1.1.b)

$$x(t) = \begin{cases} \left(\frac{1}{4} - |t|\right), & -T_1 \le t \le T_1 \\ 0, & -T_1 \le t \le T_1 \end{cases}$$

Given, $T = 1$, $T_1 = 1/4$.

Now,

$$x(t) = \begin{cases} \frac{1}{4} - t & 0 < t \le 1/4 \\ \frac{1}{4} + t & -1/4 \le t < 0 \\ 0 & T_1 < |t| < T/2 \end{cases}$$

$$a_0 = \int_0^{T/4} \left(\frac{1}{4} - t\right) dt + \int_{-T/4}^{0} \left(\frac{1}{4} + t\right) dt$$

$$\left[\frac{t}{4} - t^2\right]_0^{T/4} + \left[\frac{t}{4} + t^2\right]_0^{T/4} = \frac{1}{8} - \left(\frac{1}{32} + \frac{1}{32}\right) = \frac{1}{8} - \frac{1}{16}$$

$$= \frac{1}{16}. \quad (\because T = 1)$$

a_k, $k \neq 0$.

$$a_k = \frac{1}{T}\left[\int_{-T/4}^{0} \left(\frac{1}{4} + t\right) e^{-jw_0 t} \cdot dt + \int_0^{T/4} \left(\frac{1}{4} - t\right) e^{-jw_0 t} dt\right]$$

$$\frac{1}{T}\left[\frac{-1}{4jk\omega_0}+\frac{e^{jk\omega_0/4}}{4jk\omega_0}+\int_{-1/4}^{0} t\cdot e^{-jk\omega_0 t}\cdot dt\right.$$

$$+\frac{1}{4jk\omega_0}-\frac{e^{-j\omega_0 k/4}}{4jk\omega_0}$$

$$\left.-\int_{0}^{1/4} t\cdot e^{-jk\omega_0 t}\cdot dt\right]$$

$$=\frac{1}{T}\left\{\frac{e^{-jk\omega_0/4}}{4jk\omega_0}-\int_0^{1/4} t e^{-jk\omega_0 t}\cdot dt+\frac{e^{jk\omega_0/4}}{4jk\omega_0}+\int_{-1/4}^{0} t e^{-jk\omega_0 t}\cdot dt\right\}$$

$$=\frac{1}{T}\left(\cancel{\frac{-e^{-jk\omega_0/4}}{4jk\omega_0}}-\left[\cancel{\frac{e^{-jk\omega_0/4}}{j^2k^2\omega_0^2}}-\frac{1}{\cancel{j^2}k^2\omega_0^2}\right]\right.$$

$$\left.+\frac{e^{jk\omega_0/4}}{4j\omega_0 k}-\left[\frac{1}{\cancel{j^2}k^2\omega_0^2}-\cancel{\frac{e^{jk\omega_0/4}}{j^2k^2\omega_0^2}}\right]\right)$$

$$\frac{1}{T}\left[\frac{e^{jk\omega_0/4}-e^{-jk\omega_0/4}}{4j\omega_0 k}\right] \quad [\because \omega_0 T = 2\pi)$$

$$= -\cos\pi$$

$$=\boxed{\frac{1-\cos(\omega_0 k/4)}{2k^2\pi^2}} \qquad = \frac{1-\cos(\omega_0 k/4)}{4j\omega_0 kT\cdot k\pi/\cancel{k}}$$