GATE: ME - 14.2022

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Appendix

1) The Z-transform of $x(n)$ is defined as

$$X(z) = \sum_{n=-\infty}^{\infty} x(n) z^{-n} \tag{1}$$

If,

$$x(n) \overset{\mathcal{Z}}{\longleftrightarrow} X(z) \tag{2}$$

$$y(n) \overset{\mathcal{Z}}{\longleftrightarrow} Y(z) \tag{3}$$

The properties of $Z-$transform can be given as:

2) Linearity Property:

$$ax(n) + by(n) \overset{\mathcal{Z}}{\longleftrightarrow} aX(z) + bY(z) \tag{4}$$

3) Time shifting property:

$$x(n-k) \overset{\mathcal{Z}}{\longleftrightarrow} z^{-k} X(z) \tag{5}$$

4) Time scaling property:

$$x\left(\frac{n}{k}\right) \overset{\mathcal{Z}}{\longleftrightarrow} X\left(z^{k}\right) \tag{6}$$

5) Time reversal property:

$$x(-n) \overset{\mathcal{Z}}{\longleftrightarrow} X\left(z^{-1}\right) \tag{7}$$

6) $Z-$domain scaling:

$$a^{n} x(n) \overset{\mathcal{Z}}{\longleftrightarrow} X\left(\frac{z}{a}\right) \tag{8}$$

7) Convolution property:

$$x(n) * y(n) \overset{\mathcal{Z}}{\longleftrightarrow} X(z)\, Y(z) \tag{9}$$

8) Differentiation in $Z-$Domain:

$$n^{k} x(n) \overset{\mathcal{Z}}{\longleftrightarrow} (-1)^{k} z^{k} \frac{d^{k} X(z)}{dz^{k}} \tag{10}$$