Part A: Introduction				
Program: Certificate Course		**Class:** B.Sc. I Year	Year: **2021**	Session: 2021-2022
Subject: Mathematics				
1	**Course Code**	S1-MATH1T		
2	**Course Title**	Algebra, Vector Analysis and Geometry (Paper I)		
3	**Course Type**	Core Course		
4	**Pre-requisite (if any)**	To study this course, a student must have had the subject Mathematics in class 12th.		
5	**Course Learning Outcomes (CLO)**	The course will enable the students to: 1. Recognize consistent and inconsistent systems of linear equations by the row echelon form of the augmented matrix, using the rank of matrix. 2. To find the Eigen values and corresponding Eigen vectors for a square matrix. 3. Using the knowledge of vector calculus in geometry. 4. Enhance the knowledge of three dimensional geometrical figures (eg. cone and cylinder).		
6	**Credit Value**	Theory: 6		
7	**Total Marks**	Max. Marks: 25 + 75	Min. Passing Marks: 33	

Part B: Content of the Course		
Total No. of Lectures (in hours per week): 3 hours per week **Total Lectures:** 90 hours		
Unit	Topics	No. of Lectures
I	1.1 Historical background: 1.1.1 Development of Indian Mathematics: Later Classical Period (500 -1250) 1.1.2 A brief biography of Varahamihira and Aryabhatta 1.2 Rank of a Matrix 1.3 Echelon and Normal form of a matrix 1.4 Characteristic equations of a matrix 1.4.1 Eigen-values 1.4.2 Eigen-vectors	15
II	2.1 Cayley Hamilton theorem 2.2 Application of Cayley Hamilton theorem to find the inverse of a matrix. 2.3 Application of matrix to solve a system of linear equations 2.4 Theorems on consistency and inconsistency of a system of linear equations 2.5 Solving linear equations up to three unknowns	18

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III	3.1 Scalar and Vector products of three and four vectors 3.2 Reciprocal vectors 3.3 Vector differentiation 3.3.1 Rules of differentiation 3.3.2 Derivatives of Triple Products 3.4 Gradient, Divergence and Curl 3.5 Directional derivatives 3.6 Vector Identities 3.7 Vector Equations	18
IV	4.1 Vector Integration 4.2 Gauss theorem (without proof) and problems based on it 4.3 Green theorem (without proof) and problems based on it 4.4 Stoke theorem (without proof) and problems based on it	15
V	5.1 General equation of second degree 5.2 Tracing of conics 5.3 System of conics 5.4 Cone 5.4.1 Equation of cone with given base 5.4.2 Generators of cone 5.4.3 Condition for three mutually perpendicular generators 5.4.4 Right circular cone 5.5 Cylinder 5.5.1 Equation of cylinder and its properties 5.5.2 Right Circular Cylinder 5.5.3 Enveloping Cylinder	24

Keywords:
Indian Mathematics, Rank of a Matrix, Scalar and Vector products, Vector differentiation, Vector identities, Vector integration, General equation of second degree, Tracing of conics, System of conics, Equation of cone, Equation of cylinder.

Part C - Learning Resources

Text Books, Reference Books, Other Resources

Suggested Readings:

Text Books:

1. K. B. Datta: Matrix and Linear Algebra, Prentice Hall of India Pvt. Ltd. New Delhi 2000.
2. Shanti Narayan: A Text Book of Vector Calculus, S. Chand & Co., New Delhi, 1987.
3. S. L. Loney: The Elements of Coordinate Geometry Part-1, New Age International (P) Ltd., Publishers, New Delhi, 2016.
4. P. K. Jain and Khalil Ahmad: A text book of Analytical Geometry of Three Dimensions, Willey Eastern Ltd, 1999.
5. Gerard G. Emch, R. Sridharan, M. D. Srinivas: Contributions to the History of Indian Mathematics, Hindustan Book Agency, Vol. 3, 2005.

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Part A: Introduction				
Program: Certificate Course		**Class:** B.Sc. I Year	**Year:** 2021	**Session:** 2021-2022
Subject: Mathematics				
1	**Course Code**	S1-MATH2T		
2	**Course Title**	Calculus and Differential Equations (Paper 2)		
3	**Course Type**	Core Course		
4	**Pre-requisite (if any)**	To study this course, a student must have had the subject Mathematics in class 12th.		
5	**Course Learning Outcomes (CLO)**	The course will enable the students to: 1. Sketch curves in a plane using its Mathematical properties in the different coordinate systems of reference. 2. Using the derivatives in Optimization, Social sciences, Physics and Life sciences etc. 3. Formulate the Differential equations for various Mathematical models. 4. Using techniques to solve and analyze various Mathematical models.		
6	**Credit Value**	Theory: 6		
7	**Total Marks**	Max. Marks: 25 + 75	Min. Passing Marks: 33	

Part B: Content of the Course		
Total No. of Lectures (in hours per week): 3 hours per week **Total Lectures:** 90 hours		
Unit	Topics	No. of Lectures
I	1.1 Historical background: 1.1.1 Development of Indian Mathematics: Ancient and Early Classical Period (till 500 CE) 1.1.2 A brief biography of Bhāskarachārya (with special reference to Lilavati) and Madhava 1.2 Successive differentiation 1.2.1 Leibnitz theorem 1.2.2 Maclaurin`s series expansion 1.2.3 Taylor's series expansion 1.3 Partial Differentiation 1.3.1 Partial derivatives of higher order 1.3.2 Euler's theorem on homogeneous functions 1.4 Asymptotes 1.4.1 Asymptotes of algebraic curves 1.4.2 Condition for Existence of Asymptotes 1.4.3 Parallel Asymptotes 1.4.4 Asymptotes of polar curves	18

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II	2.1 Curvature 2.1.1 Formula for radius of Curvature 2.1.2 Curvature at origin 2.1.3 Centre of Curvature 2.2 Concavity and Convexity 2.2.1 Concavity and Convexity of curves 2.2.2 Point of Inflexion 2.2.3 Singular point 2.2.4 Multiple points 2.3 Tracing of curves 2.3.1 Curves represented by Cartesian equation 2.3.2 Curves represented by Polar equation	18
III	3.1 Integration of transcendental functions 3.2 Introduction to Double and Triple Integral 3.3 Reduction formulae 3.4 Quadrature 3.4.1 For Cartesian coordinates 3.4.2 For Polar coordinates 3.5 Rectification 3.5.1 For Cartesian coordinates 3.5.2 For Polar coordinates	18
IV	4.1 Linear differential equations 4.1.1 Linear equation 4.1.2 Equations reducible to the linear form 4.1.3 Change of variables 4.2 Exact differential equations 4.3 First order and higher degree differential equations 4.3.1 Equations solvable for x, y and p 4.3.2 Equations homogenous in x and y 4.3.3 Clairaut's equation 4.3.4 Singular solutions 4.3.5 Geometrical meaning of differential equations 4.3.6 Orthogonal trajectories	18
V	5.1 Linear differential equation with constant coefficients 5.2 Homogeneous linear ordinary differential equations 5.3 Linear differential equations of second order 5.4 Transformation of equations by changing the dependent/ independent variable 5.5 Method of variation of parameters	18

Keywords/Tags:
Indian Mathematics, Successive differentiation, Partial Differentiation, Asymptotes, Curvature, Tracing of curves, Quadrature, Rectification, Linear differential equations, Method of variation of parameters.

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