.Tech IT 5th Semester 2nd Mid-Semester Examination

Digital Signal Processing (IT 502)

Total Marks: 30 Time: 1 hour

Answer all questions. Each question carries 10 marks.

Q1. A discrete-time signal is defined as:

$x[n] = (1/3)^n u[n] + 2 u[n-2]$

(a) Find the Z-transform X(z) of the signal.

(b) Determine the Region of Convergence (ROC).

(c) Comment on causality and stability based on ROC.

Q2. Consider a length-3 FIR filter with impulse response $h[n] = \{1, 1, 1\}$, $n = 0, 1, 2$.

(a) Derive the general expression for its frequency response $H(e^{j\omega})$.

(b) Compute the magnitude and phase at $\omega = \pi/3$.

(c) Comment on its filtering nature (low-pass/high-pass/band-pass).

Q3. Explain the MAC (Multiply-Accumulate) architecture used in DSP processors. Discuss its role in high-speed digital filtering operations with reference to pipelining.