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328614(28)

B. E. (Sixth Semester) Examination, 2020

(Old Scheme)

(Et & T Branch)

DIGITAL SIGNAL PROCESSING

Time Allowed : Three hours

Maximum Marks : 80

Minimum Pass Marks : 28

Note : *Part (a) of each unit are compulsory. Attempt any **two** parts from (b), (c) & (d).*

Unit - I

1. (a) Draw the basic building blocks for representing digital system. 2

(b) Determine the direct form I & II realisation for a third order IIR transfer function

$$H(Z)=\frac{0.28z^2+0.319z+0.04}{0.5z^3+0.3z^2+0.17z-0.2}$$ 7

(c) Obtain the cascade realisation for system function given by

$$H(z)=\frac{1+\frac{1}{4}z^{-1}}{\left(1+\frac{1}{2}z^{-1}\right)\left(1+\frac{1}{2}z^{-1}+\frac{1}{4}z^{-2}\right)}$$ 7

(d) Obtain direct form & cascade form realisation for transfer function of an FIR system given by :

$$H(z)=\left(1-\frac{1}{4}z^{-1}+\frac{3}{8}z^{-2}\right)\left(1-\frac{1}{8}z^{-1}-\frac{1}{2}z^{-2}\right)$$ 7

Unit - II

2. (a) What are the types of analog filters? 2

(b) For the analog transfer function.

$$H(s)=\frac{1}{(S+1)(S+2)}$$

Determine $H(z)$ using impulse invariant technique. Assume $T = 1$ second. 7

(c) Apply bilinear transformation to

$$H(s)=\frac{2}{(s+1)(s+3)}$$ with $T = 0{\cdot}1$ second. 7

(d) Design a digital butterworth filter that satisfies the following constraint using bilinear transformation. Assume $T = 1$ second.

$$0{\cdot}9 \le \left|H(e^{j\omega})\right| \le 1 \qquad 0 \le \omega \le \pi/2$$

$$\left|H(e^{j\omega})\right| \le 0{\cdot}2 \qquad 3\pi/4 \le \omega \le \pi$$ 7

Unit - III

3. (a) Enlist any two disadvantages of digital filter as compared to analog filter. 2

(b) Explain window technique to design an FIR filter. 7

(c) A filter is to be designed with the following desired frequency response.

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

Determine the filter coefficients $h_d(n)$ if the window function is defined as

$$w(n)=\begin{cases} 1 & 0 \le n \le 4 \\ 0 & \text{otherwise} \end{cases}$$ 7

(d) The desired response of a low-pass-filter is

$$H_\alpha\left(e^{jw}\right)=\begin{cases} e^{-j3w} & -\frac{3\pi}{4} \le w \le \frac{3\pi}{4} \\ 0 & \frac{3\pi}{4} < |w| \le \pi \end{cases}$$

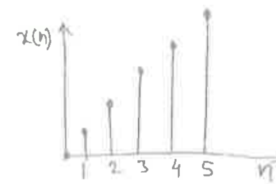
Determine $H\left(e^{jw}\right)$ for $M=7$ using a Hamming window.

Unit - IV

4. (a) .... is for reducing sampling rate & .... is for increasing sampling rate. (Fill in the blanks). 2

(b) Obtain the two-fold expanded signal $y(n)$ of the input signal $x(n)$. 7

$$x(n)=\begin{cases} n & n>0 \\ 0 & \text{otherwise} \end{cases}$$



(c) The transfer function of an IIR filter is given by

$$H(z)=\frac{1+0{\cdot}7z^{-1}}{1-0{\cdot}9z^{-1}}$$

Obtain the polyphase decomposition of $H(z)$ to decompose into 2 sections. 7

(d) Explain various applications of multirate digital signal processing. 7

Unit - V

5. (a) Give any two application areas of digital signal processing in the field of image processing. 2

(b) Explain the application of DSP in RADAR system. 7

(c) Draw the model of vocal organs to represent the mechanism of human speech production. 7

(d) Explain digital comb filter and draw its frequency response. 7