Tutorial 6-3
Discrete Fourier Transform
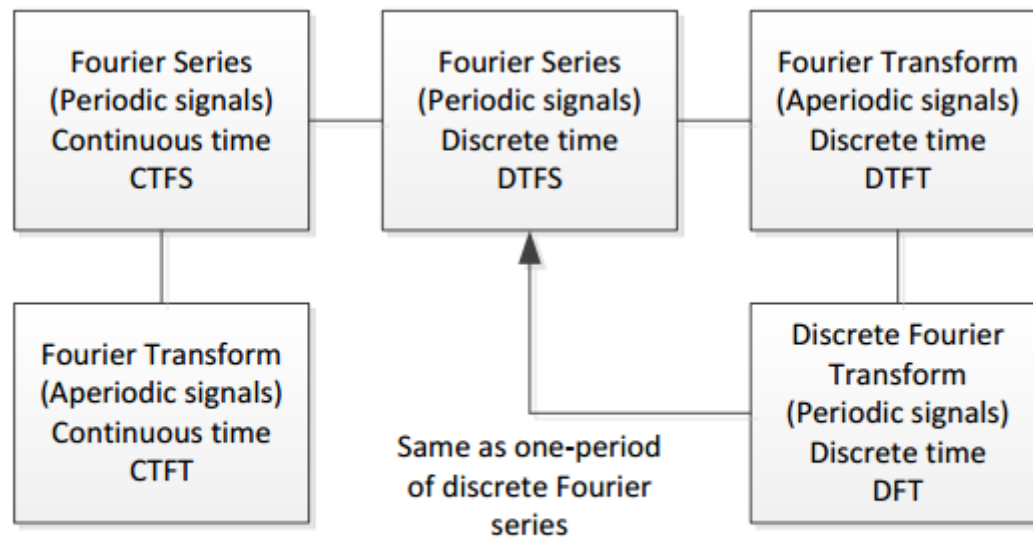
Figure 5.1 – Relationship of various Fourier transforms

	Input is		Output Spectrum is	
	Periodic	**Time Resolution**	**Periodic**	**Frequency Resolution**
Fourier Series Continuous CT-DFS	Periodic	Continuous	No	Discrete
Fourier Series Discrete DT-DFS	Periodic	Discrete	Periodic	Discrete
Fourier Transform CTFT	Non-periodic	Continuous	Non-periodic	Continuous
Fourier Transform DTFT	Non-periodic	Discrete	Periodic	Continuous
Discrete Fourier Transform DFT	Non-periodic	Discrete	Periodic	Discrete

Table I – Properties of Fourier transform input and output signals

- Discrete Fourier transform (DFT) which has all three desired properties.
  - (a) Periodic or non-periodic
  - (b) Of finite duration
  - (c) Have a discrete frequency spectrum

$$X(\Omega) = \sum_{k=-\infty}^{\infty} x[k]e^{-j\Omega k} \quad DTFT$$

$$X(n) = \sum_{k=0}^{N-1} x[k]e^{-j(2\pi kn/N)} \quad DFT$$