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| **Name:**<br><br>**Enrolment No:** | UPES |

# UNIVERSITY OF PETROLEUM AND ENERGY STUDIES

## End Semester Examination, December 2019

**Programme Name: B. Tech Mechatronics** **Semester: VII**
**Course Name: Digital Signal Processing** **Time: 03 hrs.**
**Course Code: ELEG 363** **Max. Marks: 100**
**Nos. of page(s): 01**
**Instructions: Attempt all questions from Section (A) and (B) and only one from Section (C).**

**SECTION A**

| S. No. | | Marks | CO |
|---|---|---|---|
| Q1 | Find the DTFT of the following two functions:<br>(a) $x_1(n) = x(-n-2)$ where $x(n) = e^{-0.5n}u(n)$<br>(b) $x_2(n) = 5^{-n}u(n)$. | **8** | **CO2** |
| Q2 | State and Prove convolution property of Discrete Time Fourier Transform. Using it, determine the convolution $x(n) = x_1(n) * x_2(n)$ of the sequences, where $x_1(n) = x_2(n) = \delta(n+1) + \delta(n) + \delta(n-1)$ | **7** | **CO1** |
| Q3 | Prove the statement " Circular Convolution is Linear Convolution with Aliasing." | **7** | **CO2** |
| Q4 | Find the z transform of the following functions:<br>(a) $x(n) = (-1)^n 2^{-n}u(n)$<br>(b) $x(n) = na^n \sin(\omega_0 n)u(n)$ | **8** | **CO2** |

**SECTION B**

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| Q5 | Compute the eight point DFT of the sequence x[n]=[½, ½, ½, ½,0,0,0,0] using the in-place radix-2 decimation in time and radix-2 decimation in frequency algorithms. | **15** | **CO4** |
| Q6 | Determine the Discrete Fourier transform of the following signals. (i) $x[n]=u[n]$, (ii) $x[n]=(\cos\omega_0 n)u[n]$. | **15** | **CO3** |
| Q7 | Find the inverse z transforms of the following two transfer functions:<br>$H_1(z) = (z + 0.6)/[(z2 + 0.8z + 0.5)(z - 0.4)]$<br>$H_2(z) = (z + 0.4)(z + 1)/(z - 0.5)2$ | **15** | **CO2** |

**SECTION-C (Attempt any one question)**

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| Q8 | Design a type I lowpass Chebyshev filter that has a 1-dB ripple in the pass band, a cutoff frequency $\Omega p = 1000\pi$, a stopband frequency of $2000\pi$, and an attenuation of 40 dB or more for $\Omega \geq \Omega s$. Also determine the order and poles of the filter. | **25** | **CO3** |
| Q9 | When the input to an LTI system is, $x[n]=(1/2)^n u[n]+2^n u[-n-1]$ the output is $y[n]=6(1/2)^n u[n] - 6(3/4)^n u[n]$ .<br>(i) Find the system function H(z) of the system. Plot the poles and zeros of H(z), and indicate the region of convergence.<br>(ii) Find the impulse response h[n] of the system for all values of n.<br>(iii) Write the difference equation that characterizes the system.<br>(iv) Is the system stable? Is it causal? | **25** | **CO3** |