Reg.No. ____________

Karunya UNIVERSITY

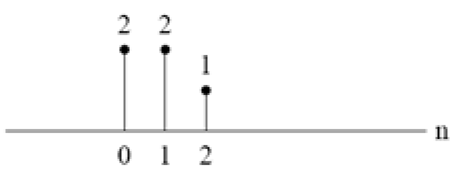
(Karunya Institute of Technology & Sciences)

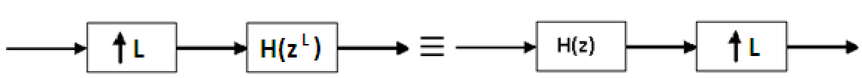
(Declared as Deemed-to-be University under Sec.3 of the UGC Act, 1956)

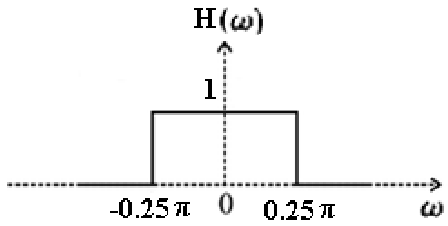
End Semester Examination – Nov/Dec – 2016

			Semester	**:**	**2016-17 ODD**
Code	**:**	**14EC3072**	**Duration**	**:**	**3hrs**
Sub. Name	**:**	**Advanced Digital Signal Processing**	**Max. marks**	**:**	**100**

ANSWER ALL QUESTIONS (5 x 20 = 100 Marks)

Q. No.	Sub Div.	Questions	Course Outcome	Marks
1.	a.	Are the following signals periodic? If so, give the period. i. $x(t) = 4\cos(3\pi t+\pi/4) + 2\cos(4\pi t)$ ii. $x[n] = 4\cos(0.5\pi n + \pi/4)$	CO1	5
	b.	Let $x^2_{ev}[n]$ & $x^2_{od}[n]$ denote, respectively the even and odd parts of a square-summable sequence $x[n]$. Prove the following result: $$\sum_{n=-\infty}^{\infty} x^2[n] = \sum_{n=-\infty}^{\infty} x^2_{ev}[n] + \sum_{n=-\infty}^{\infty} x^2_{od}[n].$$	CO1	10
	c.	Determine whether the following discrete system, where y[n] and x[n] are respectively the output and input sequences is Linear : $y[n] = \alpha x[-n]$ where α is a constant.	CO1	5
		(OR)		
2.	a.	If x[n] is shown in fig.  Sketch (i) $x_1[n] = -x[n+2]$ (ii) $x_2[n] = x[2n+1]$ (iii) $x_3[n] = 0.5(x[n]+x[-n])$	CO1	8
	b.	Determine if the system defined by the difference equation $y[n] = 0.5\,x[n-1] + 0.5\,x[n] + 1.25$ is Linear Time invariant or not.	CO1	8
	c.	Find whether the unit step sequence is an energy signal or power signal.	CO1	4
3.	a.	Determine the 4 point circular convolution of the two length- 4 sequences g[n] and h[n] given by g[n]={1,2,0,1} ; h[n] = {2,2,1,1} . Hint: Use the graphical method of circular convolution.	CO1	8
	b.	Derive the relationship between analog frequency, Ω and the digital frequency, ω.	CO1	5
	c.	Find the discrete time convolution $y[n] = x[n] * h[n]$, where $x[n] = u[n+1] - u[n-4]$ and $h[n] = u[n+1] + 2u[n-2] - 5u[n-5]$	CO1	7

		(OR)		
4.	a.	Find the impulse response of an overall system formed by cascading two LTI systems with impulse responses $h_1[n] = \begin{cases} \frac{1}{n} & (0 < n < 4) \\ 0 & \text{otherwise} \end{cases}$ $h_2[n] = \begin{cases} n & (0 < n < 4) \\ 0 & \text{otherwise.} \end{cases}$	CO1	**8**
	b.	If x [n]={..0, 3, -2, 6, 0, -8, 6, 0..}, Resolve x [n] into sum of weighted impulse sequence. ↑	CO1	**4**
	c.	Determine the inpulse response of the causal LTI system described by the difference equation y[n] – 0.35 y[n-1] = x[n]. (Hint: Use Iteration method)	CO1	**8**
5.	a.	The following signals are defined on the interval n = 0, 1, 2, 3. $X_1[n] = (-1)^n$. Compute the 4 point DFT. Use matrix method for solving DFT	CO2	**5**
	b.	Convolve the signals $x_1[n] = \delta[n] - \delta[n-2] + \delta[n-3]$ and $x_2[n] = 2\delta[n-1] + \delta[n-2] - \delta[n-3]$. Use the tabular column method for discrete convolution and verify the result using Z transform method	CO2	**5**
	e.	Obtain the response of an LTI system whose impulse response h[n] = {1,1} and input x[n] = { -1,2,1} using DIT FFT algorithm.	CO2	**10**
		(OR)		
6.	a.	Compute the 8-point DFT of the sequence $x[n] = \begin{cases} 1, & 0<=n<=7 \\ 0, & \text{otherwise} \end{cases}$ By using the decimation-in-time FFT algorithm.	CO2	**10**
	b.	Determine the z transform and ROC of the following sequence: $x[n] = a^n u[n-2] \quad a<1$	CO2	**5**
	c.	Suppose that we are given a program to find the DFT of a complex-valued sequence x[n]. How can this program be used to find the Inverse DFT of X[k]. Derive the expression?	CO2	**5**
7.	a.	Prove the following Cascade Equivalence. 	CO3	**5**
	b.	Explain with block diagram the implementation of Audio-Sub band Coding and Decoding system.	CO3	**10**
	c.	Discus the features of Quadrature Mirror Filters (QMF) and its use in digital filter banks	CO3	**5**
		(OR)		
8.	a.	Derive the time-domain and frequency-domain expression for the Decimation operation of factor D.	CO3	**10**

	b.	Derive the expression for 3 phase realization of a length-9 FIR filter. Draw the canonical realization for the same.	CO3	**10**
		<u>Compulsory:</u>		
9.	a.	Design a linear phase FIR filter of length 5 samples using Hamming window. The desired frequency response is shown in figure below. 	15	**CO3**
	b.	For the analog transfer function H(s) = $\frac{3}{(s+3)(s+5)}$, determine H(z) using impulse invariant transformation. Assume T= 1 sec.	5	**CO3**

ALL THE BEST