



Mahatma Gandhi University

Kottayam

Programme	BSc (Hons) Statistics					
Course Name	Analytical Tools for Statistics-I					
Type of Course	DSC					
Course Code	MG5DSCSTA302					
Course Level	300 - 399					
Course Summary	In essence, this course provides a comprehensive foundation in mathematical concepts that are not only essential for understanding higher-level mathematics but also have wide-ranging applications in various scientific disciplines. The inclusion of sets, sequences, series, functions, and uniform convergence ensures a well-rounded understanding of mathematical structures and their significance.					
Semester	5	Credits			4	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		4				60
Pre-requisites						

MGU-UGP (HONOURS)

COURSE OUTCOMES

CO No.	Expected Course Outcome	Learning Domains	Program Outcome
1	Use logical reasoning to prove theorems on sets and real sequences and hence develop analytical skill to solve problems involving sets and sequences.	E	2

2	Develop Mathematical models using infinite series to real-world problems	E	1
3	Develop skill to distinguish between continuous and discontinuous functions and their implications.	E	2
4	Explain and illustrate the relationship between differentiability and continuity.	E	1
5	Test the uniform convergence of sequence and series of functions.	An	2

**Remember (K), Understand (U), Apply (A), Analyze (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)*

COURSE CONTENT

Content for Classroom Transaction (Units)

Module	Course Description	Hours	CO No.
Module 1	Sets and Sequences	15	
1.1	Sets-Bounded and unbounded sets, supremum and infimum.	3	1
1.2	Neighbourhood of a point, limit point of a set, derived set, Bolzano-Weierstrass theorem (without proof), open and closed sets.	4	1
1.3	Sequences-Convergence and divergence of sequences, Bolzano-Weierstrass theorem (without proof), limit inferior and limit superior (Definitions and examples only), Cauchy's general principle of convergence, Cauchy sequences. Limits of some special sequences such as r^n , $\left(1 + \frac{1}{n}\right)^n$ and $n^{\frac{1}{n}}$.	5	1
1.4	Algebra of sequences, Sandwich theorem, Cauchy's first and second theorems on limits, Monotonic sequences, Monotone convergence theorem.	3	1
Module 2	Infinite Series	15	
2.1	Definition, positive term series, tests for convergence: comparison test, Cauchy's root test, D'Alembert's ratio test, Raabe's test, logarithmic test.	10	2

2.2	Alternating series, Leibnitz test for the convergence of alternating series.	3	2
2.3	Absolute convergence and conditional convergence.	2	2

Module 3	Limit and Continuity of Functions of a Single Variable	15	
3.1	Limits of a function, continuous functions, continuity at a point and continuity in an interval, discontinuous functions, types of discontinuity, functions continuous on closed interval	10	3
3.2	Uniform continuity and absolute continuity,	5	3
Module 4	Differentiability of Functions of a Single Variable and Uniform Convergence of Sequences and Series of Functions	15	
4.1	Derivatives, derivability at a point, derivability in an interval.	3	4
4.2	Darboux's theorem (without proof), intermediate value theorem for derivatives, Rolle's Theorem, Lagrange's Mean Value Theorem, Cauchy's Mean value theorem.	4	4
4.3	Sequence of functions, point wise convergence, uniform convergence, Mn test for uniform convergence (Without proof).	5	5
4.4	Series of functions, Point wise convergence, uniform convergence, Weierstrass's M-Test (Without proof).	3	5
Module 5	Teacher Specific content		

Teaching and Learning Approach	<p>Classroom Procedure (Mode of transaction)</p> <p>Direct Instruction: Brainstorming lecture, E-learning, Interactive Instruction, Seminar, Group Assignments, Authentic learning, Presentation by students by group.</p>
Assessment	<p>MODE OF ASSESSMENT</p> <p>A. Continuous Comprehensive Assessment (CCA)</p> <p><i>Formative assessment</i></p> <p>Quiz, Assignments, Seminar.</p> <p>Theory:10 marks</p> <p><i>Summative assessment</i></p> <p>Written tests</p> <p>Theory: 20 marks</p>

Types	B. End Semester Evaluation: Total: 70 marks (Duration : 2 Hrs) Short answer type questions: Answer any 10 questions out of 12 ($10 \times 3 = 30$). Short essay type questions: Answer any 4 questions out of 6 ($4 \times 7 = 28$). Essay type questions: Answer any 1 question out of 2 ($1 \times 12 = 12$).
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References:

1. Malik, S.C. and Arora, S. (2017). Mathematical Analysis, 5th Edition, New Age International limited, New Delhi.
2. Bali, N.P (2023). Real Analysis, 2nd Edition. New Age International limited, New Delhi.

Suggested Readings:

1. Shanti Narayan and Raisinghania, M.D. (2021). Elements of Real Analysis, S. Chand & Company, New Delhi
2. Rudin, W. (2023). Principles of Mathematical Analysis, 3rd Edition, McGraw Hill.
3. Apostol, T.M. (2002). Mathematical Analysis, 2nd Edition, Narosa Publishing House, New Delhi.



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Syllabus