(3 Hrs) **Total Marks: 80**

NOTE : 1) Question number 1 is compulsory.
2) Attempt any three questions from the remaining five questions.
3) Assume suitable data wherever necessary.

Q1(a) Determine the values of power and energy for the following signals: (20)

i) $x_1(t) = e^{j(2t+\pi/4)}$ ii) $x_2(n) = (1/2)^n u(n)$.

(b) Check whether the given systems are time-variant, linear and causal:

i) $y(t)= x(t) +dx(t)/dt$ ii) $nx(n)$

(c) Check for periodicity of the given signals .Also determine the fundamental period.

i) $x(t)= 2 \cos (10t+1) – \sin (4t-1)$ ii) $x(n) = e^{j7\pi n}$

(d) Find the correlation of the two sequences , $x(n) =\{1,2,3\}$ and $y(n) =\{2,4,1\}$.

Q2(a) Determine x(n) for all possible ROC conditions. (10)

$$X(z)= \frac{1}{1-0.8z^{-1}+0.12z^{-2}}$$

(b) Perform convolution of the following causal signals (10)

(i) $x_1(t)= e^{-2t} . u(t)$, $x_2(t)= e^{-5t} . u(t)$

(ii) $x_1(t)= t\, u(t)$, $x_2(t)= e^{-5t} u(t)$

Q3 (a) A Discrete time LTI system is specified by

$y(n) = -7y(n-1) – 12y(n-2) + 4\, x(n-1) -2\, x(n)$ (10)

$y(-1) = -2$ $y(-2) = 3$

Determine (a) zero input response

(b) zero state response if $x(n) = (6)^n u(n)$

(c) Total response of the system

(b). A continuous time LTI system for which the input x(t) and output y(t) are related by the differential equation : (10)

$$\frac{d^2y(t)}{dt^2} - \frac{dy(t)}{dt} - 2y(t) = x(t) \ ;$$

(i) Determine H(s) as a ratio of two polynomials in s. Sketch the pole-zero pattern of H(s).

(ii) Determine h(t) for each of the following cases :

1. The system is stable.

2. The system is causal.

3. The system is neither stable nor causal.

Q4 (a) Using Laplace transform determine the complete response of the system described by the equation , (10)

$$\frac{d^2y(t)}{dt^2} + 5\frac{dy(t)}{dt} + 4y(t) = \frac{dx(t)}{dt} \; ;$$

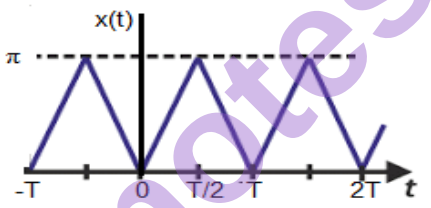
$y(0) = 0$; $dy(t)/dt\,|_{t=0} = 1$, for the input $x(t) = e^{-2t}u(t)$.

(b) Determine the Fourier transform of the given continuous time domain signal given by

$x(t) = e^{-at}\cos\Omega_o\, u(t)$ (5)

(c) Define ESD and PSD .What is the relation of ESD and PSD with autocorrelation ? (5)

Q5 (a) Determine the Fourier series of the given signal: (10)



(b) Prove time shifting property of Z transform. (5)

(c) Determine the impulse response for the cascade of two LTI systems having impulse responses $h_1(n) = (1/2)^n u(n)$ and $h_2(n) = (1/4)^n u(n)$. (5)

Q6(a) Compute the Fourier transform and sketch the magnitude and phase function of causal sequence given by : $x(n) = 1/3$; $0 \le n \le 2$ (10)

$= 0$; else

(b) State and prove Initial and final value theorem. Determine the initial and final values of x(t) if its Laplace transform is given by : $X(s) = \frac{10\,(2s+3)}{s(s^2+2s+5)}$ (10)

****