Name : .....

Roll No. : .....

Invigilator's Signature : .....

CS/B.TECH(EEE)/SEP.SUPPLE/SEM-7/EEE-703/2012

2012
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) Casual signals are

a) right sided sequence

b) left sight sequence

c) both sided sequence

d) none of these.

ii) If $x(n)$ upon z transform gives $X(z)$ then

a) $x(-n) \leftrightarrow X(z)$ b) $x(-n) \leftrightarrow z\,X(z)$

c) $x(-n) \leftrightarrow X(z)/z$ d) $x(-n) \leftrightarrow X(1/z)$.

iii) Find the correct alternative :

a) $x(t)^{*}\delta\ (t - t_0) = x\ (t - t_0)$

b) $x(t)^{*}\delta\ (t - t_0) = 1$

c) $X(t)^{*}\delta\ (t - t_0) = x\ (t_0)$

d) $X(t)^{*}\delta\ (t - t_0) = x\ (t)$.

iv) The number of multiplications required to compute N-point DFT using radix-2 FFT is

a) $N/2\ ^{*}\log_2 N$ b) $N/2\ ^{*}\log_2 (N/2)$

c) $N^{*}\log_2 N$ d) $N^{*}\log_2 (N/2)$.

v) Fourier transform of cos $n\omega_0$ is

a) $\pi\delta(\omega + \omega_0) + \pi\delta(\omega - \omega_0)$

b) $\pi\delta(\omega + \omega_0) - \pi\delta(\omega - \omega_0)$

c) $\pi\delta(\omega + \omega_0) + 2\pi\delta(\omega - \omega_0)$

d) $2\pi\delta(\omega + \omega_0) + \pi\delta(\omega - \omega_0)$.

vi) The convolution sum is

a) $Y(n) = x(n)^{*} y(n)$

b) $Y(n) = k = -\infty\infty x(k)\delta(n - k)$

c) $Y(n) = k = -\infty\infty x(k)h(n - k)$

d) $Y(n) = k = -\infty\infty x(k)h(k)$.

vii) Direct form – I and direct form – II exists for

a) FIR system only b) IIR system only

c) Both (a) and (b) d) Analog filter.

viii) The z transform of delta function is

a) 1

b) $1/(1-z)$

c) $1/(1 - z^{-1})$.

ix) The z transform of unit step function is

a) 1

b) $1/(1-z)$

c) $1/(1-z^{-1})$

x) If $x(n) = \{ 1, 0, 0, 1 \}$, the DFT value $x(0)$ is

a) 2 b) $1 + j$

c) 0 d) $1 - j$.

xi) Which of the following is *not* a property of FIR filter ?

a) Always stable

b) Physically realizable

c) Non-linear phase response

d) Linear phase response.

GROUP – B

(Short Answer Type Questions)

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

2. Find the Z-transform and explain ROC of the following.

(i) $X1[n] = \{ 2, 4, 5, 7, 0, 1 \}$

(ii) $X2[n] = \delta [n - k], k > 0$.

3. Determine Z-transform of $x[n] = \left(\frac{1}{2}\right)^n u[n]$ and explain ROC.

4. Find out convolution of two sequences $x1[n] = \{ 1, -2, 1 \}$ and $x2[n] = \{ 1, 1, 1, 1, 1 \}$

5. Draw the phase and magnitude spectrum of the periodic sequence : $x[n] = \{ 1, 1, 0, 0 \}$.

6. Explain the different types of filters in digital systems.

7. Explain the different types of window in digital systems.

GROUP – C

(Long Answer Type Questions)

Answer any *three* of the following. 3 × 15 = 45

8. Determine the inverse Z-transform $X(z) = 1/(1 - 1 \cdot 5z^{-1} + 0 \cdot 5z^{-2})$

   when ROC : mod (*z*) > 1

   when ROC : mod(*z*) < 0.5.

9. a) Derive the expression for Discrete Fourier Series coefficient [*Ck*] and for real signal.

   b) Explain the properties of DFT.

10. Design low pass FIR filter for N = 5 and $\omega_c = 0 \cdot 5$ rad, using Hanning window.

11. Find *X*(*k*) by using decimation in time FFT algorithm of the sequence : *x*(*n*) = { 3, 1, 5, 4, 2, 1, 0, 1 }.

12. Write short notes on any *three* of the following : 3 × 5

    a) Properties of *Z*-transform

    b) Odd and even signals

    c) DFT and FFT

    d) Butterworth or Chebyshev filter

    e) Convolution.