# EE23BTECH11054 - Sai Krishna Shanigarapu*

EE23BTECH11054 - Sai Krishna Shanigarapu*

EXERCISE 9.2

**13** If the sum of $n$ terms of an A.P. is $3n^2 + 5n$ and its $m^{th}$ term is 164, find the value of $m$ and obtain the Z-transform of the series.

Solution:

$$S(n) = 3(n+1)^2 + 5(n+1) \tag{1}$$

$$x(n) = (x(0) + nd)(u(n)) \tag{2}$$

$$S_0 = 8 \tag{3}$$

$$S_1 = 22 \tag{4}$$

$$d = 6 \tag{5}$$

$$m = 26 \tag{6}$$

$$x(n) = (8 + 6n)(u(n)) \tag{7}$$
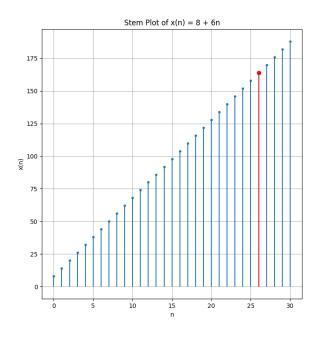
$$X(z) = \sum_{n=-\infty}^{\infty} x(n) z^{-n} \tag{9}$$

$$= \sum_{n=0}^{\infty} (8 + 6n) z^{-n} \qquad \text{using (7)} \tag{10}$$

$$= \frac{8 - 2z^{-1}}{(1 - z^{-1})^2} \qquad \left\{ z \in \mathbb{C} : |z^{-1}| < 1 \right\} \tag{11}$$

So, the Z-transform of the given series is

$$X(z) = \frac{8 - 2z^{-1}}{(1 - z^{-1})^2}$$

| Symbol | Parameters |
|--------|------------|
| $S_n$ | Sum of $n$ terms |
| $x(n)$ | general term |
| $d$ | common difference |
| $X(z)$ | Z-transform of $x(n)$ |
| $u(n)$ | unit step function |

TABLE I
PARAMETERS



Fig. 1. Plot of x(n) vs n

$$x(n) \overset{Z}{\to} X(z) \tag{8}$$