Assignment-3

EE:1205 Signals and systems
Indian Institute of Technology, Hyderabad

Sai Preetam Umesh Sasankota
EE23BTECH11221

I. QUESTION 1.2.4

$1 \times 2 \times 3 + 2 \times 3 \times 4 + 3 \times 4 \times 5 + \ldots$

II. SOLUTION

From the given sequence, we know that

$$a_n = n(n + 1)(n + 2) \tag{1}$$

$$S_n = \sum a_n \tag{2}$$

$$= \sum n(n + 1)(n + 2) \tag{3}$$

$$= \sum n(n^2 + n + 2n + 2) \tag{4}$$

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

$$= \sum n^3 + 3 \sum n^2 + 2 \sum n \tag{6}$$

$$= \frac{n^2(n + 1)^2}{4} + \frac{3n(n + 1)(2n + 1)}{6} + \frac{2n(n + 1)}{2} \tag{7}$$

$$= \frac{n(n + 1)}{2}[\frac{n(n + 1)}{2} + 2n + 1 + 2] \tag{8}$$

$$= \frac{n(n + 1)}{2}[\frac{n^2 + n}{2} + 2n + 3] \tag{9}$$

$$= \frac{n(n + 1)}{2}[\frac{n^2 + 5n + 6}{2}] \tag{10}$$

$$= \frac{n(n + 1)(n + 2)(n + 3)}{4} \tag{11}$$

Hence the sum of the series is

$$\frac{n(n + 1)(n + 2)(n + 3)}{4} \tag{12}$$