

Name :

Roll No. :

Invigilator's Signature :

CS/M.Tech (ECE)/SEM-2/MEC-201/2010

2010

ADVANCED DIGITAL SIGNAL PROCESSING

Time Allotted : 3 Hours

Full Marks : 70

The figures in the margin indicate full marks.

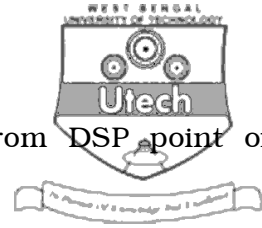
Candidates are required to give their answers in their own words as far as practicable.

GROUP – A

1. Answer any *five* of the following : 5 × 2 = 10

- i) Prove the digital systems in $y(n) = x(n^2)$ is
 - a) linear and causal
 - b) linear and non-causal
 - c) non-linear and causal
 - d) non-linear and non-causal.

- ii) Find a digital filter is said to be IIR & explain it
 - a) if present o/p depends on previous o/p only
 - b) if system function $H(Z)$ has one or more non-zero denominator coefficients
 - c) if all poles lie outside the unit circle
 - d) if system function has only zeros.



- iii) Describe infinite memory system from DSP point of view.
- iv) Define energy signal & power signal.
- v) Mention the basic difference between continuous signal and discrete signal.
- vi) Write down about basic application of correlation of signals.

GROUP – B

(Short Answer Type Questions)

Answer any *three* of the following. $3 \times 5 = 15$

- 2. Show that an absolutely summable sequence having finite energy sequence may not be absolutely summable.
- 3. State Parseval's theorem for DT aperiodic signals.
- 4. Write down the basic difference between DFT & DTFT. State Wiener-Khintchine theorem.
- 5. Determine the average power and the energy of the following sequences :
 - i) $x(n) = A_o e^{j\omega n}$
 - ii) $x(n) = u(n)$.
- 6. Determine the autocorrelation function and power spectral density (psd) for the following signal :
 $x(t) = A_c \cos (2\pi f_c t A_c + \phi_o)$ where A_c and f_c are constants, ϕ_o is a random variable which is uniformly distributed over the interval $(-\pi, \pi)$.



GROUP – C

(Long Answer Type Questions)

Answer any *three* of the following. $3 \times 15 = 45$

7. Consider the following length 7 sequences defined for $-3 \leq n \leq 3$ $x(n) = \{ 3 \ -2 \ 0 \ 1 \ 4 \ 5 \ 2 \}$; $y(n) = \{ 0 \ 7 \ 1 \ -3 \ 4 \ 9 \ -2 \}$; $w(n) = \{ -5 \ 4 \ 3 \ 6 \ -5 \ 0 \ 1 \}$

Evaluate cross-correlation sequence $r_{xy}(l)$ between $x(n)$ and $y(n)$ and the cross-correlation sequence $r_{xw}(l)$ between the sequences $x(n)$ and $w(n)$. $2 \times 7 \frac{1}{2}$

8. a) Determine the value of the constant k that minimizes the mean square error $E([X-k]^2)$, and then find the minimum value of the mean square error. Given $k = m_x$, show by illustration. $7 \frac{1}{2}$

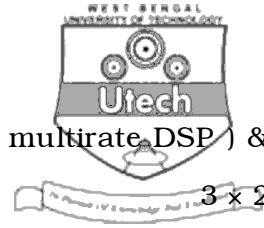
- b) Find DFT of following sequence $x(n) = \{ 0, 1, 2, 3, 4, 5, 6, 7 \}$ using matrix method. $7 \frac{1}{2}$

9. a) What is the need for Spectral estimation ? How can the energy density spectrum be determined ? What is periodogram ? 3×3

- b) What are the non-parametric methods of power spectrum estimation ? 3

- c) Discuss power spectrum estimation using Bartlett method. 3

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10. a) Write various applications of MDSP (multirate DSP) & its advantages. 3 x 2
- b) What do you mean by decimation ? Describe the sampling rate conversion by a rational (I/D).Describe sampling theorem. 3 x 3
11. Write short notes on any *three* of the following " 3 x 5
- a) Recursive filter.
 - b) Non-recursive filter.
 - c) Direct form-II structure second order filter.
 - d) Adaptive filter.
 - e) Interpolation and decimation.
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