Thapar Institute of Engineering and Technology, Patiala

Electronics and Communication Engineering Department

End Semester Test
Max. Marks: 100 (35%)
Date: May 18, 2018
Instructor: Dr. Kulbir Singh

UEC 404 (Signals and Systems)
Time Allotted: 3 Hrs.
B.E. 2nd year Mechatronics (MTX)

Instructions: You are expected to answer all (Five) questions. Organize your work, in a reasonably neat and coherent way. Mysterious or unsupported answers will not receive full credit. Calculator without graphing mode and alphanumeric memory is permitted. Assume any missing data/information, appropriately.

Q1.	a)	Comment upon the stability of the following system: $x(t) = e^{4t}u(t)$	3
	b)	Comment upon the causality of the following system: $y(n) = x(n) - x(n-1)$	3
	c)	Determine whether the following signals are energy or power signals. i) $x(n) = \left(\frac{1}{4}\right)^n u(n)$ ii) $x(t) = e^{-2t}u(t)$	6
	d)	Consider a system $h(t) = t\,u(t)$ is excited by the input $x(t) = \cos t\, u(t)$. Calculate the output of the system for the given excitation using convolution.	8
Q2.	a)	Calculate the Fourier transform of the following continuous time domain signal: $x(t) = e^{-at}\cos\Omega_0 t\ u(t)$	10
	b)	Determine the Fourier series representation of the following discrete time signal. $x(n) = 3e^{\frac{j5\pi n}{2}}$	10
Q3.	a)	Determine the Z-transform of the following discrete time domain signals. i) $x(n) = [3(2^n) - 4(3^n)]u(n)$ ii) $x(n) = na^n u(n)$	10
	b)	Determine the inverse Z-transform of: $X(z) = \frac{1}{1 - 1.5z^{-1} + 0.5z^{-2}}$ i) if ROC is , $\|z\| > 1$ ii) if ROC is , $\|z\| < 0.5$ iii) if ROC is , $0.5 < \|z\| < 1$	10

P.T.O.

Q4.	a)	List various properties of DFT and derive any two of them.	10
	b)	An 8-point sequence is given by $x(n) = \{2, 7, 3, 1, 4, 9, 2, 4\}$. Compute 8-point DFT of $x(n)$ by using radix-2 decimation-in-time FFT method with the help of well labeled sketch.	10
Q5.	a)	What is the physical significance of random signals? Discuss about the concept of Random Variable and Random Process.	7
	b)	A random experiment consists of drawing two cards from a deck in succession (without replacing the first card drawn). Assign a value to the probability of obtaining two red aces in two draws.	6
	c)	In a random experiment, a trial consists of four successive tosses of a coin. If we define an RV x as the number of heads appearing in a trial, determine $P_x(x)$ and $F_x(x)$.	7