



COLLEGE OF ENGINEERING AND TECHNOLOGY

Department: Electronics and Communications Dep.

Course: Signals and Systems EC321

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Sheet #3

1. Prove mathematically that the signals given are periodic. For each signal, find the fundamental period T_0 and the fundamental frequency ω_0 .

- a. $x(t) = 2 \cos(7t/6)$
- b. $x(t) = 7 \sin(t)$
- c. $x(t) = e^{j4t}$
- d. $x(t) = \cos(t) + \sin(2t)$
- e. $x(t) = e^{j(5t+\pi)}$
- f. $x(t) = e^{-j10t} + e^{j15t}$

2. For each signal, if it is periodic, find the fundamental period T_0 and the fundamental frequency ω_0 . Otherwise, prove that the signal is not periodic.

- a. $x(t) = \cos(3t) + \sin(5t)$
- b. $x(t) = \cos(t) + \sin(\pi t)$
- c. $x(t) = \cos(3t) + \sin(9t)$
- d. $x(t) = \cos(3\pi t) + \sin(4\pi t) + \cos(5t)$
- e. $x(t) = \cos(4\pi t) + \sin(6\pi t) + e^{j5\pi t}$
- f. $x(t) = \cos(3t + 30^\circ) + e^{j2t} + \sin(3\pi t)$

3. Consider the following signals, if this signal is periodic find its fundamental period T_0 and its fundamental frequency ω_0 . Otherwise, prove that the signal is not periodic.

- a. $x(t) = 5 \sin(15t + 60^\circ) + 2 \sin(7t)$
- b. $x(t) = \cos(\pi t) + 3 e^{-j15t} + \sin(7t)$
- c. $x(t) = \sin(\pi t) + \cos(3t)$
- d. $x_4(t) = x_1(t) + x_2(t) + x_3(t)$

$$x_1(t) = \cos(\pi t), \quad x_2(t) = \sum_{n=-\infty}^{\infty} \text{rect}\left(\frac{t+n}{0.2}\right), \quad \text{and} \quad x_3(t) = 4 \sin\left(\frac{5\pi}{6}t + \frac{\pi}{4}\right).$$

4. Given $x(t) = u(t - 1) - u(t - 2) + u(2 - t) - u(3 - t) + u(t - 3) - u(t - 4)$

- a. Sketch $x(t)$
 - b. Calculate the values in each stage
- 5. Given $x(t) = 3 u(t) + t u(t) - (t-1) u(t-1) - 5 u(t-2)$**
- a. Sketch $x(t)$
 - b. Calculate the values in each stage

6. Write a mathematical model for $x(t)$ shown in Figure

