(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.

Q.1 a) How will you obtain z-transform of the D.T signal x(nT),from laplace transform of sampled version of x(t), using $z = e^{st}$ **(5)**

b) Check whether the following system is static/dynamic, linear/non-linear, shift variant/shift invariant and casusal/non-causal **(5)**

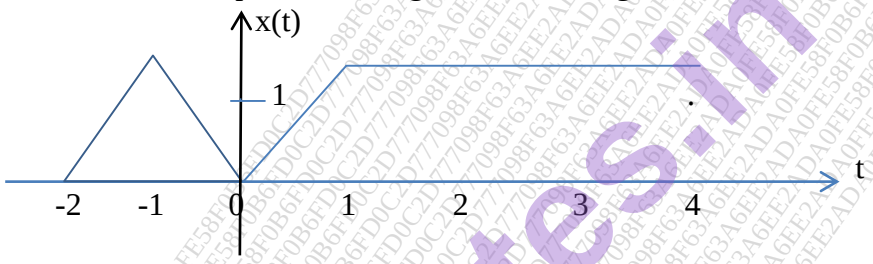
i)$y(t) = x(t) \cos 100\pi t$

ii) $y(n) = n.x(n)$

c) Determine DTFS for the sequence $x(n)= 4\cos\frac{\pi n}{2}$ **(5)**

d) Prove that energy of a power signal is infinite and power of an energy signal is zero. **(5)**

Q.2 a) Find the even and odd parts of the signal shown in figure **(5)**



b) Verify periodicity of the following continuous time signals, if periodic, find the fundamental period. **(5)**

i)$x(t) = 2\cos(\frac{t}{4})$

ii) $x(n) = 2\cos(\frac{2\pi n}{3}) + 3\cos(\frac{2\pi n}{7})$

c) The analog signal x(t) is given below: **(10)**

$x(t) = 5\cos 50\pi t + 2\sin 200\pi t - 2\cos 100\pi t$

Determine the minimum sampling frequency and the sampled version of analog signal at this frequency. Sketch the waveform and show the sampling points.

Q.3 a) The transfer function of discrete time causal system is given by, **(10)**

$$H(Z) = \frac{1 - Z^{-1}}{1 - 0.2Z^{-1} - 0.15Z^{-2}}$$

Draw cascade and parallel realization.

b) Perform the following convolution operation of two functions in time domain. **(10)**

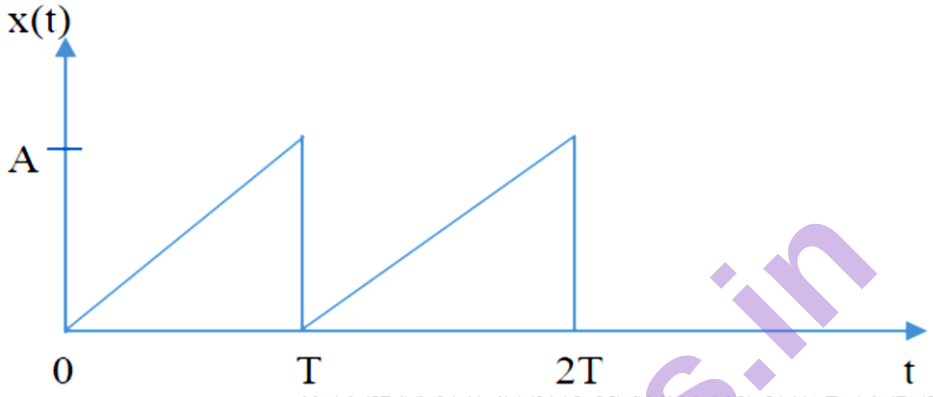
$x_1(t) = e^{-4t}\,u(t)$ $x_2(t) = u(t-4)$

Q.4 a) Using the Laplace Transform determine the complete response of the system described by the equation : **(10)**

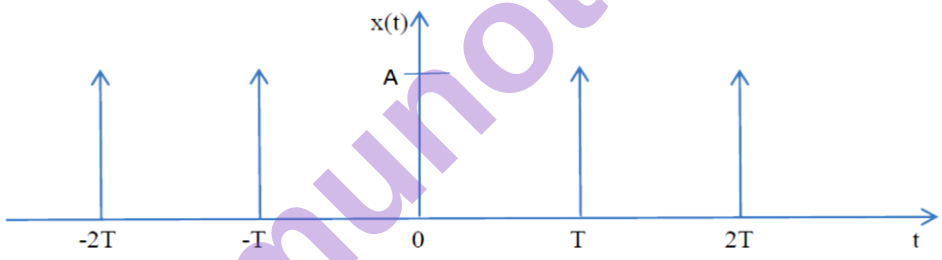
$$\frac{d^2y(t)}{dt^2} + 5\frac{dy(t)}{dt} + 4y(t) = \frac{dx(t)}{dt}$$

Assume that initial conditions of the system are y(0) = 0 and y'(0) = 1 at input $x(t) = e^{-2t}\,u(t)$

b) Obtain the exponential form of the Fourier series representation of the signal shown in following signal: **(10)**



Q.5 a) Determine the FT of the periodic impulse function shown in figure. **(10)**



b) A causal LTI system has a transfer function $H(Z) = H_1(Z).\,H_2(Z)$, **(10)**

where $H_1(Z) = \frac{1 - 0.2Z^{-1}}{1 + 0.5Z^{-1}}$, $H_2(Z) = \frac{1}{1 + 0.3Z^{-1}}$

i)If the system is stable, give it's ROC

ii) Find the impulse response of the system

iii) Find the system response if $X(Z) = \frac{1}{1 - 0.2Z^{-1}}$

iv) Draw the pole-zero diagram.

Q.6 a) Prove Duality property of fourier transform. **(05)**

b) Define the ESD and PSD. What is the relation of ESD and PSD with auto correlation? **(05)**

c) Determine the impulse response for the cascade of two LTI systems having impulse response $h_1(n) = (\frac{1}{3})^n\,u(n)$ and $h_2(n) = (\frac{1}{4})^n\,u(n)$ **(05)**

d) Find initial and final value of signal. **(05)**

$X(S) = \frac{s+1}{s(s+2)}$