Time: 3 Hours **Max. Marks: 80**

Note: -1. Question no. 1 is compulsory.
2. Answer any three out of remaining questions.
3. Figures to right indicate full marks.
4. Assume suitable data wherever necessary.

Q.1 a) Sketch even and odd components of the following [5]

$X(t) = 1 \quad , 0 \le t \le 1$

$= 2\text{-}t \ , 1 \le t \le 2$

b) Find if the following signal is energy or power signal, if yes determine its energy or power
$x(t) = A \quad , -T_0 \le t \le T_0 \quad = 0$ otherwise [5]

c)Find the Laplace Transform using property of $x(t) = e^{-2t}u(t) - e^{2t}u(-t)$ and plot ROC [5]

d) Find Z transform & sketch the ROC $x(n)=[(-1)^n (2)^{-n}] u(n)$ [5]

Q.2 a) Check whether the system described by $y(t) = x(t+10)+x^2(t)$ is [10]
i) Static/dynamic ii) Causal/non-causal iii) Stable/unstable
iv)Time invariant/Time varient
b) Perform the convolution [10]

$x(t) = u(t)$ $h(t) = 1$ for $-1 \le t \le 1$

Q3 a) State and prove Time Scaling property of Laplace Transform [10]

b) Find the response of system

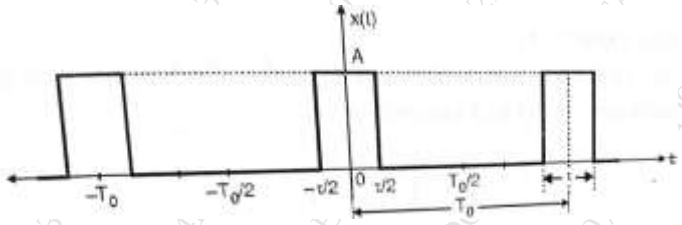
$$\frac{d^2y(t)}{dt^2} + \frac{5dy}{dt} + 6\, y(t) = x(t)$$

Subject to initial conditions $y(0)=2$, $y'(0)=1$ and input $x(t)= e^{-t}u(t)$ [10]

Q 4 a) i) State and prove Time Reversal property of Z transform [5]
ii) Obtain Z transform using property of signal $x(n) = n\, u(n)$ [5]

b) Determine an impulse response of system described as [10]
$y(n)= x(n)+ 0.6\, y(n-1)- 0.08\, y(n-2)$

Q5 a) Obtain exponential fourier series for rectangular pulse train shown below and sketch the spectrum [10]



b) i) Obtain Fourier Transform of a unit step function [5]

ii)State and prove time differentiation property of Fourier Transform [5]

Q6 a) Determine the spectra of periodic signal x(n) = {1,1,1,0} with period N=4 using discrete Time Fourier series [10]

Q6 b) i) Explain Relationship between Fourier transform and Laplace Transform [5]

ii) Explain Relation between Z transform and DTFT [5]
