HABIB UNIVERSITY

Homework 3
Signals And Systems
Dr. Shafayat Abrar

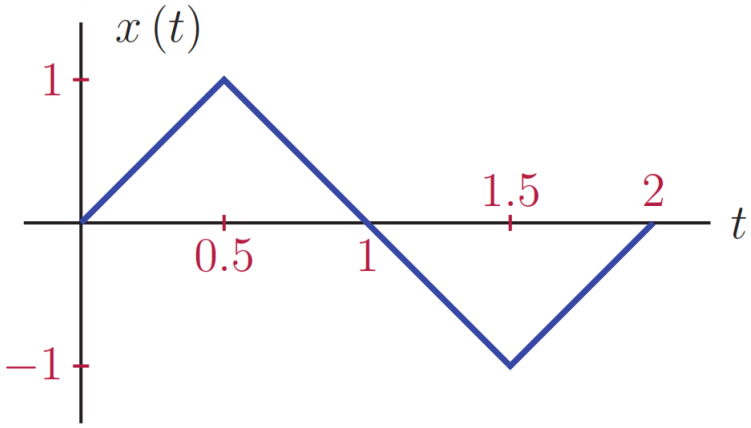
Assigned on: April 14, 2022
Due on: xyz **, 2022

Continuous-Time Fourier Transform

Q1: (a) The Fourier transform of the triangular pulse with peak amplitude A and two corners at $\pm\tau$ is

$$A\Lambda\left(\frac{t}{\tau}\right) \overset{\mathcal{F}}{\longleftrightarrow} A\tau\,\mathrm{sinc}^2\left(f\tau\right)$$

Using this result along with linearity and time shifting properties of the Fourier transform, find the transform of the signal shown in Fig. below:



Q2: The transform pair

$$e^{-a|t|} \overset{\mathcal{F}}{\longleftrightarrow} \frac{2a}{a^2+\omega^2}$$

was obtained in Example 4.16. Using this pair along with the duality property, find the Fourier transform of the signal

$$x(t) = \frac{2}{1+4t^2}$$

Q3: Compute and sketch the Fourier transforms of the modulated pulse signals given below:

a. $x(t) = \cos(10\pi t)\Pi(t)$

b. $x(t) = \cos(10\pi t)\Pi\left(\frac{t}{2}\right)$

c. $x(t) = \cos(10\pi t)\Pi(2t)$

d. $x(t) = \cos(10\pi t)\Pi(4t)$

Q4: Determine the Fourier transform of the signal

$$x(t) = \sin(\pi t)\Pi\left(t - \frac{1}{2}\right) = \begin{cases} \sin(\pi t), & 0 \leq t \leq 1 \\ 0, & \text{otherwise} \end{cases}$$

a. Using the modulation property of the Fourier transform

b. Using the multiplication property of the Fourier transform

Q5: Use Parseval's theorem to prove that

$$\int_{-\infty}^{\infty} |\operatorname{sinc}(f)|^2 df = 1$$

Note: We can discuss these problems during problem session this week.

IMPORTANT: You are allowed to discuss with each other, but please refrain from all forms of academic dishonesty including **cheating**, **collusion** and **plagiarism**. You are **not** allowed to **share** your rough or final work or disclose final answers with others. Your submission must be your **independent** work. **Provide a tidy work showing all mathematical steps and provide vector diagrams with discussions. An untidy, unexplained, incorrect, or incomplete work will be penalized.**

Habib University (HU) defines **Collusion** as a 'form of cheating which occurs when people work together in a deceitful way to develop a submission for an assessment which has been restricted to individual effort'. This means that you have worked together on a task, that you were instructed to do by yourself. The HU policy also states that avoiding unauthorised collaboration is a student's responsibility. Students must "produce assignments independently, except when they are asked to participate in a group project requiring a joint group response to a task".

Cheating is defined as "a failure to comply with any reasonable direction or instruction of an officer, employee or agent of the University relating to the conduct of the formal examination or assessment" this includes: (a) copying from another student in an exam or on a task, (b) using prohibited material (notes or phones) in an exam, (c) paying someone else to do an assessment task for you (this is called 'contract cheating'), (d) using freely available content or tools to complete an assessment task which you were required to do individually.

Plagiarism occurs when you: (a) use other people's words, ideas, or designs e.g. images; (b) without acknowledging where they came from, (c) in order to pass an assessment, get a higher mark or benefit in some other way.

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Dear Students, be ethical and professional. Thanks and regards.