

**Department of Electrical Engineering**

**Final – Assignment Spring 2020**

**Date: 23/06/2020**

**Course Details**

**Course Title:** Dr. Shahid Latif

**Module:** \_\_\_\_\_

**Instructor:** Communication Systems

**Total Marks:** 50

**Student Details**

**Name:** \_\_\_\_\_

**Student ID:** \_\_\_\_\_

Note: Attempt all of the following questions.

Q1.	(a)	Consider the signal $g(t)$ , a periodic train of rectangular pulses of duration 0.25 seconds and period of 1 second. This even signal is described analytically over one period as:  $g(t) = \begin{cases} 2, & 0 \leq t \leq 1/8 \\ 0, & 1/8 < t < 7/8 \\ 2, & 7/8 \leq t \leq 1 \end{cases}$ <p>(a) Using the complex exponential Fourier series coefficients, determine the amplitude spectrum and the power spectrum of <math>g(t)</math>.                      (b) Determine what portion of the power lies within the main lobe and also find the frequency <math>W</math>, where <math>W</math> is an integer, so about 96% of the power lies in the frequency range <math>[-W, W]</math>.</p>	Marks 5 CLO 2
	(b)	A signal is Fourier transformable if it satisfies the Dirichlet's conditions. What are these conditions for Fourier Transform Pair?	Marks 5 CLO 2
Q2.	(a)	Fourier Transform for Periodic Signals in a strict mathematical sense does not exist, as periodic signals are not energy signals. Consider the periodic signal $g(t)$ with period $T_0$ . Define the periodic signal $g(t)$ using the generating function $p(t)$ , where $p(t)$ equals $g(t)$ over one single period and is zero elsewhere.	Marks 5 CLO 2
	(b)	Determine the Fourier transform of $g(t) = \text{sinc}(t)$ ?	Marks 5 CLO 2
Q3.	(a)	"The bandwidth of a signal reflects a range of positive frequencies with significant spectral content". Keeping this statement in view classify atleast four types of bandwidths, considering $B=f_2 - f_1$ , where $f_2 \geq f_1 \geq 0$ .	Marks 5 CLO 2
	(b)	The impulse response of an LTI system is $h(t)=u(t)-u(t-2)$ . Determine the output signal $y(t)$ provided that the input signal is $x(t)=u(t)-u(t-3)$ .	Marks 5 CLO 2
Q4.	(a)	"Convolution is an input-output relationship in time domain". Denotes the convolution operation. Write and prove equation for the convolution integral function $y(t)$ is response to convolution input $x(t)$ and impulse response $h(t)$ .	Marks 5 CLO 2
	(b)	The frequency response of an LTI system is  $H(f) = \frac{1}{2 + j2\pi f}$ Determine the output signal in the time domain provided that the input signal is $x(t) = e^{-t}u(t)$	Marks 5 CLO 2
Q5.	(a)	Differentiate between distortion less transmission and non-linear distortion.	Marks 5 CLO 2
	(b)	Differentiate between low-pass filter, high-pass filter, band-pass filter and band-stop filter	Marks 5 CLO 2