Seventh Semester B.Tech. Degree Examination, November 2015
(2008 Scheme)
08.703 : DIGITAL SIGNAL PROCESSING (E)

Time : 3 Hours
Max. Marks : 100

Instructions: Answer all questions from Part – A and one full question from each Modules of Part – B.

PART – A

1. Discuss the steps involved in creating digital signal from given analog signals with the help of neat sketch.

2. What is the need of processing of signals? In telephony system which processing method is utilised?

3. Define periodic and aperiodic signals and hence explain how spectrum of these signals can be obtained.

4. Define DTFT of a sequence x(n). Show that DTFT of an aperiodic sequence is periodic with period 2π.

5. What is ROC in a z-plane? Discuss ROC of finite duration signals.

6. Find z-Transform of x(n) = na^n u(n).

7. Distinguish between decimation in time and decimation in frequency algorithms of FFT.

8. Explain the relation between s-plane and z-plane with the help of neat sketch; hence comment on stability of system.

9. What are the objectives of digital filters in DSP?

10. Compare between IIR and FTR filters. (10×4= 40 Marks)
PART – B

Module – I

11. a) What will be the problems associated with reconstruction of signals after sampling? How these problems can be avoided? 6

b) Define causality and linearity of a system and check for causality and linearity for \( y(n) = x(n) - x(n^2 - n) \). 6

c) Test for energy and power of following sequence

i) \( x(n) = e^{\frac{\pi}{8}}n^2 \)

ii) \( x(n) = \cos \frac{\pi}{6}n \). 6

d) Given \( x_1(n) = \{1, 3, 2, 1\} \) \( x_2(n) = \{1, -2, 3, 2\} \) find following and sketch the result

i) \( x(2n) \)

ii) \( [x_1(n)] \times [x_2(n)] \). 4

12. a) Perform convolution sum of two sequences using graphical method and hence verify the result using tabulation method

\[ x(n) = \left\{ 1, 2, 2, 1 \right\} \quad h(n) = \left\{ 1, 2, 2, 1 \right\}. \] 10

b) State and explain any two properties of DTFT. 4

c) Find DTFT of sequence \( x(n) = a^n u(n) \). Where ‘a’ is a real and \( |a| < 1 \) and hence plot the spectrum. 6

Module – II

13. a) State and explain scaling property of z-Transform and using this property find z-Transform of \( x(n) = 2^n u(n) \). 5
b) Find z-Transform of following including ROC.

i) \( x(n) = \frac{1}{2} \delta(n) + \delta(n-1) - \frac{1}{3} \delta(n-3) \)

ii) \( x(n) = a^n \sin(\omega_n)u(n) \).

\[
\text{c) Obtain inverse z-Transform of } X(z) = \frac{Z}{3z^2 - 4z + 1} \text{ if ROCs are}
\]

i) \(|z|>|\)

ii) \(|z|<\frac{1}{3}\)

iii) \(\frac{1}{3}<|z|<\)

14. a) Check the stability of system described by system function

\[
H(z) = \frac{1}{1 - \frac{9}{2} z^{-1} - \frac{3}{2} z^{-2}}
\]

also explain the principle of Schur-Cohn stability test.

b) Given \( x(n) = \{1, 2, 3, 4, 4, 3, 2, 1\} \), find DFT using Radix 2 FFT.

Module – III

15. a) Obtain direct form I and direct form II realization of the system function.

\[
H(z) = \frac{1 + 2z^{-1} + z^{-2}}{1 - 0.75z^{-1} + 0.125z^{-2}}
\]

b) Obtain cascade and parallel form realization of \( H(z) = \frac{3(2z^2 + 5z + 4)}{(2z + 1)(z + 2)} \).
16. a) Obtain the ladder structure of the given system function

\[ H(z) = \frac{2 + 8z^{-1} + 6z^{-2}}{1 + 8z^{-1} + 12z^{-2}}. \]

b) Design low pass Butterworth filter using bilinear transformation method for satisfying following constraints.

Pass band \( w_p = 0.162 \) rad
Stop band \( w_s = 1.63 \) rad
Pass band ripple = 3dB
Stop band attenuation = 30 dB
Sampling frequency = 8 KHz.