B.Tech IT 5th Semester Mid Semester Examination
Digital Signal Processing

Maximum Marks: 30 **Answer all questions. Each question carries 10 marks.**

Q1. (a) Define and sketch the following discrete sequences for n = -3 to n = 5:

(i) Delta sequence $\delta[n]$

(ii) Unit step sequence u[n]

(iii) Exponential sequence x[n] = (0.5)^n u[n].

(b) Show that an arbitrary sequence x[n] = {2, -1, 3} for n = 0, 1, 2 can be represented as a linear combination of shifted delta sequences.

Q2. (a) A system is described by the input-output relation y[n] = x[n] + x[n-1].

Test whether the system is (i) Linear, (ii) Time-invariant, (iii) Causal. Justify your answers.

(b) Compute the convolution y[n] = x[n] * h[n], where

x[n] = {1, 2, 1} for n = 0, 1, 2

h[n] = {1, 1} for n = 0, 1.

Q3. (a) Define the Discrete Fourier Transform (DFT) and its inverse. Write down the mathematical expressions.

(b) Compute the 4-point DFT of the sequence x[n] = {1, 1, 1, 1}. Show all steps clearly.

(c) For the same sequence, use the properties of DFT to explain whether the resulting spectrum is real, imaginary, or complex.