

	<b>Name of the School</b>	School of Basic & Applied Sciences	<b>Name of the Department</b>	Mathematics
	<b>Name of the Program</b>	B.Tech, CSE	<b>Course Code- Course</b>	UBS 1003M
	<b>Session</b>	2024-25	<b>Branch, Year &amp; Semester</b>	CSE , 1 <sup>st</sup> , 1 <sup>st</sup>

## Unit 5: Sequence and Series

### Question Bank

#### 2 Marks Questions

- Give an example of a monotonically increasing sequence which is
  - Convergent
  - Divergent
- Give an example of a monotonically decreasing sequence which is
  - Convergent
  - Divergent
- Discuss the nature of the series  $2 - 2 + 2 - 2 + 2 - 2 + \dots$
- Test for convergence of the series  $1 + \frac{2}{3} + \frac{3}{4} + \dots + \frac{n}{n+1} + \dots + \infty$
- Examine the convergence of the series  $\frac{1}{\sqrt{1} + \sqrt{2}} + \frac{1}{\sqrt{2} + \sqrt{3}} + \frac{1}{\sqrt{3} + \sqrt{4}} + \dots$

#### 6 Marks Questions

- Examine the convergence of the following series
 
$$\frac{3}{5} + \frac{4}{5^2} + \frac{3}{5^3} + \frac{4}{5^4} + \dots \text{to } \infty$$
- State D' Alembert's Ratio Test for convergence of an infinite series. Using D' Alembert's ratio test, test for convergence of the series whose  $n^{\text{th}}$  term is  $\frac{n^2}{2^n}$ .
- Test the following series for convergence
 
$$\frac{2}{1^p} + \frac{3}{2^p} + \frac{4}{3^p} + \dots$$
- Examine the following series for convergence

$$\sum_{n=1}^{\infty} \frac{(n+1)^n}{n^{n+1}} x^n$$

## 10 Marks Questions

1. Discuss the convergence of the infinite series

$$\sum \frac{\sqrt{n}}{\sqrt{n^2+1}} x^n \quad (x > 0)$$

2. Test for convergence of positive term series

$$1 + \frac{\alpha+1}{\beta+1} + \frac{(\alpha+1)(2\alpha+1)}{(\beta+1)(2\beta+1)} + \frac{(\alpha+1)(2\alpha+1)(3\alpha+1)}{(\beta+1)(2\beta+1)(3\beta+1)} + \dots$$

3. Discuss the convergence of the series

$$\frac{x}{1} + \frac{1}{2} \cdot \frac{x^3}{3} + \frac{1 \cdot 3}{2 \cdot 4} \cdot \frac{x^5}{5} + \frac{1 \cdot 3 \cdot 5}{2 \cdot 4 \cdot 6} \cdot \frac{x^7}{7} + \dots$$

4. Test the convergence of the following series

a.  $\sum \left( \frac{n}{n+1} \right)^{n^2}$

b.  $\left( \frac{2^2}{1^2} - \frac{2}{1} \right)^{-1} + \left( \frac{3^3}{2^3} - \frac{3}{2} \right)^{-2} + \left( \frac{4^4}{3^4} - \frac{4}{3} \right)^{-3} + \dots$

5. Test for the convergence of the series

$$\frac{x}{1 \cdot 2} + \frac{x^2}{3 \cdot 4} + \frac{x^3}{5 \cdot 6} + \dots$$

# Solutions

### 2 Marks Questions.

- a.  $\frac{n}{n+1}$
  - b.  $n$
- a.  $\frac{1}{n}$
  - b.  $-n$
- Oscillating finitely
- Divergent
- Divergent

### 6 Marks Questions

1. Convergent
2. Convergent
3. Convergent for  $p > 2$  and divergent for  $p \leq 2$ .
4. Convergent for  $x < 1$  and divergent if  $x \geq 1$ .

### 10 Marks Questions

1. Convergent if  $x < 1$  and divergent if  $x \geq 1$ .
2. Convergent when  $\beta > \alpha > 0$  and divergent if  $\alpha \geq \beta > 0$
3. Convergent if  $x^2 \leq 1$  and divergent when  $x^2 > 1$
4. a. Convergent    b. Convergent
5. Convergent if  $x \leq 1$  and divergent if  $x > 1$ .