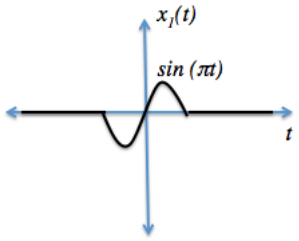
1	2	3	4	5	

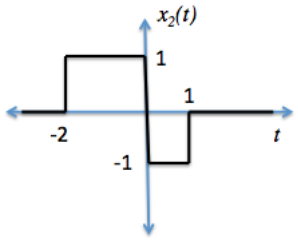
Quiz 2 – EE1101 – Signals and Systems – 2016-17 Semester - II

Name:	Roll:	Section: KJ UK DV VV (tick)

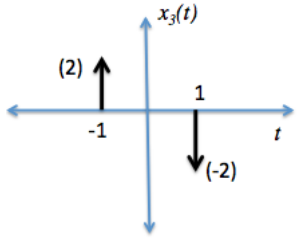
1. Write the mathematical expression for the Fourier transform of the following functions using the properties of Fourier Transforms and the fact that the Fourier transform of $x(t) = 1$, $|t| < 1$ (and zero otherwise) is $X(j\omega) = 2\sin\omega/\omega$. **[3]**



(a)



(b)



(c)

2. (a) Find the Fouier series coefficients for a $2\pi-$periodic function defined as $x(t) = t$, $-\pi \leq t \leq \pi$. **[2]**

   (b) The Basel problem was posed by Pietro Mengoli in 1644 and solved by Leonhard Euler in 1734. The problem was to find the value of the infinite summation: $\sum_{k=1}^{\infty} \frac{1}{k^2}$. Euler, then 28 years old, solved the problem, giving the value of $\frac{\pi^2}{6}$ and thus became famous. Prove that Euler was right. *Hint*: Parsevals. **[3]**

3. Given the following input($x(t)$)-output($y(t)$) relation for a linear time-invariant (LTI) system:

$$\frac{dy(t)}{dt} + 2y(t) = x(t), \text{with } x(t) = A\cos(\omega_0 t).$$

Find ω_0 such that the signal $y(t)$ has a maximum value of $A/3$. **[4]**

4. Consider an auditorium with an echo problem. We can model the speaker's voice as the input, and the audio received by you in the audience as the output of an LTI system. The impulse response of such as system can be expressed as: $h(t) = \sum_{k=0}^{\infty} \exp(-kT)\,\delta(t-kT)$, where $\exp(-kT)$ represents the attenuation (or reflection coefficient) of the k^{th} echo. It is desired to obtain echo-free audio at your end by passing the received signal through an appropriate system that you need to design. Find the frequency response of this system. **[4]**

5. $x(t)$ is a $T-$periodic function showing half-wave symmetry, i.e. $x(t) = -x(t - T/2)$. Show that the even Fourier series coefficients of such a signal are always zero, i.e. $a_{2k} = 0$, $k \in \mathbb{Z}$. **[4]**

♣ — *END* — ♠