

Name :

Roll No. :

Invigilator's Signature :

CS / M.TECH(ECE-MVLSI) / SEM-2 / MVLSI-202 / 2012

2012

DIGITAL SIGNAL PROCESSING & APPLICATIONS

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.

Question No. 1 is compulsory and attempt any *four* questions from the rest.

1. i) Check for linearity

a) $y(n) = x(n) + 1/x(n-1)$

b) $y(n) = x(n) \cos \omega$

ii) Check for time invariance

a) $y(n) = x(-n)$

b) $y(n) = e^{x(n)}$

iii) Check for causality

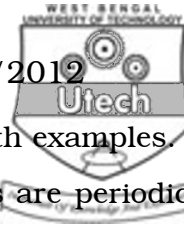
$$y(n) = \sum_{k=-\infty}^{n+1} x(k)$$

iv) Check for stability

a) $y(n) = x(n) e^n$

b) $y(n) = \cos \{x(n)\}$

4 + 4 + 2 + 4



2. a) Define periodic and aperiodic signals with examples.
 b) Determine whether the following signals are periodic, if so, then specify its fundamental period :
 i) $x(n) = e^{j6\pi n}$
 ii) $x(n) = \cos\{(\pi/3)n\} + \cos\{(3\pi/4)n\}$
 c) Explain time domain sampling & frequency domain aliasing. State Nyquist Sampling Theorem. 3 + 4 + 7
3. a) Explain with examples :
 i) Real exponential signal
 ii) Complex exponential signal.
 b) Define :
 i) Energy Signal and
 ii) Power Signal.
 c) Find whether the following signal is a power signal or energy signal :
 $x(n) = \sin\{(\pi/4)n\}$ 5 + 5 + 4
4. a) Write down the physical significance of linear convolution. How linear convolution can be achieved from circular convolution ?
 b) Find the convolution of the following signals :
 $x(n) = 1$ when $n = -2, 0, 1$
 $= 2$ when $n = -1$
 $= 0$ elsewhere
 $h(n) = \delta(n) - \delta(n-1) + \delta(n-2) - \delta(n-3)$
 c) Find the convolution of two finite duration sequences :
 $x(n) = b^n u(n), h(n) = a^n u(n)$
 when (i) $a \neq b$ and (ii) $a = b$ 4 + 4 + 6



5. a) Write down the physical significance of Z-transform. What is its relation with Fourier transform & how are they different ?
- b) Find the Z-transform & ROC of : $x(n) = r^n \cos n\theta u(n)$
- c) Find out the relationship between s-plane and z-plane.
- d) Find one sided Z-transform to determine $y(n); n \geq 0$
- if $y(n) = (1/2)y(n-1) + x(n), x(n) = (1/3)^n u(n), y(-1) = 1$ 4 + 3 + 3 + 4
6. a) What are frequency domain sampling and time domain aliasing ?
- b) Determine the 8-point DFT : $x(n) = \{1, 1, 1, 1, 1, 1, 0, 0\}$
- c) Determine the IDFT of $x(k) = \{1, 0, 1, 0\}$ 4 + 6 + 4
7. a) Write down the difference between DIT-FFT and DIF-FFT. What is bit reversal logic ? How the number of complex multiplications can be reduced using FFT algorithm ?
- b) Find the DFT of the following sequence using DIT-FFT algorithm : $\{1, 2, 3, 4, 4, 3, 2, 1\}$ 6 + 8



8. a) Write down the difference between a digital and an analog filter.
- b) Design an analog Butterworth filter that has $a - 2\text{dB}$ passband attenuation at a frequency of 20 rad/sec and at least $- 10\text{dB}$ stop band attenuation at 30 rad/sec .
- c) For analog transfer function $H(S) = \{2/(s + 1)(s + 2)\}$ of a Butterworth filter using impulse invariant method. Assume $T = 1\text{sec}$.
- 3 + 6 + 5

