ISRA UNIVERSITY

Islamabad Campus

Program: BSC & MSC (Electrical)
Semester - Fall 2018
Solution
Signal & Systems

Assignment – 3   **Due Date: 03/01/2019**
Marks: 10   **Handout Date: 31/12/2018**

Question # 1:

Find the Fourier series coefficients for each of the following signals:

1. $x(t) = \sin\left(10\pi t + \frac{\pi}{6}\right)$
2. $x(t) = 1 + \cos(2\pi t)$

Solution:

1) $x(t) = \sin\left(10\pi t + \dfrac{\pi}{6}\right)$

Sol^n

Using Euler's identity $\sin\theta = \dfrac{e^{j\theta} - e^{-j\theta}}{2j}$

$$x(t) = \frac{e^{j\left(10\pi t + \pi/6\right)} - e^{-j\left(10\pi t + \pi/6\right)}}{2j}$$

$$= \frac{e^{j10\pi t}\, e^{j\pi/6}}{2j} - \frac{e^{-j10\pi t}\, e^{-j\pi/6}}{2j}$$

$$= \frac{e^{j\pi/6}\, e^{j2\pi t \cdot 5}}{2j} - \frac{e^{-j\pi/6}\, e^{j2\pi t \cdot 5}}{2j}$$

$\therefore\; x(t) = \displaystyle\sum_{k} a_k e^{j k \omega_0 t}$

hence $\omega_0 = 2\pi$

then

$k = 5 \;\&\; -5$

$a_5 = \dfrac{e^{j\pi/6}}{2j}\;\;,\;\; a_{-5} = \dfrac{-e^{-j\pi/6}}{2j}$

otherwise $a_k = 0$.

$\longleftrightarrow$

2) $x(t) = 1 + \cos(2\pi t)$

Sol^n

Using Euler's identity $\cos\theta = \dfrac{e^{j\theta} + e^{-j\theta}}{2}$

$$x(t) = 1 + \frac{e^{j2\pi t}}{2} + \frac{e^{-j2\pi t}}{2}$$

$\omega_0 = 2\pi$

$a_{-1} = a_1 = \dfrac{1}{2}$ and $a_0 = 1$. All other a_k's $= 0$.

Good Luck