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24422

B. Tech. 7th Sem. (EE) Examination – May, 2019

DIGITAL SIGNAL PROCESSING

Paper : ECE-409-F

Time : Three Hours] *[Maximum Marks : 100*

Before answering the questions, candidates should ensure that they have been supplied the correct and complete question paper. No complaint in this regard, will be entertained after examination.

Note : Attempt five questions in all selecting *one* question from each section. Question No. **1** is ***compulsory***. All questions carry equal marks.

1. (a) Discuss the advantages and disadvantages of digital signal processing over analog signal processing. 4

(b) Check whether the following signal are energy or power signals and calculate their energy or power : 6

(i) $x(n) = u(n)$

(ii) $x(n) = Cos(\omega_0 n)u(n)$

(c) Find the Z transform of $a^n u[n]$ and draw its ROC. 4

(d) Differentiate between analog & digital filters. 4

(e) Explain linear time variant and linear time invariant system. 2

SECTION – A

2. (a) Explain the signal and its classification. 10

(b) Determine the inverse discrete Fourier transform (IDFT) of $X(k) = \{3, (2+j), 1, (2-j)\}$. 10

3. (a) Explain in details various properties of discrete Fourier transform (DFT). 10

(b) Obtain the direct forms I and II realizations for a 3rd order IIR transfer function : 10

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

SECTION – B

4. (a) State and prove the sampling theorem. Draw the spectrum of a sampled signal and also explain the aliasing effect.

(b) Explain the process of reconstruction of the signal from its samples. Obtain the impulse response of an ideal reconstruction filter. 8

5. (a) Find the inverse Z-Transform of the following function $X(Z)$ by using partial fraction expansion method : 14

$$X(Z) = \frac{Z+2}{2Z^2 - 7Z - 3}$$

If the ROC are :

(a) $|Z| > 3$

(b) $|Z| < \frac{1}{2}$

(c) $\frac{1}{2} < |Z| < 3$

(b) Explain the concept of region of convergence (ROC) in Z-transform and its properties. 6

SECTION – C

6. (a) What are the different design techniques of IIR digital filters ? Explain the design steps of IIR filter by Bi-linear transformation method and also discuss the warping effect. 15

(b) Convert the analog filter with system function :

$$H(S) = \frac{S+0.1}{(S+0.1)^2 + 9}$$

in to a digital IIR filter using bilinear transformation. The digital filter should have a resonant frequency of $\omega_r = \pi/4$. 5

7. (a) What is linear phase filter ? What conditions are to be satisfied by the impulse response of an FIR system in order to have a linear phase ? 10

(b) What are the different types of window function ? Compare the frequency domain characteristics of the different type of window function. 10

SECTION – D

8. (a) What is multirate digital signal processing (MDSP) ? Write the various advantages and application of MDSP. 10

(b) Explain the decimation process for an integer factor M with an example. 10

9. (a) What are the digital filter banks ? Give some applications where these filter bank are used. 10

(b) Write the short note on the following : 10

(i) Filter Structure

(ii) Sampling rate conversion
