T.E. Sem 6.(Rev.) Discrete Time signal Processing 06/6/08
Extrx.

Con. 3399-08. **CO-2863**

(REVISED COURSE)

(3 Hours) **[Total Marks : 100**

N.B. (1) Question No. **1** is **compulsory**.
(2) Attempt any **four** questions out of the remaining **six** questions.
(3) Assume suitable **data** if **necessary**.

1. (a) Without performing DFT/FFT find DFT of the following sequence : **20**
$x(n) = \{ 2, 2, 2, 2 \}$
justify your answer.

(b) Find the Z transform of the following sequence.

$$x(n) = \frac{a^n}{n!}$$

(c) Determine the energy of the sequence

$$x(n) = \left(\frac{1}{2}\right)^n \qquad n \geq 0$$
$$= 3^n \qquad n < 0$$

(d) Determine if the systems described by the following input-output equations are causal or non-causal
(i) $y(n) = x(2n)$ (ii) $y = x(-n)$

(e) Determine whether the following signals are periodic :

(i) $x(n) = \cos \frac{1}{2} n$ (ii) $x(n) = e^{j0 \cdot 2n\pi} + e^{-j0 \cdot 3\, n\, \pi}$.

2. (a) Given : **10**
$X(K) = \{ 36, -4 + j\,9{\cdot}656, -4 + j4, -4 + j1{\cdot}656, -4, -4 - j1{\cdot}656, -4 - j4, -4 - j\,9{\cdot}656 \}$
Find x(n) by using any IFFT algorithm.

(b) Find DFT of the following using DIT FFT **10**
$x(n) = \{ 1, 2, 1, 2, 0, 2, 1, 2 \}$.

3. (a) A DT LTI system has a difference equation **10**
$2y(n) + 3y(n-1) + y(n-2) = u(n) + u(n-1) - u(n-2)$ with initial conditions
$y(-1) = 2,\ y(-2) = -1$.
Find :
(i) Zero input response
(ii) Zero state response
(iii) Total response.

(b) Using overlap and save technique perform convolution of : **10**
$x(n) = \{ 1, 2, 3, 4, 5, 6, 7, 8 \}$
with $h(n) = \{ 1, 2 \}$.

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4. (a) Prove that $x_1(n) * x_2(n) \xleftrightarrow{z} X_1(z) \cdot X_2(z)$ **10**

if $x_1(n) \xleftrightarrow{z} X_1(z)$

$x_2(n) \xleftrightarrow{z} X_2(z)$

(b) Determine and sketch the magnitude and phase response of the following system : **10**

$y(n) = 2 \cdot x(n-1) - x(n-2)$

5. (a) Consider a causal LTI system whose system function is : **12**

$$H(z) = \frac{1 - \frac{1}{2} z^{-1}}{1 - z^{-1} + \frac{3}{16} z^{-2}}$$

Implement system in each of the following forms :

(i) Direct Form-I
(ii) Direct Form-II
(iii) Cascade Form
(iv) Parallel form.

(b) Obtain inverse Z-transform of **8**

$X(z) = \ln (1 + az^{-1}) \; |z| > |a|.$

6. (a) Explain convolution and correlation property of z-transform. Determine the cross correlation sequence $r_{xy}(l)$ of **10**

$x(n) = \{1, 2, 3, 4\}$
$y(n) = \{5, 6, 7, 8\}$

(b) Obtain the inverse z-transform of the function X(z) **10**

$$X(z) = \frac{z^2 + 2z}{z^2 + 4z + 3}$$

7. Attempt any **four** of the following :— **20**

(a) DSP processor
(b) Comparison between IIR and FIR system
(c) Maximum and Minimum phase system
(d) Auto correlation and Cross correlation
(e) Computational complexity of DFT and FFT.
