Name: **Enrolment No:**	UPES UNIVERSITY OF TOMORROW

UPES

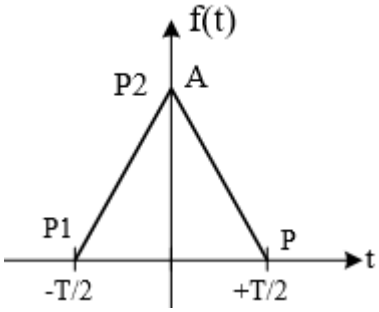
End Semester Examination, May 2025

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

Program: B.Tech(Electronics & Communication Engineering/Electronics & Computer Engineering) **Time: 03 Hrs**

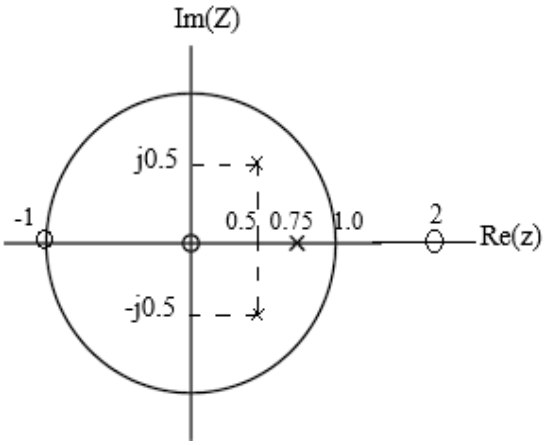
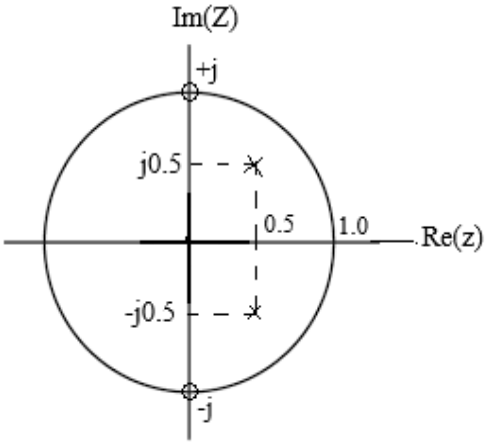
Course Code: CSEG-3042 **Max. Marks: 100**

SECTION A (5Qx4M=20Marks)

S. No.		Marks	CO
Q.1	Discuss the block diagram and application of the Digital Signal Processing system.	**4**	**CO1**
Q.2	Discuss the 5 properties and significance of Discrete Time Fourier Transform (DTFT). Determine the CTFT of the rectangular pulse shown below. 	**4**	**CO2**
Q.3	Differentiate between even and odd signals. Show that the product of two even signals or the two odd signals is an even signal and that the product of an even and odd signal is an odd signal.	**4**	**CO3**
Q.4	What is the role of ADC in DSP? Illustrate with exact quantization and encoding scheme.	**4**	**CO1**
Q.5	Determine the Z transform of $\text{Cos}\,\omega_0 n$ for n ≥ 0.	**4**	**CO4**

SECTION B (4Qx10M= 40 Marks)

Q.6	**(a)** Given x(n) = {0, 1, 2, 3} Find X(k) using the DIT-FFT algorithm with the complete structure of signal flow and computation. **(b)** Show the mathematical equations for the state space representation of the Continuous-time LTI system.	**5+5**	**CO3**
Q.7	Discuss the basic direct form structure of FIR filter realization for computation and MAC operation with the processor. How the design structure relates to the convolution of two signals. Estimate the convolution of two signals using the graphical method or Z transform method. $x(n) = \{4, 3, 2, 1, \},$ $h(n) = \{4, 2, 3, 2\}$	**10**	**CO2**
Q.8	Check whether the given signals are causal or non-causal $\frac{dy(t)}{dt} + 2y(t) = x(t)$ $y(n) = x(n^2)$ $y(n) = x(n) - x(n-1)$ How to check the linearity and non-linearity of a DSP system. Take the same equations and explain.	**10**	**CO1**

Q.9	State and prove the sampling theorem for DSP applications. **OR** Determine the DFT of the following sequence using the direct method. $$x(n) = \begin{Bmatrix} \frac{1}{4} & for\ 0 \le n \le 2 \\ 0 & otherwise \end{Bmatrix}$$	**10**	**CO3**
SECTION-C (2Q x 20M=40 Marks) **Attempt any *Two* of the following**			
Q.10	(**a)** What is the need for Direct form realization of IIR systems such as Direct form-I and direct form-II? Realize the following difference equation in both forms. $$y(n) = b_0x(n) + b_1x(n-1) + b_2x(n-2) + b_3x(n-3) - a_1y(n-1) - a_2y(n-2) - a_3y(n-3)$$ ***OR*** **(b)** Discuss the role of window methods in FIR filter design with mathematical equations. Discuss the magnitude response of low pass, high pass, band pass, and band reject filters with the detail of Gibb's phenomena. A digital filter has edge frequency F_p =7 KHz, Fs = 3 KHz, and F_T = 25 KHz, which determines the normalized pass band and stop band frequencies.	**10+10**	**CO2**
Q.11	**(a)** Determine the transfer function H(z) of both discrete-time filters based on the pole-zero diagrams shown in the Figures below.   **(b)** Computer the 8-point FFT for the following sequence using either the DIT-FFT or DIF-FFT algorithm with a complete description of the flow diagram and N=8 $$x(n) = n + 1$$	**20**	**CO3**
Q.12	**(a)** Explain the architecture of the TMS 320C64X/ TMS 320C40 DSP processor with the complete details of functional modules. **(b)** Discuss the concept of single and double precision IEEE-754 floating points concept. Present the number 85.125 in IEEE single and double precision formats.	**15+5**	**CO4**