	Utech
Name :	
Roll No.:	A Summer Of Completing and Conference
Invigilator's Signature :	

CS/B.TECH/ECE(NEW)/SEM-6/EC-602/2013

2013

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

(Multiple Choice Type Questions)

1. Choose the correct alternatives for any ten of the following:

 $10 \times 1 = 10$

- i) If $x_1(n)$ and $x_2(n)$ are finite length sequences of lengths L and M respectively, their linear convolution has the length
 - a) L+M-2
- b) L + M 1

c) L+M

- d) $\max(L, M)$.
- ii) z-transform of unit step is
 - a) $(1-z^{-1})^{-1}$
- b) $(1-z)^{-1}$
- c) $(z-1)^{-1}$
- d) (1-z).

- iii) FIR filter is
 - a) recursive and linear
 - b) non-recursive and linear
 - c) recursive and non-linear
 - d) recursive.

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- iv) Stability region of z-transform is
 - a) within unit z-circle
 - b) outside the unit z-circle
 - c) on the unit z-circle only
 - d) entire z-plane.
- v) An LTI system described by impulse response $h(n) = a^n u(n)$ is stable if
 - a) |a| > 1

b) |a| < 1

c) $|a| \le 1$

- d) $|a| \ge 1$.
- vi) A signal x (n) is called an energy signal if its energy E and power P satisfy
 - a) both E and P infinite
- b) $E = \infty, P < \infty$
- c) $E < \infty, P = 0$
- d) $E < \infty, P = \infty$.
- vii) Final value theorem by z-transform is

a)
$$x(\infty) = Lt (z-1) \times (z)$$

b)
$$x(\infty) = Lt \atop z \to 0 (z-1) \times (z)$$

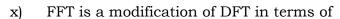
c)
$$x(\infty) = Lt (z-1) \times (z)$$

d)
$$x(\infty) = Lt z \times (z)$$
.

- viii) If the Fourier transform of a sequence x(n) is $x(e^{j\omega})$, then the Fourier transform of x(n-k) is
 - a) 0

- b) $(e^{-j\omega k})\times(e^{j\omega})$
- c) $(e^{-j\omega})\times(e^{j\omega})$
- d) none of these.
- ix) Between IIR and FIR filters,
 - a) FIR has better phase response
 - b) IIR has better stability
 - c) FIR is recursive
 - d) IIR is non-recursive.





- a) computational speed b) no
 - b) noise💢
- c) linearity
- d) none of these.
- xi) Between circular convolution and linear convolution
 - a) length of linear convolution is greater
 - b) length of circular convolution is greater
 - c) lengths of both are same
 - d) none of these.
- xii) Bit reversal is applicable to
 - a) DFT

b) FFT

c) CFT

d) none of these.

GROUP - B

(Short Answer Type Questions)

Answer any three of the following

 $3 \times 5 = 15$

- 2. The impulse response of one LTI system is $h(n) = \{1, 2, 1, -1\}$. Determine the response of the system to the input signal, $x(n) = \{1, 2, 3, 1\}$.
- 3. Determine and explain the relationship between s-plane and z-plane.
- 4. Distinguish between IIR and FIR filters.
- 5. Determine z-transform of $x(n) = \left(\frac{2}{3}\right)^n u(n) + \left(\frac{3}{4}\right) u_{n-1}$.
- 6. Draw direct form-II and cascade form of the following transfer function :

$$H(z) = \frac{1 + \left(\frac{1}{3}\right)z^{-1}}{1 - \left(\frac{3}{4}\right)z^{-1} + \left(\frac{1}{8}\right)z^{-2}}$$

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7. Write down the difference equation for transfer function

$$H(z) = \frac{1 + \left(\frac{1}{4}\right)z^{-1} + \left(\frac{1}{2}\right)z^{-2} + \left(\frac{1}{3}\right)z^{-3}}{1 + z^{-1} + \left(\frac{1}{4}\right)z^{-2} - \left(\frac{1}{3}\right)z^{-3} + \left(\frac{1}{2}\right)z^{-4}}$$

GROUP - C

(Long Answer Type Questions)

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

- 8. a) Determine linear convolution and circular convolution of sequences $\{1, 2, 3, -1\}$ and $\{3, 4, 2, -3\}$. 5+5
 - b) Describe correlation and multiplication using z-transform.
- 9. What is DFT ? What is FFT ? Describe time decimation of FFT computation. Explain how FFT is superior to DFT.

2 + 3 + 8 + 2

- 10. a) Describe windowing. Explain Gibbs oscillation in this context. Explain the function of rectangular and Hamming windows for filter realization. 4 + 3 + 5
 - b) Explain ROC of transformation.

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- 11. a) Describe Butterworth IIR filter using impulse invariant method.
 - b) Explain aliasing error and overlapping.
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- c) Describe mapping of DSP algorithm onto FPGA.
- 12. Write short notes on any three of the following:

 3×5

- a) Energy and power signals
- b) Perseval's relation and its application
- c) Bilinear transformation
- d) Casual and non-casual signals.

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