Semester	**3**
Course	**BSc Statistics Honours**
Paper Code	**C2ST230311T**
Paper Title	**Real Analysis I and Linear Algebra I**
No. of Credits	**4**
Theory / Practical / Composite	**Theory**
Minimum No. of preparatory hours per week a student has to devote	**4**
Number of Modules	**2**
Syllabus	***Module 1: Real Analysis 1*** ***Unit 1:*** ***Real number system***: Basic Ideas. Archimedean property. [3L] ***Sequences of real numbers***: Definition, convergence, limit of a sequence. Bounded and monotone sequences. Cauchy sequences. Properties and applications.[7L] ***Series of real numbers***: Definition, convergence. Tests of convergence (statement and applications) – Comparison, Limit comparison, Ratio, Root, Rabbe's, Cauchy Condensation, Logarithmic, Integral tests, Abel's and Dirichlet's tests. Absolute and conditional convergence of series. [4L] ***Unit 2:*** ***Limits of real valued functions***: Definition, left hand and right hand limits. Infinite limits and limits at infinity. Sequential definition of limits. Properties of limits. Applications. [4L] ***Continuity of real valued functions***: Definition, left hand and right hand continuity. Discontinuous functions. Sequential definition of continuity. Properties of continuous functions. Applications. Intermediate value property. [4L] ***Differentiability of real valued functions***: Definition, properties. Chain rule. Rolle's theorem, Lagrange's mean value theorem. Applications. [4L]

	Module 2: linear algebra I ***Unit 1:*** ***Algebra of Matrices:*** A review - properties related to triangular, symmetric and skew-symmetric matrices, idempotent matrices, orthogonal matrices, singular and non-singular matrices and their properties. Trace of a matrix. Adjoint and inverse of a matrix and related properties. Partitioning of matrices and simple properties. [8L] ***Unit 2:*** ***Determinants:*** Definition, properties, algebraic operations and evaluation of determinants using transformations. Product of determinants. Vandermonde determinants for nth order. Jacobi's Theorem. [12L] ***Unit 3:*** ***Ideas of vectors:*** Definition, unit vector, null vector, sum vector, linear combination of vectors, linearly independent vectors, orthogonal vectors, orthonormal vectors. Gram-Schimdt orthogonalization. [6L]
Learning Outcomes	o To understand the definition of sequences and their properties. o To apply different tests to evaluate convergence of series. o To identify and verify properties of real valued functions. o To understand concepts of matrix algebra and determinants. o To learn the ideas of vectors.
Reading/Reference Lists	1. Bertle R. G., Sherbert D. R. (2011): Introduction to Real Analysis, 4th Edition, Wiley & Sons Inc. 2. Goldberg R. R. (2020): Methods of Real Analysis, Oxford & IBH Publishing Co Pvt Ltd. 3. Ghorpade S. R., Limaye V. B. (2006): A Course in Calculus and Real Analysis, Springer Publications. 4. Khuri A. (2003) :Advanced Calculus with Applications in Statistics, 2nd Edition, Wiley Interscience. 5. Rudin W. (2017): Principles of Mathematical Analysis, 3rd Edition, McGraw Hill Publication. 6. Hadley G. (2002): Linear Algebra. Narosa Publishing House (Reprint). 7. Mapa S. K. (2016): Higher Algebra: Abstract and Linear. Levant

<table>
<tr><td></td><td colspan="2">Books.
8. Narayan S. (2004): A Textbook of Matrices, S Chand & Co Ltd.
9. Searle S. R. (1982): Matrix Algebra Useful for Statistics. John Wiley & Sons.</td></tr>
<tr><td>Evaluation</td><td colspan="2">CIA: 30
End-Sem: 70
Total: 100</td></tr>
<tr><td rowspan="2">Paper Structure for Theory Semester Exam</td><td>Module-I (35 marks)</td><td>Module-II (35 marks)</td></tr>
<tr><td>To answer Short: 4 out of 6 (5 marks)
Long: 1 out of 2 (15 marks)</td><td>To answer Short: 4 out of 6 (5 marks)
Long: 1 out of 2 (15 marks)</td></tr>
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