M.E. 1st Semester (Electronics and Communication Engg.) Examination, December–2017

ADVANCED DIGITAL SIGNAL PROCESSING

Paper–MEEC–507

Time allowed : 3 hours] *[Maximum marks : 100*

Note : *Attempt any **five** questions.*

1. (a) What are the basic element of digital signal processing ? Discuss the advantage and disadvantages if digital signal processing over analog signal processing. 10

(b) Explain the concept of causality and stability. 5

(c) Check whether the following digital systems are BIBO stable or not. 5

(i) $y(n) = ax^2(n)$

(ii) $y(n) = ax(n) + b$

2. (a) State and prove the sampling theorem. Draw the spectrum of a sampled signal and also explain the aliasing effect. 12

(b) Find the Fourier transform of $x(t) = e^{-b^2 t^2}$ 8

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

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

If the ROC are

(a) $|Z| > 3$

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

(c) $\frac{1}{2} < |Z| < 3$ 12

(b) Explain the concept of region of convergence (ROC) in Z-transform and its properties. 8

4. (a) What is the need for FFT algorithm ? Explain the DIT and DIF algorithms. 10

(b) For a given x (n) = (1, 2, 3, 4, 4, 3, 2, 1), find X (k) using DIT FFT algorithms. 10

5. (a) What is an FIR system ? Compare FIR system with an IIR system. 8

(b) 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. 12

6. (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

7. (a) Explain in detail various properties of discrete fourier transform (DFT). 10

(b) Draw the structure of cascade and parallel realization of the system characterized by 10

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

8. Write the short note on any *two* : 10×2=20

(a) Effect of finite word length in digital filter

(b) Find the Z transform of $a^n u[n] + b^n u[-n-1]$

(c) Linear Convolution.