Part A: Introduction				
Program: **Certificate Course**		Class: **B.A./ B.Sc. I Year**	Year: **2022**	Session: **2022-2023**
1	Course Code	**MATH-1P (I)**		
2	Course Title	I - Lab 01 - Calculus and Algebra		
3	Course Type	**Practical**		
4	Pre-requisite (if any)	No		
5	Course Learning Outcomes (CLO)	At the end of course, Students will be able to • Learn Free and Open Source Software (FOSS) tools for computer programming • Solve problems on Calculus and Algebra theories studied in Mathematics Paper 1and 2 by using FOSS softwares. • Acquire knowledge of applications of Calculus and Algebra through FOSS.		
6	**Credit Value**	**2**		
7	**Total Marks**	**Max. Marks: 50**	**Min Passing Marks : 17**	

Part B: Content of the Course	
	Total Periods: 30
Tentative Practical List	Mathematics practical with Free and Open Source Software (FOSS) tools forcomputer programs, such as GeoGebra/Maxima/Scilab/ Octave /Python/R. **Course Objectives:** • To learn Free and Open Source Software (FOSS) tools for computerprogramming • Acquire knowledge of applications of algebra and calculus through FOSS **List of Practicals**: (At least 15 practicals) • Programs to illustrate left hand and right hand limits for discontinuous functions. • Program to illustrate continuity of a function • Program to illustrate differentiability of a function • Program to verify Rolle's theorem • Program to verify Lagrange's theorem • Programs to verify Cauchy's mean value theorem and finding Taylor's theorem for a given function. • Program to illustrate nth derivative without Leibnitz rule.

	• Program to construct series using Maclaurin's expansion for functions of two variables. • Program to finding the asymptotes of curves. • Program to finding radius of curvature of cycloid. • Program to finding partial derivative of a given function. • Program to calculating the area under two curves. • Obtaining partial derivatives of some standard functions. • Evaluation of the line integral with constant limits. • Evaluation of the line integral with variable limits. • Evaluation of the double integral with constant limits. • Evaluation of the double integral with variable limits. • Evaluation of the triple integral with constant limits. • Evaluation of the triple integral with variable limits. • Programs for area and volume. • Verifying whether given operator is binary or not • To find identity element of a group • To find inverse element of a group. • To construct Cayley's table • Verification of a subgroup of a given subset of a group • Finding all possible subgroups of a finite group. • Examples to verify Lagrange's theorem. • To find the left and right cosets and index of a subgroup • To find all the cyclic subgroups of a given group • Verification of normality of a given subgroup of a group • Illustrating homomorphism and isomorphism of groups • Examples on different types of rings.

	• Examples on integral domains and fields. • Examples on subrings, ideals and subrings which are not ideals. • Homomorphism and isomorphism of rings- illustrative examples. • Solving polynomial equations. • Finding G.C.D of polynomials. • Finding product of two matrices • To test linear independency of a given set of a vectors in a vector space.

Part C - Learning Resource		
Text Books, Reference Books, Other Resources		
SUPPORT FROM THE GOVT FOR STUDENTS AND TEACHERS IN UNDERSTANDING AND LEARNING FOSS TOOLS: As a national level initiative towards learning FOSS tools, IIT Bombay for MHRD, government of India is giving free training to teachers interested in learning open source software's like scilab, maxima, octave, geogebra and others. (Website: http://spoken-tutorial.org;) (email: info@spokentutorial.org; contact@spoken-tutorial.org)		
Part D: Assessment and Evaluation		
Suggested Continuous Evaluation Methods: Maximum Marks: 50 Continuous Comprehensive Evaluation (CCE): Not Applicable University Exam(UE): 50 Marks		
Internal Assessment: Continuous Comprehensive Evaluation (CCE)	Class Test/Assignment/Presentation	Not Applicable

