B.Tech IT 5th Semester Mid Semester Examination

Digital Signal Processing

Answer all the questions: Full Marks: 30

1. Explain the difference between continuous-time and discrete-time signals. Why is the process of sampling important in Digital Signal Processing?
Define a unit step sequence and a unit impulse (delta) sequence.
Given the discrete sequence $x[n] = \{2, 4, 6, 8\}$, represent it using a summation of scaled and shifted delta functions $\delta[n]$.

(2+2)+3+3=10

2. What are the key properties of an LTI system? Briefly describe any two of them, providing relevant mathematical expressions.
Consider two LTI systems: System A has an impulse response $h_A[n] = \{1, 2\}$ and System B has $h_B[n] = \{2, 1\}$. Determine the equivalent system's impulse response when: a) The systems are connected in series.

b) The systems are connected in parallel.

(3+3)+4=10

3. Define convolution in the context of discrete-time signals. Explain why convolution is important in analyzing the output of LTI systems.
Compute the convolution of the two discrete-time sequences:

$x[n] = \{1, 2, 1\}$
$h[n] = \{1, 1\}$.

Show all steps in the convolution process.   (3+2)+5=10