

Roll No.

22145

**M.E. 1st Sem. (Electronics &
Communication Engg.)**

Examination – December, 2013

Advanced Digital signal Processing

Paper :MEEC-507

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 any *five* questions. All questions carry equal marks.

1. (a) Determine the Z- transform and sketch ROC of following signals

$$(i) \quad x_1(n) = \begin{cases} \left(\frac{1}{3}\right)^n, & n \geq 0 \\ \left(\frac{1}{2}\right)^{-n}, & n < 0 \end{cases} \quad 10$$

$$(ii) \quad x_2(n) = \begin{cases} \left(\frac{1}{3}\right)^n - 2^n, & n \geq 0 \\ 0, & n < 0 \end{cases}$$

- (b) State and prove convolution and correlation properties of Z - transform. 10

2. (a) Using long division, determine the inverse

$$Z\text{-transform of } X(z) = \frac{1 + 2Z^{-1}}{1 - 2Z^{-1} + Z^{-2}} \quad 10$$

- (b) State and prove Parseval's theorem for fourier transform. 10

3. (a) By using partial fraction expansion method, Find the inverse Z transform of

$$X(z) = \frac{1 + Z^{-1}}{1 - Z^{-1} + 0.5Z^{-2}} \quad 10$$

- (b) Determine the eight - point DFT of the signal .

$$x(n) = (1, 1, 1, 1, 1, 1, 0, 0) \quad 10$$

4. (a) Determine the Fourier transform of the signal. 10

$$x(n) = a^{|n|}, \quad -1 < a < 1$$

- (b) Discuss various properties of DFT. 10

5. (a) Discuss the procedure of designing on FIR filter using windowing technique. 10

- (b) By means of DFT and IDFT, determine the response of FIR filter with impulse response

$$h(n) = (1, 2, 1) \text{ to the input sequence } x(n) = (2, 1, 2, 1) \quad 10$$

6. (a) Convert the analog filter into digital filter whose system function is $H(s) = \frac{s+0.2}{(s+0.2)^2+9}$. Use impulse invariant technique. Assume $T = 1$ sec. 10
- (b) Describe the conditions for digital filter to be causal and stable.

Check the stability of filter for

$$H(z) = \frac{Z^2 - Z + 1}{Z^2 - Z + \frac{1}{2}} \quad 10$$

7. (a) Discuss the effects of finite word length in digital filters. Analyse truncation and round off processes in binary number representations. 10
- (b) Draw the structures of cascade and parallel realisations of

$$H(z) = \frac{(1 - Z^{-1})^3}{(1 - \frac{1}{2}Z^{-1})(1 - \frac{1}{8}Z^{-1})} \quad 10$$

8. Write short notes on (any *two*): 10,10
- (i) DIF FFT algorithm
 - (ii) Design of Hilbert transformers
 - (iii) Cepstrum