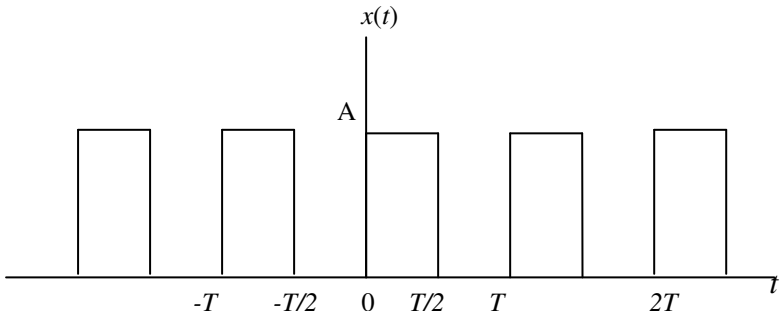
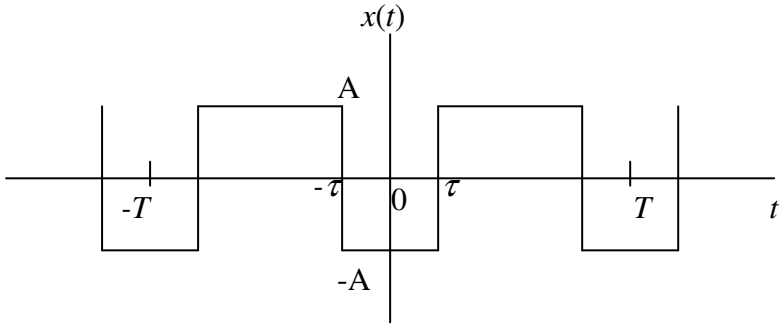
Tutorial 2

1. Determine the (i) complex Fourier Series and (ii) trigonometric Fourier Series approximation of the signal shown below



2. Find and sketch the magnitude spectrum of the periodic signal shown below for (i) $\tau = T/4$ and (ii) $\tau = T/8$ (assume T = 1s and A = 1/2).



3. Determine the average power in the signal $y(t) = \cos(4(t\text{-}3)) + \cos(7(t\text{-}3))$.

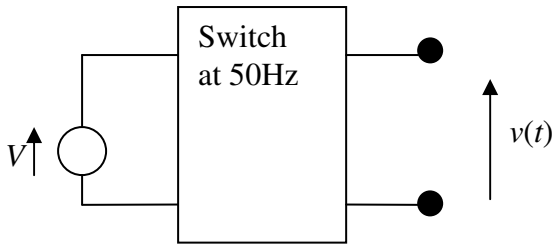
4. Verify that a periodic signal can be represented by

$$x(t) = a_o + \sum_{n=1}^{\infty} \left(a_n \cos n\omega_o t + b_n \sin n\omega_o t \right),$$

where a_o is the dc components, a_n and b_n are the trigonometric Fourier series coefficients. Hence show that

$$a_n = \frac{2}{T}\int_{<T>} x(t)\cos n\omega_o t dt \text{ and } b_n = \frac{2}{T}\int_{<T>} x(t)\sin n\omega_o t dt .$$

5. Consider a simple dc to ac converter shown below, in which the conversion is achieved by switching the switch at 50Hz. Assume the switch is either open or close.



Sketch and label the output signal of the converter. Calculate the conversion efficiency, defined as $\frac{power\quad out}{power\quad in}$. [Assume that all the harmonics except the fundamental are removed by low pass filtering]