
$$0.9 \le |H(e^{jw})| \le 1 \qquad \text{for} \qquad 0 \le w \le \frac{\pi}{2}$$
$$|H(e^{jw})| \le 0.2 \qquad \text{for} \qquad \frac{3\pi}{4} \le w \le \pi$$
Apply bilinear transformation with sampling time $T = 1\ sec$. CO3 [7]

Q4. A digital low pass filter is to be designed with the following desired frequency response:

$$H_d(e^{jw}) = \begin{cases} -e^{-j2w}, & -\frac{\pi}{4} \le w \le \frac{\pi}{4} \\ 0, & \frac{\pi}{4} \le w \le \pi \end{cases}$$

Determine the filter coefficients, system function and frequency response of the designed filter if the rectangular window of length 5 has been used. CO3 [7]

Q5. (a) Determine the order of a digital low pass Chebyshev filter that has 1 dB ripple in the passband below the frequency 0.2π and stopband attenuation of atleast 15 dB for frequencies between 0.2π and π. CO5 [3]

(b) Explain in detail any one of the following:
   1. Frequency Sampling Method for FIR filter Design
   2. Multirate Digital Signal Processing CO4 [4]