

(3 Hrs)

Total Marks : 80

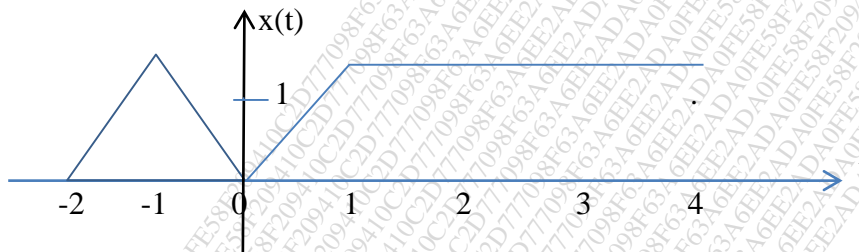
NOTE: 1) Question number 1 is compulsory.

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) $x(t) = 2 \cos\left(\frac{t}{4}\right)$
 - ii) $x(n) = 2 \cos\left(\frac{2\pi n}{3}\right) + 3 \cos\left(\frac{2\pi n}{7}\right)$
- 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)

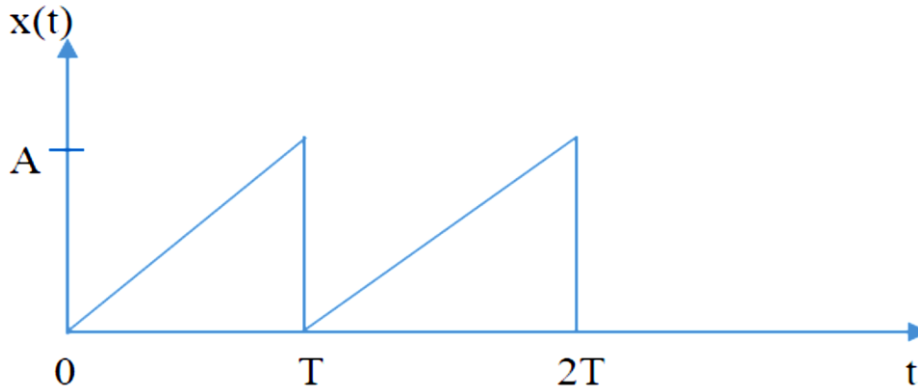
$$x_1(t) = e^{-4t} u(t) \quad x_2(t) = u(t - 4)$$

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

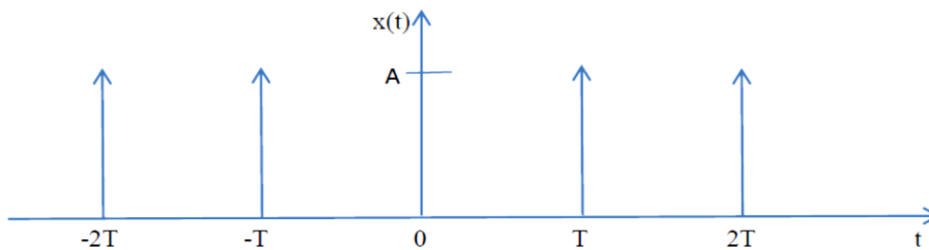
$$\frac{d^2y(t)}{dt^2} + 5 \frac{dy(t)}{dt} + 4y(t) = \frac{dx(t)}{dt}$$

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 $H(Z) = H_1(Z) \cdot H_2(Z)$, **(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 **(05)**

response $h_1(n) = (\frac{1}{3})^n u(n)$ and $h_2(n) = (\frac{1}{4})^n u(n)$

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

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