Time allowed: 3 Hours

Max. Marks: 50

NOTE: *Attempt* <u>*five*</u> *questions in all, including Question No. I which is compulsory and selecting two questions from each Part.*

x-x-x

Q.No.1 (i) What do you mean by transformations of independent variable?

(ii) What are singularity functions?

(iii) Write down the Dirichlet's conditions in CTFS.

(iv) Find Fourier transform of $x(n) = \sin\omega_o n$.

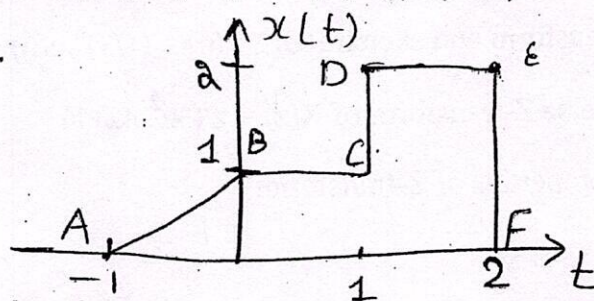(v) Derive the relationship between Laplace transform and Fourier transform. (5x2=10)

Part– A

Q.No. 2 (a) A continuous time signal x(t) is shown below. Sketch and label:
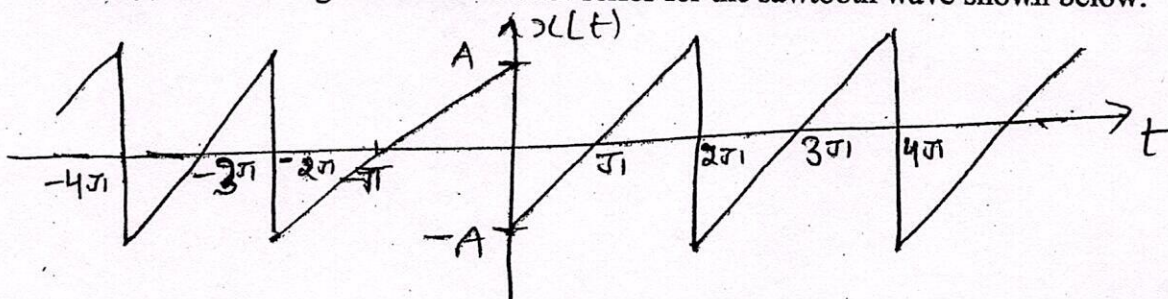
(i) x(t) u(1-t)   (ii) x(t)[u(t)-u(t-1)]   (iii) x(t) δ(t-3/2)

(b) Mention the properties of LTI systems.   (6, 4)

Q.No.3 (a) Find the trigonometric Fourier series for the sawtooth wave shown below:

(b) Determine the discrete Fourier series representation of the following signals:

(i) $x(n) = \cos^2(n\pi/8)$ (ii) $x(n) = \cos(n\pi/3) + \sin(n\pi/4)$ (5, 5)

Q. No.4 (a) Find the Fourier transform for $e^{-at}\sin\omega_o t\, u(t)$. Assume a > 0.

(b) Write the expression for Parseval's relation in case of CTFT and proof it.

(c) Explain the reconstruction of signals using interpolation.   (3, 3, 4)

P.T.O.

Part-B

Q.No.5 (a) The input x(n) and output y(n) of a causal stable LTI system are related as

y(n) – 1/6 y(n-1) – 1/6 y(n-2) = x(n)

(i) Calculate the frequency response $H(e^{jw})$ and (ii) the impulse response h(n) of the system.

(b) Write down the expression for Hilbert transform. Mention its properties.   (6, 4)

Q.No.6 (a) Let $x(t) = \{ e^{-at},$ $0 \leq t \leq T$

                              0,   otherwise

Find Laplace transform of x(t).

(b) Find the initial and final values of X(s) = (2s+5)/((s+1)(s+2)),   ROC: Re(s) > -1.

(c) Find Laplace transform of te^{-at} u(t).   (3, 4, 3)

Q.No.7 (a) Find Z-transform and sketch ROC: $x(n) = (1/3)^n$ u(n) + $(1/2)^n$ u(-n-1)

(b) Determine the inverse Z-transform of X(z) = z/(3z^2-4z+1)

(c) Mention any four properties of Z-transform.   (4, 3, 3)

x-x-x