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| **Enrolment No:** | |

**UNIVERSITY OF PETROLEUM AND ENERGY STUDIES**

**End Semester Examination, July 2020**

**Course: Digital Signal Processing** **Semester: VI**

**Program: B. Tech ASE+AVE**

**Course Code: ECEG 2023** **Max. Marks: 100**

**Instructions:**

1. **Read the Instruction carefully before attempting**
2. **For Theory based : Type the Answers in word file**
3. **For Figures if any : Draw a free hand sketch and insert the same word file**
4. **For Numerical : Solve it in a paper and insert in the same word file**
5. **Upload as a single word file for all the Question in Blackboard.**

**Note : Please upload the word document only, Do not upload PDF and or other format. The answer scripts will be considered for evaluation only through Blackboard. No other mode of submission is acceptable.**

**SECTION A [Case Based Study] 60 Marks**

| S. No. | | **Marks** | **CO** |
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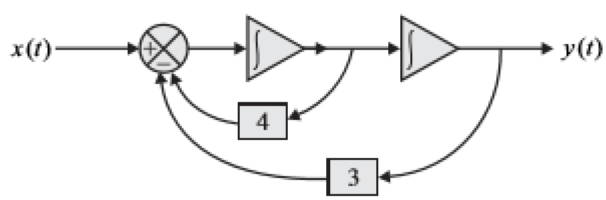
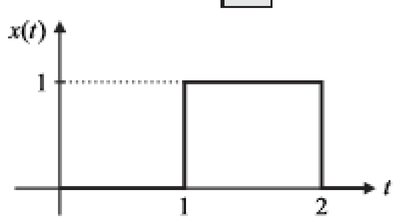
| Q 1 | For the linear, time-invariant system whose block diagram is shown in figure with input x (t) and y (t)<br><br><br><br><br>(a) Find the transfer function.<br>(b) Find the step response of the system [i.e. find y (t) when x (t) is a unit step function and the initial conditions are zero].<br>(c) Find y (t), if x (t) is as shown in figure and initial conditions are zero. | **25** | **CO3** |

NOTE : The submission time of the Question Paper Answer Sheet is 24 Hhrs from the scheduled time (*exceptional provision due to extraordinary circumstance due to COVID-19 and due to internet connectivity issues in the far-flung areas*).

No Submission will be entertained after 24 Hrs

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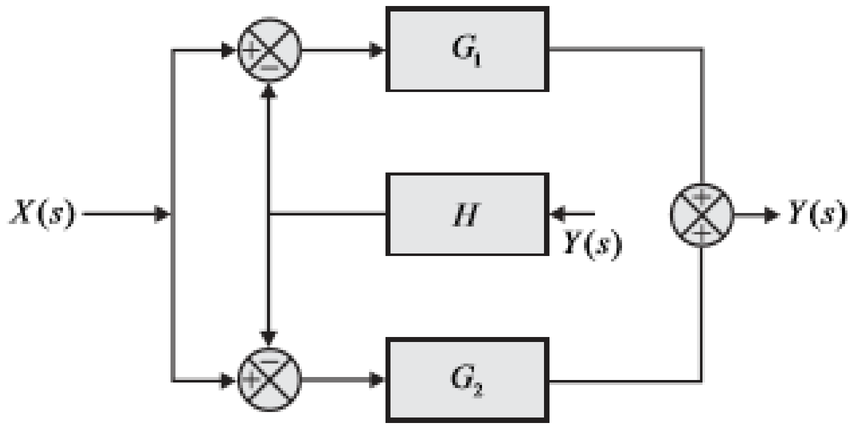
| Q 2 | Obtain the 8-point DFT of the following sequence using Radix-2 DIF FFT Algorithms.<br>Show the results along signal flow graph<br>**x(n)** = { $\mathbf{1, -1, -1, -1, 1, 1, 1, -1}$}<br>a) Draw a Butterfly structure<br>b) Twiddle factor<br>c) Output from Stage A, B, C | **15** | **CO4** |
| Q 3 | Let *x(n)* be a 4-point sequence:<br>$x(n) = \{1, 1, 1, 1\} = \begin{cases} 1 & 0 \le n \le 3 \\ 0 & otherwise \end{cases}$<br>(a) Compute the DTFT $X(e^{jw})$ and plot its magnitude and phase.<br>(b) Compute the 4-point DFT of *x(n)*. | **20** | **CO2** |
| **SECTION B [Numerical and Short Answers] 40 Marks** | | | |
| Q 4 | A difference equation of the system is given as<br>$y(n) - y(n-1) + \frac{1}{4} y(n-2) = x(n) + \frac{1}{4} x(n-1) - \frac{1}{4} x(n-2)$<br>Determine the transfer function of the inverse system. Check whether the inverse system is causal and stable. | **10** | **CO1** |
| Q 5 | Find the transfer function $\frac{Y(s)}{X(s)}$ of the system given below.<br><br> | **5** | **CO3** |

