

AMERICAN UNIVERSITY OF BEIRUT
Electrical and Computer Engineering Department
EECE 340
Homework I

Problem 1

Determine whether the following signal is periodic. If it is periodic, find its period.

$$x(t) = \sin\left(\frac{5}{13}\pi^2 t\right)$$

Problem 2

Determine whether or not the following signal $f(t)=4u(t)+2\sin(3t)$ is periodic. If the signal is periodic, determine its fundamental period.

Problem 3

Determine whether or not each of the following signals is periodic. If the signal is periodic, determine its fundamental period.

a) $x(t) = \left[\cos\left(\frac{\pi}{3}t - \pi\right)\right]^3$

b) $x(t) = \cos\left(\frac{\pi}{3}t\right) + \sin\left(\frac{3\pi}{4}t - \pi\right)$

Problem 4

Consider the periodic signal $x(t)$ given by the expression

$$x(t) = (2 + 2j)e^{-j3t} - 3je^{-j2t} + 5 + 3je^{j2t} + (2 - 2j)e^{j3t}$$

Determine the period of $x(t)$ and its fundamental frequency.

Problem 5

Consider the everlasting signal $X(t) = e^{-at}$. Is $X(t)$ an energy signal? For which values of "a" $X(t)$ is a power signal? Determine its average power.

Problem 6

Classify these signals into energy-type signals, power-type signals, and signals that are neither energy type nor power type signals. For energy-type and power-type signals, find the energy or the power content of the signals

a. $x(t) = 4e^{j2\pi f_0 t} + 3e^{j(2\pi f_1 t + \theta)}$

b. $y(t) = e^{-2|t|}$

Problem 7

Categorize each of the following signals as an energy signal or a power signal. State the reason for your answer.

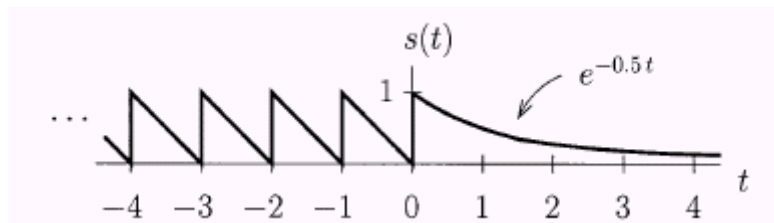
(a) The continuous-time signal $x(t)$, defined by

$$x(t) = \begin{cases} 3e^{-2t}, & t \geq 0, \\ 0, & \text{otherwise.} \end{cases}$$

(b) The continuous-time signal $z(t)$, defined for $-\infty < t < \infty$ by

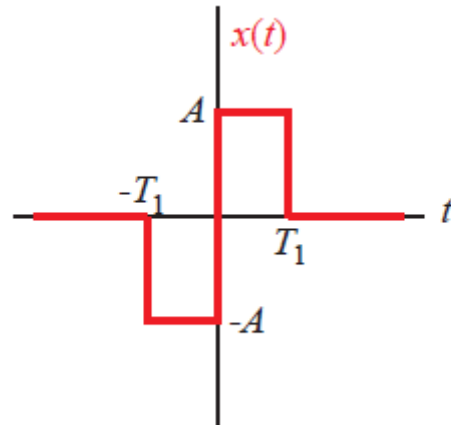
$$z(t) = 3 \sin(\pi t) + 2 \cos(3\pi t)$$

(c)



Problem 8

Consider the signal shown below



- What is the total energy of the signal $x(t)$
- What is the time-averaged power of the signal $x(t)$ (4 pts)

Problem 9

Consider the signal shown below

$$x(t) = \begin{cases} \frac{1}{\sqrt{t}} & t > 1 \\ 0 & t \leq 1 \end{cases}$$

- Determine the total energy of this signal. Is $x(t)$ an Energy Signal?
Determine the average power of this signal. Is $x(t)$ a power signal.

Problem 10

A continuous-time signal $g(t)$ is defined as:

$$g(t) = \begin{cases} 12 \cos^2(2\pi t), & -8 < t < 31 \\ 0, & \text{elsewhere} \end{cases}$$

- Is $g(t)$ an energy signal?
- Is $g(t)$ a power signal?
- Based on your results in parts (a) and (b), categorize the signal as an energy signal or a power signal.