

Roll Number: _____

Thapar University, Patiala

Department of Electronics and Communication Engineering

END SEMESTER EXAMINATIONB. E. (Second Year): Semester-III (2016/17)
(ECE/ENC)

Course Code: UEC404

December 12, 2016

Course Name: Signals and Systems

Time: 3 Hours, M. Marks: 100

Monday, 9.00 - 12.00 Hrs

Name Of Faculty: RP, US, RU, MK

Note: Attempt all questions**Assume missing data, if any, suitably**

Q.1 (a)	Plot the following signals $x(t) = u(t-3) - u(t-5)$ and $h(t) = e^{-3t} u(t)$ and compute i. $y(t) = x(t) * h(t)$ ii. $g(t) = \frac{dx(t)}{dt} * h(t)$	(10)
Q.1 (b)	A linear system 'S' has the relationship $y[n] = \sum_{k=-\infty}^{\infty} x[k]g[n-2k]$ between its input $x[n]$ and its output $y[n]$, where $g[n] = u[n] - u[n-4]$. i. Determine $y[n]$ when $x[n] = \delta[n-1]$ ii. Is the system 'S' linear and time invariant (LTI)? Justify your answer.	(06)
Q.1 (c)	Determine whether or not each of the following signals is periodic. If a signal is periodic, specify its fundamental period. i. $x(t) = e^{j(\pi t-1)}$ ii. $x[n] = \cos\left(\frac{\pi}{2}n\right) \cos\left(\frac{\pi}{4}n\right)$	(04)
Q.2 (a)	Consider two right sided signals $x(t)$ and $y(t)$ related through the differential equations $\frac{dx(t)}{dt} = -2y(t) + \delta(t)$ and $\frac{dy(t)}{dt} = 2x(t)$. Determine $Y(s)$ and $X(s)$, along with their regions of convergence.	(06)
Q.2 (b)	Evaluate the Fourier transform of the signal $x(t)$ shown in Fig.1.	(06)
	<p style="text-align: center;">(Fig.1)</p>	
Q.2 (c)	The input and output of a causal LTI system are related by difference equation $y[n] - \frac{3}{4}y[n-1] + \frac{1}{8}y[n-2] = 2x[n]$ i. What is the frequency response of the system? ii. Find the impulse response of the system.	(08)

Q.3 (a)	<p>Let $x[n]$ be an absolutely summable signal with rational z-transform $X(z)$. If $X(z)$ is known to have a pole at $z = \frac{1}{2}$, could $x[n]$ be</p> <ol style="list-style-type: none"> a finite-duration signal? a left-sided signal? a right-sided signal? a two-sided signal? <p>Give justification for your answers.</p>	(10)
Q.3 (b)	<p>A causal LTI system is described by the difference equation $y[n] = y[n-1] + y[n-2] + x[n-1]$. Find the system function $H(z) = \frac{Y(z)}{X(z)}$ for this system. Plot the poles and zeros of $H(z)$ and indicate the region of convergence. Also, find the unit sample response of the system.</p>	(10)
Q.4 (a)	<p>Using DFT and IDFT, determine the sequence $x_3[n]$ corresponding to the circular convolution of the sequences $x_1[n] = \{2, 1, 2, 1\}$ and $x_2[n] = \{1, 2, 2, 1\}$.</p>	(10)
Q.4 (b)	<p>Compute the 8-point DFT $X(k)$ of the sequence $x(n) = 2^n$, $0 \leq n \leq 7$; using the radix-2 decimation-in-time algorithm. Compare the number of multiplications required to compute the DFT of a 16-point sequence using direct computation and that using FFT.</p>	(10)
Q.5 (a)	<p>A biased coin is loaded such that $P(H) = \frac{1+\epsilon}{2}$ with $0 < \epsilon < 1$. Show that probability of a match in two independent tosses will be greater than $\frac{1}{2}$.</p>	(10)
Q5 (b)	<p>A certain random variable has the cumulative distribution function (CDF) given by:</p> $F_X(x) = \begin{cases} 0, & \text{for } x \leq 0 \\ kx^2, & \text{for } 0 < x \leq 10 \\ 100k, & \text{for } x > 10 \end{cases}$ <ol style="list-style-type: none"> Calculate the value of k. Find the values of $P(x \leq 5)$ and $P(5 < x \leq 7)$. Plot the corresponding probability density function (PDF). 	(10)

Note: The answer sheets will be shown on 21-12-2016 at 10 a.m. onwards in Room Number C-221 (VLSI Lab).