Time: 3 Hours **Marks: 80**

N.B.:

1. Q.1. is compulsory

2. Solve any three questions out of remaining questions

Q 1 (a) Compare between Power Signal & Energy Signal **(5 marks)**

(b) Obtain Discrete Time Fourier Transform of following signal, **(5 marks)**

$$x(n) = (2)^n u(n)$$

(c) Check whether following systems are Static, Time Invariant, Linear, Causal, & Stable: **(5 marks)**

i) y(t) = x(t)cost

ii) y(t) = cos[x(t)]

(d) Sketch Double Sided Spectrum of following signal: **(5 marks)**

$$x(t) = 20 \sin(2\pi t + 45^\circ) - 8\cos(6\pi t + 120^\circ)$$

Q 2 (a) Verify whether the following continuous time signals are periodic. If periodic, determine the fundamental period: **(10 marks)**

i. $x_1(t) = \sin(15\pi t)$; ii. $x_2(t) = \sin(20\pi t)$; iii. $x(t) = x_1(t) + x_1(t)$

(b) Sketch the following signal with respect to time: **(10 marks)**

$$x(t) = u(t) - r(t-1) + 2r(t-2) - r(t-3) + u(t-4) - 2u(t-5)$$

Q 3 (a) For the given function, $X(s) = \frac{4s}{s^2 + 2s + 1}$. Using only the properties of Laplace Transform, Find the following: **(10 marks)**

i. $x(5t)$ ii. $x(t) * u(t)$

(b) A Continuous Time LTI System is initially relaxed and is represented by the differential equation: $y''(t) + 3y'(t) + 2y(t) = 2x(t)$ Find the following: **(10 marks)**

i. Transfer Function of the system

ii. Impulse Response of the system

iii. System Response for an input, $x(t) = 4e^{-3t}u(t)$

Q 4 (a) Determine the initial value and final value of a signal for the function, **(10 marks)**

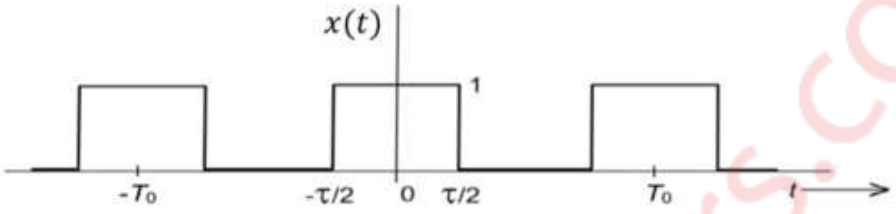
$$X(z) = \frac{2z^2 + 0.25}{(z + 0.25)(z - 1)}$$

(b) An causal LTI system is described by the following difference equation: **(10 marks)**

$$y(n) = -\frac{3}{4}y(n-1) + x(n) - x(n-1)$$

Determine the following:
i) System Function
ii) Pole Zero Plot
iii) Impulse Response
iv) Comment on system stability

Q 5 (a) Obtain the Exponential Fourier Series of following rectangular pulse train: **(10 marks)**



(b) Obtain the Fourier Transform of a dc signal **(05 marks)**

(c) Obtain the Discrete Time Fourier Transform of following: **(05 marks)**

$$x(n) = -(\alpha)^n u(n)$$

Q 6 (a) The impulse response of an LTI System is given by, $h(t) = e^{-2t}u(t)$. **(10 marks)**
Then find the Step Response of the system.

(b) If Fourier Transform of a signal, $x(t)$, is $X(F)$, Then, Prove that, **(10 marks)**

$$\frac{d}{dt}x(t) \xleftrightarrow{F.T.} j2\pi f X(f)$$
