Roll No. .....

EX–703(N)

B. E. (Seventh Semester) EXAMINATION, Dec., 2010

(New Scheme)

(Electrical & Electronics Engg. Branch)

DIGITAL SIGNAL PROCESSING

[EX – 703(N)]

Time : Three Hours

Maximum Marks : 100

Minimum Pass Marks : 35

Note : Attempt all questions. Attempt any *two* parts in each question. Each question having equal marks.

1. (a) Show that the signal given by $x(t) = t^{-1/4} \cdot u(t-1)$ is neither an energy signal nor a power signal. 10

   (b) Write down the properties of Discrete-Time Fourier Transform (DTFT) in details. 10

   (c) Find the response of a discrete-time LTI system with impulse response : 10

$$h(n) = \left(\frac{1}{2}\right)^n u(n)$$

for input :

$$x(n) = \left(\frac{3}{n}\right)^n u(n)$$

Use DTFT analysis and synthesis equations.

2. (a) Discuss the properties of z-transformation and also gives its application. 10

(b) A discrete-time signal is given by the expression : 10

$$x(n) = n\left(-\frac{1}{2}\right)^{n} u(n) \otimes \left(\frac{1}{4}\right)^{-n} u(-n)$$

Find the z-transform.

(c) Solve the difference equation of a Causal discrete-time LTI system which is expressed as under : 10

$$y(n) + 3y(n-1) = x(n)$$

Assume that the system is initially relaxed.

3. (a) Given the two sequences of length 4 as under : 10

$$x(n) = \{0, 1, 2, 3\}$$
$$h(n) = \{2, 1, 1, 2\}$$

Compute the circular convolution.

(b) Discuss DFT (Discrete Fourier Transform) properties as follows : 10

(i) Time reversal of a sequence

(ii) Circular time shift of a sequence

(iii) Circular frequency shift

(c) Obtain the 8-point FFT of the following pulse signal using flow diagram : 10

$$x(0) = x(1) = x(2) = x(3) = 1,$$
$$x(4) = 0, x(5) = x(6) = x(7) = 1$$

Use DIF-FFT algorithm.

4. (a) Determine a cascade realisation of the system characterised by the transfer function which is expressed as under : 10

$$H(z) = \frac{2(z+2)}{z(z-0{\cdot}1)(z+0{\cdot}5)(z+0{\cdot}4)}$$

(b) Prove Telligen's theorem for digital filter and also give its application. 10

(c) The system transfer function of analog filter is given by : 10

$$H_a(s) = \frac{s + 0{\cdot}1}{(s + 0{\cdot}1)^2 + 16}$$

Obtain the system transfer function of digital filter using BLT which is resonant at $\omega_r = \pi/2$.

5. (a) Write short notes on the following : 10

(i) Gibbs phenomenon

(ii) Rectangular window for FIR filter design.

(b) Derive an expression for system function if the unit sample response $h(n)$ is obtained using frequency sampling technique. 10

(c) Design an FIR linear phase filter using Kaiser window to meet the following specifications : 10

$$0{\cdot}99 \le |H(e^{jw})| \le 1{\cdot}01, 0 \ge w \ge 0{\cdot}19\pi$$
$$|H(e^{jw})| \le 0{\cdot}01, 0{\cdot}2\pi \le w \le \pi$$