$$C_n = \frac{1}{T}\int_0^{aT} E\, e^{-i\frac{2\pi}{T}nt}\, dt$$

$$= \frac{E}{T}\left[\frac{e^{-i\frac{2\pi}{T}nt}}{-i\frac{2\pi}{T}n}\right]_0^{aT}$$

$$= \frac{E}{T}\left(\frac{e^{-i2\pi an}}{-i\frac{2\pi}{T}n} - \frac{1}{-i\frac{2\pi}{T}n}\right)$$

$$= \frac{E}{-i2\pi n}\left[\exp(-i2\pi an) - 1\right]$$

$$= \frac{E}{-i2\pi n}\left[\cos 2\pi an - i\sin 2\pi an - 1\right]$$

$$= \frac{E}{2\pi n}\left(-\sin 2\pi an + i(-\cos 2\pi an + 1)\right)$$

$$= -\frac{E}{2\pi n}\left(\sin 2\pi an + i(\cos 2\pi an - 1)\right)$$