



Name :

Roll No. :

Invigilator's Signature :

CS/M.TECH(ECE)/SEM-1/MCE-103/2011-12

2011

ADVANCED DIGITAL SIGNAL PROCESSING

Time Allotted : 3 Hours

Full Marks : 70

The figures in the margin indicate full marks.

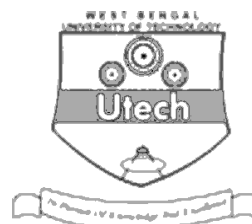
*Candidates are required to give their answers in their own words
as far as practicable.*

Group – A

(Answer all questions.)

1. Justify the answer :

- a) How can find step response of a system if the impulse response $h(n)$ is known ? 3
- b) Determine the unit sep response of the LTI system with impulse response $h(n)=a^n u(n) \mid a \mid < 1$. 3
- c) Show that $x(n)=(1/2)^n u(n)$ is energy signal 3
- d) Explain the relationship between Fourier transform and DFT. 3
- e) What is the advantages of windowing technique ? 2



Group – B

Attempt any *two* questions from the following :

$$2 \times 14 = 28$$

2. a) Determine the Discrete Time Fourier Transform of the following signal :

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

- b) Determine the energy density spectrum of the following signal using the Wiener-Khinchine Theorem :

$$X(n) = a^n u(n) \quad -1 < a < 1 \quad 7 + 7$$

3. a) In each of the following co-efficients of DTFS is specified. The signal is periodic with period $N = 8$.

Determine the signal $x(n)$ in each case

(i) $X_K = \cos(k\pi/4) + \sin(3k\pi/4)$

(ii) $X_K = \begin{cases} \sin(k\pi/4) & 0 \leq k \leq 6 \\ 0 & k = 7 \end{cases}$

$$k = 7$$

- b) State and prove the Parseval's Relation. $(4 + 4) + 6$

4. a) Determine the N -point DFT of the Blackman window

$$W(n) = 0.42 - 0.5 \cos(2\pi n / N - 1) + 0.08 \cos(4\pi n / N - 1)$$

$$0 \leq n \leq N - 1$$



- b) By mean of the DFT and IDFT, Determine the response of the FIR filter with impulse

response

$$h(n) = \{1, 2, 3\}$$

to the input sequent

$$x(n) = \{1, 2, 2, 1\}$$

7 + 7

Group – C

Answer any *two* questions from the following : $2 \times 14 = 28$

5. a) Explain designing technique of FIR filter using Fourier series method.
- b) Design an ideal low pass filter with the frequency response

$$H_d(e^{jw}) = 1, \text{ for } -\Pi/2 \leq w \leq \Pi/2$$

$$0, \text{ for } \Pi/2 \leq w \leq \Pi$$

Find the values of $h(n)$ for $N = 11$. Find $H(Z)$. $4 + 10$

6. a) Distinguish Hamming and Hanning window.
- b) Design a LPF using rectangular window by taking 9 samples of $W(n)$ and with cut of frequency of 1.2 rad/sec ? $5 + 9$



7. a) What is Haar transform ?
- b) What are the advantages of Wavelet transform over STFT ?
- c) What is wavelet de-noising ?
- d) Prove that Haar transform conserves energy.

3 + 3 + 2 + 6
