

# GATE: ME - 14.2022

EE22BTECH11219 - Rada Sai Sujan

## APPENDIX

*Complex Fourier series:*

$$x(t) = \sum_{n=-\infty}^{\infty} c_n e^{j2\pi n f t} \quad (1)$$

where  $c_n$  is the exponential fourier coefficient.

$$c_n = \frac{1}{T} \int_0^T x(t) e^{-j2\pi n f t} dt \quad (2)$$

where  $T$  is the time period of function  $x(t)$ .

*Trigonometric fourier series:*

$$e^{j2\pi n f t} = \cos(2\pi n f t) + j \sin(2\pi n f t) \quad (3)$$

Substituting (3) in (1)

$$\begin{aligned} x(t) &= \sum_{n=-\infty}^{\infty} c_n (\cos(2\pi n f t) + j \sin(2\pi n f t)) \quad (4) \\ &= a_0 + \sum_{n=1}^{\infty} (a_n \cos(2\pi n f t) + (b_n \sin(2\pi n f t))) \quad (5) \end{aligned}$$

where  $a_0, a_n$  and  $b_n$  are trigonometric fourier series.

$$a_0 = c_0 \quad (6)$$

$$= \frac{1}{T} \int_0^T x(t) dt \quad (7)$$

$$a_n = 2\text{Re}(c_n) \quad (8)$$

$$= \frac{2}{T} \int_0^T x(t) \cos(2\pi n f t) dt \quad (9)$$

$$b_n = -2\text{Im}(c_n) \quad (10)$$

$$= \frac{2}{T} \int_0^T x(t) \sin(2\pi n f t) dt \quad (11)$$