Time: 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   Verify periodicity of the following continuous time signals. If   5
         Periodic, find the Fundamental period.
         (i)x(t)= 3 Cos (5t+π/6)
         (ii) x(t)=$e^{-j2\pi t/7}$

    b   Prove that, Fourier transform of convolution of two signals is the   5
         product of the Fourier transform of the individual signals.

    c   What is the general condition for stability of a discrete time LTI   5
         system in z-domain?

    d   Find the convolution of following signals using Laplace Transform.   5
         X(t)=cos(t).u(t), y(t)=t.u(t)

Q2 a   Show that for LTI discrete time system, the inverse z-transform of   4
         transfer function is the impulse response of the system

    b   Determine power or energy of the following continuous time signal: 4
         (i) x(t)=e^{-2t}.u(t)
         (ii) x(t)=3 cos(5mt)

    c   Determine whether the following systems are linear/nonlinear, time   12
         variant/invariant, causal/noncausal, and stable/unstable.
         (i) y (t) = 3 X(t) +5
         (ii) y (t) = sin(t). x(t)

Q3 a   Determine inverse Z transform for the following functions: 10
         1) $x(z) = \dfrac{1}{1-15z^{-1}+0.5z^{-2}}$
         2) $x(z) = \dfrac{1}{(1+z^{-1})(1-z^{-1})^2}$

    b   Determine the impulse response sequence of the discrete time LTI   10
         system defined by
         Y(n) − 3y(n-1) -4y(n-2) = x(n) + 2x(n-1)

Turn Over

2

Q4   a   State the sampling theorem. Consider an analog signal   10
x (t) = 10 cos 100πt.
If the sampling frequency is 75 Hz, find the discrete time signal x (n).

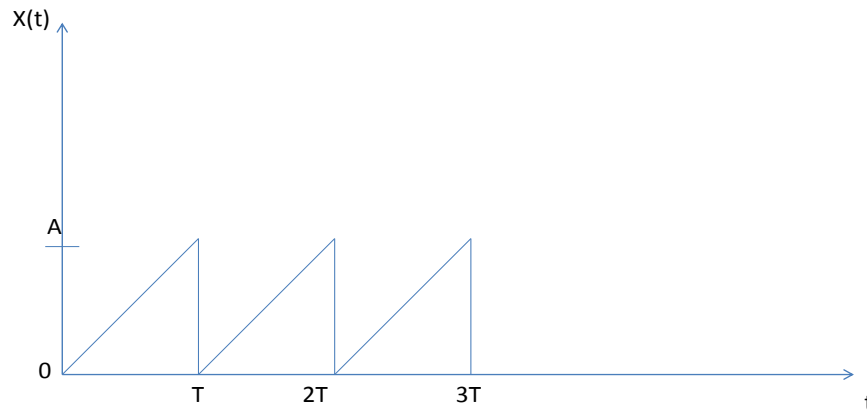Also find an alias frequency corresponding to the sampling frequency of 75 Hz.

    b   Determine the complete response of the system described by the   10
equation :

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

$$y\ (0) = 0\ ;\qquad \frac{dy(t)}{dt} = 1\ at\ t = 0$$

For the input, x(t) = e^{-2t}u(t)

Q5   a   Determine the trigonometric form of Fourier series for the ramp   10
signal shown in figure:-

Turn Over

b
Obtain inverse Laplace transform of $X(s) = \dfrac{2s^2+5s+5}{(s+2)(s+1)^2}$ for all possible ROC conditions.

10

Q6 a
Perform convolution of the following signals, by graphical method and sketch the resultant signal.
$X1(t) = e^{-3t}u(t)$ and $X2(t) = t\,u(t)$

10

Q6 b
Determine the Fourier transform of the periodic impulse function shown in figure:-

10