Name: **Enrolment No:**	

UPES

End Semester Examination, May 2024

Course: Digital Signal Processing — **Semester: 6**

Program: B.Tech (CSE+ All) — **Time: 03 hrs.**

Course Code: CSEG3042P — **Max. Marks: 100**

Instructions:

- **Electronic gadgets are not allowed during the examination except scientific calculators.**
- **Carrying any material related to the subject of examination and bags are prohibited during the examination.**
- **Exchange of material is prohibited.**

SECTION A
(5Qx4M=20Marks)

S. No.		Marks	CO
Q 1	Find the linear and circular convolution of the following sequences: $x[n] = [1, 0, -0.5, -1]$ and $h[n] = [1, -1, -0.5]$.	2+2	CO1
Q2	Find the z −transform of the signal, $x[n] = n^2 u[n]$.	4	CO1
Q3	Find 4-point DFT of the sequence, $x[n] = \cos\left(\frac{n\pi}{4}\right)$	4	CO1
Q4	Explain up-sampling and down sampling with an example.	4	CO1
Q5	Detail the applications of Multi rate system?	4	CO1

SECTION B
(4Qx10M= 40 Marks)

Q6	Determine the impulse response of the recursive system: $y[n] - y[n-1] = x[n] - x[n-5]$.	10	CO2
Q7	a) Write expressions for DFT and IDFT of a sequence of length N. b) Find the inverse FFT of $X[k] = [10, -2 + j2, 4, -2 - j2]$.	3+7	CO2
Q8	The desired frequency response of a low pass filter is $H_d(e^{i\omega}) = \begin{cases} 1; & \frac{-\pi}{2} \le \omega \le \frac{\pi}{2} \\ 0; & \frac{\pi}{2} \le \omega \le \pi \end{cases}$. Determine $h_d[n]$ for window length $M = 7$ using rectangular window.	10	CO3

Q9	Obtain the cascade and parallel realization structures for the system $y[n] = 0.5\, y[n-1] + 0.25y[n-2] + x[n] + x[n-1]$. (OR) Draw and explain the poly-phase implementation of interpolator with an example.	**10**	**CO3**
SECTION-C (2Qx20M=40 Marks)			
Q10	a) Write the DIT-FFT algorithm to compute 8-poin FFT of a sequence. b) Find the DFT of the sequence $x(n) = \{8,8,8,0,1,4,2,3\}$ using DIF FFT.	**8+8+4**	**CO4**
Q11	a) For the following discrete time signals, determine whether the system is linear, shift invariant, causal and stable. (i) $y[n] = x[n+7]$ (ii) $y[n] = x^3[n]$ b) For the analog transfer function $H_a(s) = \frac{2}{(s+1)(s+2)}$. Determine its digital equivalent using impulse invariance method taking $T = 1sec$. (OR)	**8+12**	**CO4**
	An LTI system is characterized by the difference equation $y(n) = 0.68y(n-1) + 0.5x(n)$. The input signal $x(n)$ has a range of $-5V$ to $+5V$, represented by $8 - bits$. Find the quantization step size, variance of the error signal and variance of the quantization noise at the output.	**20**	**CO4**