COURSE CODE (CREDITS): 25B11MA212   MAX. MARKS: 15
COURSE NAME: MATHEMATICS FOR LIFE SCIENCES-II
COURSE INSTRUCTOR: MDS   MAX. TIME: 1 Hour

Note: *(a) All questions are compulsory.*
(b) The candidate is allowed to make suitable numeric assumptions wherever required for solving problems
(c) Use of calculators is not allowed

Q.No	Question	CO	Marks
Q1	In a bioreactor, the dissolved oxygen concentration (in mg/L) measured after the nth operating cycle is modeled by the sequence $$O_n = 7 - \frac{5}{2^n}, \quad n = 1, 2, 3, \cdots$$ Check whether the sequence $\{O_n\}$ is a) monotonic (b) bounded (c) convergent.	CO-1	3
Q2	After each booster dose, a small amount of inflammatory response (in arbitrary units) is produced: $$u_n = \frac{n(n+3)}{(n+1) \cdot (2n+3)^2}, \quad n = 1,2,3,\cdots$$ The total inflammatory exposure over many doses is $$\sum_{n=1}^{\infty} \frac{n(n+3)}{(n+1) \cdot (2n+3)^2}.$$ Check whether the series converges or diverges.	CO-1	3
Q3	For the following series $$\frac{x}{2 \cdot 3} + \frac{x^2}{5 \cdot 7} + \frac{x^3}{8 \cdot 11} + \frac{x^3}{11 \cdot 15} + \cdots \cdots, \quad x > 0.$$ a) Write the general term of the series. b) Discuss the convergence of the following series.	CO-1	3
Q4	Discuss the convergence of the following series $$\sum_{n=1}^{\infty} \frac{(-1)^{n+1}}{n^2 + 3n + 2}.$$	CO-1	3
Q5	The temperature distribution $u(x,t)$ in a rod satisfies the heat equation $$\frac{\partial u}{\partial t} = \alpha^2 \frac{\partial^2 u}{\partial x^2}.$$ where α is the thermal diffusivity. Given that $$u(x,t) = e^{-t} \sin(\pi x)$$ determine the thermal diffusivity α.	CO-2	3