

FOUR YEAR UNDER GRADUATE PROGRAM (2024-28)
DEPARTMENT OF MATHEMATICS
COURSE CURRICULUM

| Part A: Introduction | | | |
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| Program: Bachelor in Science (Degree/Honors) | | Semester - V | Session:2024-2025 |
| 1 | Course Code | MASC-05 | |
| 2 | Course Title | Real Analysis | |
| 3 | Course Type | Discipline Specific Course (DSC) | |
| 4 | Pre-requisite(if any) | Knowledge of algebra, real numbers, set theory, functions and elementary calculus. | |
| 5 | Course Learning Outcome (CLO) | <p>This Course will enable the students to:</p> <ul style="list-style-type: none"> ➤ Understand basic properties of real number system such as least upper bound property and Order property. ➤ Realize importance of bounded, convergent, Cauchy and monotonic sequences of real numbers, find their limit superior and limit inferior. ➤ Learn about Riemann integrability of bounded functions and algebra of R-integrable functions. ➤ Determine various applications of the fundamental theorem of integral calculus. ➤ Relate concepts of uniform continuity, differentiation, integration and uniform convergence.. | |
| 6 | Credit Value | 4 C | 1Credit = 15 hours- Learning and Observation |
| 7 | Total Marks | Maximum Marks : 100 | Minimum Passing Marks:40 |

| Part B: Content of the Course | | |
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| Total no of teaching – learning period =60 Periods (60 Hours) | | |
| UNIT | Topics | No of Periods |
| I | <p>Contributions and Biography of Indian Mathematicians Swami Bharati Krishna Tirth, Madhav, Neelkanth Somayaji and Shrinivaas Aayangar Ramanujan</p> <p>Real Numbers : The set of real numbers R as an ordered field, Least upper bound properties of R, Metric property and completeness of R, Archimedean property of R, Dense subsets of R, Nested intervals property; Neighborhood of a point in R, Open sets, limit point of a set, closed and perfect sets in R.</p> | 15 |
| II | <p>Convergence of sequences in R: Bounded and monotonic sequences, Convergent sequence and its limit, Limit theorems, Monotone convergence theorem, Subsequences, Bolzano-Weierstrass theorem, Limit superior and limit inferior, Cauchy sequence, Cauchy's convergence criterion.</p> | 15 |
| III | <p>Infinite Series: Convergence and divergence of infinite series of positive real numbers, Necessary condition for convergence, Cauchy criterion for convergence; Test for</p> | 15 |

(Dr. S. Dashpudi)

(Dr. P. K. Sahu)

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| | convergence of positive term series; Basic comparison test, Comparison test, D'Alembert's Ratio test, Cauchy root test, Raabe's test, Logarithmic test, Cauchy Integral test, Alternating series, Leibnitz's test, Series of arbitrary terms, Absolute and conditional convergence, Rearrangement of series and Riemann's theorem. | |
| IV | Riemann Integration and Improper Integrals: Riemann integrability of bounded functions, Examples of R- integrable and non-integrable functions, Algebra of Riemann integrable functions, Integrability of continuous and monotonic functions, Darboux theorems, Fundamental theorem of integral calculus, Improper Integral. | 15 |

Part C - Learning Resource

Text Books, Reference Books, Other Resources

Text Books Recommended-

1. T.M. Apostol (2008). *Mathematical Analysis: A Modern Approach to Advanced Calculus*. Pearson Education.
2. Charalambos D. Aliprantis & Owen Burkinshaw (1998). *Principles of Real Analysis*. Academic Press

Reference Books Recommended-

3. Robert G. Bartle & Donald R. Sherbert (2015). *Introduction to Real Analysis* (4th edition). Wiley India.
4. Gerald G. Bileau, Paul R. Thie & G.E. Keough (2015). *An Introduction to Analysis* (2nd edition), Jones and Bartlett India Pvt. Ltd.
5. E. Hewitt & K. Stromberg (2013). *Real and Abstract Analysis*. Springer-Verlag.
6. K.A. Ross (2013). *Elementary Analysis: The Theory of Calculus* (2nd edition). Springer.
7. Walter Rudin. *Principles of Mathematical Analysis* (3rd edition), Tata McGraw Hill.

E-resources: <https://onlinecourses.nptel.ac.in>
<https://epqp.inflibnet.aci.in>
<https://swayam.gov.in>
<https://www.mooc.org>

Part D: Assessment and Evaluation

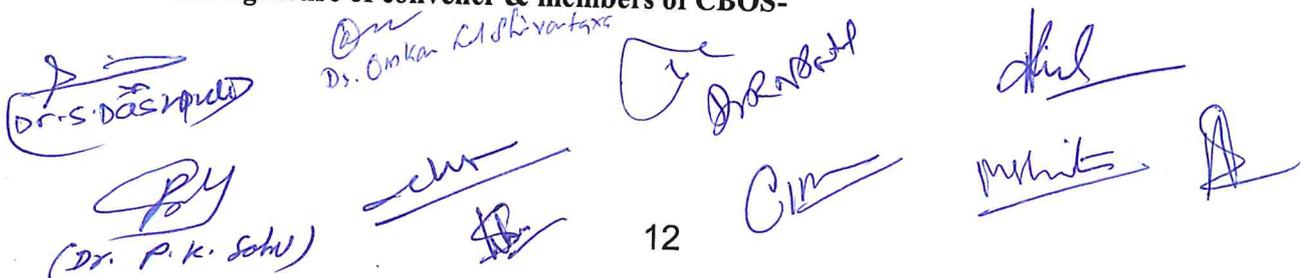
Suggested Continuous Evaluation Methods:

Maximum Marks: **100 Marks**
 Continuous Internal Assessment (CIA): **30 Marks**
 End Semester Examination (ESE): **70 Marks**

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| Continuous Internal Assessment (CIA) (Conducted by course teacher) | Test/Quiz – 20+20 Marks Assignment/Seminar- 10 Marks | Better marks out of two test/quiz + obtained marks in Assignment shall be considered against 30 marks |
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| End Semester Examination (ESE) | Two Section-A&B Section-A: Q1. Objective- 10x1=10 marks Q2. Short answer type question- 5x4=20 marks Section-B: Descriptive answer type question, 1 out of 2 from each unit- 10x4= 40 Marks |
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Name and signature of convener & members of CBOS-



 Dr. S. Dasgupta
 Dr. Omkar
 Dr. P. K. Sahu
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