Use bilinear transformation and obtain $H(z)$. 7

(*d*) Draw the direct form I and II for the system with transfer function 7

$$H(z)=\frac{\left(1-\frac{1}{2}z^{-1}\right)\left(1+.\frac{1}{4}z^{-1}\right)}{\left(1+\frac{1}{2}z^{-1}\right)\left(1-\frac{1}{4}z^{-1}\right)\left(1-\frac{1}{8}z^{-1}\right)}$$

Unit-V

5. (*a*) What is meant by linear phase filter? 2

(*b*) Obtain FIR linear phase and cascade realization of the system function 7

$$H(z)=\left(1+\frac{1}{2}z^{-1}+z^{-2}\right)\left(1+\frac{1}{4}z^{-1}+z^{-2}\right)$$

(*c*) Obtain direct form realization structure for FIR system given by 7

(*i*) $H(z)=\left(1-\frac{1}{4}z^{-1}+\frac{3}{8}z^{-2}\right)$

(*ii*) $h(n)=\{1, 2, 3, 4, 3, 2, 1\}$

(*d*) Draw the structure of parallel realization

$$H(z)=\frac{(1-z^{-1})^3}{\left(1-\frac{1}{2}z^{-1}\right)\left(1-\frac{1}{8}z^{-1}\right)}$$

324655(24)

BE (6th Semester)

Examination, April - May, 2016

(New Scheme)

Principles of Digital Signal Processing

Time Allowed : 3 hours *Maximum Marks :* 80

Minimum Pass Marks : 28

Note : (*i*) Part (*a*) of each is compulsory. Attempt any **two** from parts (*b*), (*c*) and (*d*) of each question.

(*ii*) The figures in the right-hand margin indicate marks.

Unit-I

1. (*a*) Explain the following signals with example : 2

(*i*) Periodic and aperiodic signals

(*ii*) Even and odd signals

(*b*) Determine the power and energy of the given signal 7

(*i*) $x(t) = A \cos(\omega t + \phi)$

(*ii*) $x(t) = e^{at}\, u(t)$.

(*c*) A given analog signal is

$x(t) = 2\cos 200\pi t + 3\sin 600\pi t + 8\cos 1200\pi t$

(*i*) Calculate the nyquist rate.

(*ii*) If $x(t)$ is sampled at a rate of f_s=5 kHz, what is discrete time signal? 7

(*d*) Check whether the following systems are static/dynamic, linear/non-linear, causal/ non-causal and time invariant/time variant : 7

$$y(n) = x(n)\, x(n-1)$$

Unit-II

2. (*a*) What is meant by an LTI system? 2

(*b*) Determine the frequency response, magnitude and phase response and time delay of the system given by

$$y(n) = x(n) - x(n-1) + x(n-2) \quad 7$$

(*c*) Determine the impulse response of the system defined by equation

$$y(n) = \frac{5}{6}y(n-1) - \frac{1}{6}y(n-2) + x(n)$$

to the input signal $y(n) = \zeta(n) - \frac{1}{3}\zeta(n-1)$

Assume zero initial condition.

(*d*) Verify whether the following impulse responses describe causal, stable. Give reason for answer : 7

(*i*) $h(n) = e^{-0.06\,n}\, u(n)$

(*ii*) $h(n) = u(n+2) + u(n+3)$

(*iii*) $h(n) = \sin\left(\frac{n\pi}{2}\right)$

Unit-III

3. (*a*) List the properties of DFT. 2

(*b*) Find the DFT of a sequence 7

$$x(n) = [1, 1, 0, 0]$$

(*c*) Given $x(n) = \{0, 1, 2, 3, 4, 5, 6, 7\}$, find $X(K)$ using DITFFT algorithm. 7

(*d*) Given $x(n) = 2^n$ and $N = 8$, find $X(K)$ using DIFFFT algorithm. 7

Unit-IV

4. (*a*) Name the different design techniques for IIR filters. 2

(*b*) Design a Butterworth filter using the impulse invariance method for the following specification : 7

$$0.8 \leqslant \left|H(e^{j\omega})\right| \leqslant 1 \quad ; 0 \leqslant \omega \leqslant 0.2\pi$$

$$\left|H(e^{j\omega})\right| \leqslant 0.2 \quad ; 0.6\pi \leqslant \omega \leqslant \pi$$

(*c*) A digital filter with 3 dB bandwidth of 0.23π is to be designed from analog filter whose system response is

$$H(s) = \frac{\Omega_c}{s + \Omega_c}$$