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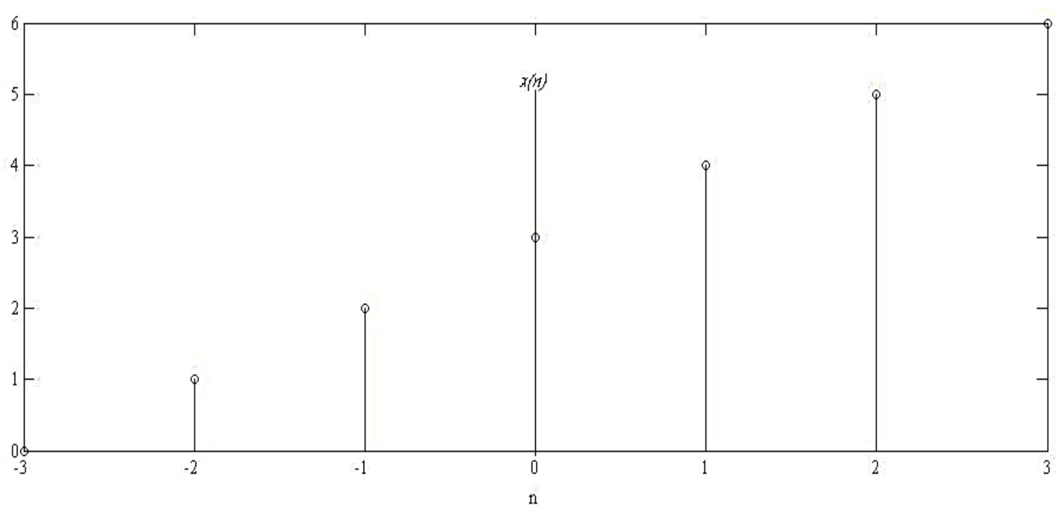
| Q 6 | The system function of the LTI system is given as<br>$$\mathbf{H(z)} = \frac{\mathbf{3-4z^{-1}}}{\mathbf{1-3.5z^{-1}+1.5z^{-2}}}$$<br>Specify the ROC of H(z) and determine unit sample response h(n) for following Anti-causal system | **5** | **CO2** |
| Q 7 | Determine the sequence x(n) whose Z Transform is given as<br>$X(z) = \frac{1+2z^{-1}+z^{-2}}{1-\frac{3}{2}z^{-1}+\frac{1}{2}z^{-2}}$ , ROC : $\lvert z \rvert > 1$ | **5** | **CO2** |
| Q 8 | Discuss the types of digital filters in details. | **5** | **CO4** |
| Q 9 | Compute the circular convolution of given sequence<br>$\mathbf{X_1(n)} = \{\,\mathbf{2, 1, 2, 1}\}$<br>$\mathbf{X_2(n)} = \{\,\mathbf{1, 2, 3, 4}\}$<br>Using DFT and IDFT | **5** | **CO1** |
| Q 10 | Let ***x(n)*** **= {1, 2, 3, 4, 5, 6}**. The signal x(n) is shown in figure1. Find and sketch<br>↑<br>The following signals derived from x(n):<br>**(a)** $y_1(n) = x(n-3)$<br>**(b)** $y_2(n) = x(n+2)$<br> | **5** | **CO1** |

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