**Department of Electrical Engineering**
**Final Exam Assignment**
**Date: 27/06/2020**

## Course Details

**Course Title:** Digital Signal Processing **Module:** 6th
**Instructor:** ____________ **Total Marks:** 50

## Student Details

**Name:** ____________ **Student ID:** ____________

| | | | |
|---|---|---|---|
| Q1. | (a) | Determine the response y(n), $n \geq 0$, of the system described by the second order difference equation<br>$$y(n) - 4y(n-1) + 4y(n-2) = x(n) - x(n-1)$$<br>To the input $x(n) = (-1)^n u(n)$. And the initial conditions are y (-1) = y (-2) = 0. | **Marks 7**<br>**CLO 2** |
| | (b) | Determine the impulse response and unit step response of the systems described by the difference equation.<br>$$y(n) - 0.7y(n-1) + 0.1y(n-2) = 2x(n) - x(n-2)$$ | **Marks 7**<br>**CLO 2** |
| Q2. | (a) | Determine the causal signal x(n) having the z-transform<br>$$x(z) = \frac{1}{(1-2z^{-1})(1-z^{-1})^2}$$<br>(Hint: Take inverse z-transform using partial fraction method) | **Marks 6**<br>**CLO 2** |
| | (b) | Evaluate the inverse z- transform using the complex inversion integral<br>$$X(z) = \frac{1}{1-az^{-1}} \qquad \lvert z\rvert > \lvert a\rvert$$ | **Marks 6**<br>**CLO 2** |
| Q.3 | (a) | A two- pole low pass filter has the system response<br>$$H(z) = \frac{b_o}{(1-pz^{-1})^2}$$<br>Determine the values of $b_o$ and p such that the frequency response $H(\omega)$ satisfies the condition H(0) = 1 and $\left\lvert H(\frac{\pi}{4})\right\rvert^2 = \frac{1}{2}$. | **Marks 6**<br>**CLO 3** |

| | | | |
|---|---|---|---|
| | (b) | Design a two-pole bandpass filter that has the center of its passband at ω = π/2, zero in its frequency response characteristics at ω = 0 and ω = π and its magnitude response in $\frac{1}{\sqrt{2}}$ at ω = 4π/9. | **Marks** **6** <br> **CLO** **3** |
| Q 4 | (a) | A finite duration sequence of Length L is given as <br> $$x(n) = \begin{cases} 1, & 0 \le n \le L-1 \\ 0, & otherwise \end{cases}$$ <br> Determine the N- point DFT of this sequence for N ≥ L | **Marks** **6** <br> **CLO** **2** |
| | (b) | Perform the circular convolution of the following two sequences. Solve the problem step by step <br> $$x_1(n) = \left\{\underset{\uparrow}{2}, 1, 2, 1\right\}$$ <br> $$x_2(n) = \{\underset{\uparrow}{1}, 2, 3, 4\}$$ | **Marks** **6** <br> **CLO** **2** |