Declaration

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- Member

Part A: Introduction				
Program: **Certificate Course**		Class: **B.A./B.Sc. I Year**	Year: **2022**	Session: **2022-2023**
1	Course Code	**MATH-1P (II)**		
2	Course Title	II - Project 01 - History of Mathematician		
3	Course Type	**Project**		
4	Pre-requisite (if any)	NIL		
5	Course Learning Outcomes (CLO)	Studying history of mathematicians help students: • Develop a deeper understanding of the mathematics they hare already studied by seeing how it was developed over time and in various places. • Know the rich intellectual heritage of the country. • Develop an appreciation of mathematics and build positive attitude towards mathematics increasing student's motivation decreasing anxiety related the subject. • To acquire knowledge about development of mathematics in ancient , medieval and modern period of history.		
6	**Credit Value**	**2**		
7	**Total Marks**	**Max. Marks: 50**	**Min Passing Marks : 17**	

Part B: Content of the Course	
	Total Periods: 30
Project List	**Course Objectives:** An elective course designed to acquire special / advance knowledge, such as supplement study / support study to a project work and a candidate will study such a course on his own with an advisory support a teacher / faculty member. **Project** Contributions and biographies of Indian Mathematicians- Bodhayan, Apasthambh, Katyayan and Mahaveeracharya, Brahmagupta, and Bhaskaracharya in special context of Leelavati and contributions of mathematicians involved in context of the paper of calculus and algebra. (10 Mathematicians)

Part C - Learning Resource		
Text Books, Reference Books, Other Resources		
Part D: Assessment and Evaluation		
Suggested Continuous Evaluation Methods: Maximum Marks: 50 Continuous Comprehensive Evaluation (CCE): Not Applicable University Exam(UE): 50 Marks		
Internal Assessment: Continuous Comprehensive Evaluation (CCE)	Class Test/Assignment/Presentation	Not Applicable

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Part A: Introduction				
Program: Certificate Course		Class: B. A. / B.Sc. Part I	Year: 2022	Session:2022-2023
1	Course Code	Paper – MATH- 1T		
2	Course Title	Calculus		
3	Course Type	Theory		
4	Pre-requisite (if any)	No		
5	Course Learning Outcome (CLO)	**This Course will enable the students to:** • Calculate the limit and examine the continuity and understand the geometrical interpretation of differentiability. • Understand the consequences of various mean value theorems. • Draw curves in cartesian and polar coordinate systems. • Understand conceptual variations while advancing from one variable to severalvariables in calculus. • Inter-relationship amongst the line integral, double and triple integral formulations. • Realize importance of Green, Gauss and Stokes' theorems in other branches ofmathematics.		
6	Credit Value	4		
7	Total Marks	Maximum Marks : 50	Minimum Passing Marks :	

Part B: Content of the Course Total Periods: 60		
Unit	Topics	No. of Periods
I	**Sequences, Continuity and Differentiability:** Notion of convergence of sequences and series of real numbers, ϵ-δ definition of limit and continuity of a real valued function; Differentiability and its geometrical interpretation; Rolle's theorem, Lagrange's mean value theorem, Cauchy's mean value theorem and their geometrical interpretations, Darboux's theorem.	12
II	**Expansion of Functions:** Successive differentiation and Leibnitz theorem, Maclaurin's and Taylor's theorems for expansion of a function, Taylor's theorem in finite form with Lagrange, Cauchy and Roche–Schlömilch forms of remainder.	12
III	**Curvature, Asymptotes and Curve Tracing:** Curvature; Asymptotes of general algebraic curves, parallel asymptotes, Asymptotes parallel to axes; symmetry, concavity and convexity, points of inflexion, Tangents at origin, Multiple points, Position and nature of double points; Tracing of	12

	cartesian, polar and parametric curves; Envelopes and Evolutes.	
IV	**Functions of Several Variables:** Limit, continuity and first order partial derivatives, Higher order partial derivatives, Change of variables, Euler's theorem for homogeneous functions, Taylor's theorem, Total differentiation and Jacobians.	12
V	**Double and Triple Integrals:** Double integration over rectangular and non-rectangular regions, Double integrals in polar co-ordinates, Triple integral over a parallelepiped and solid regions, Volume by triple integrals, Line integrals, Green's theorem, Area as a line integral, Surface integrals, Stokes' theorem, The Gauss divergence theorem.	12

Part C - Learning Resource

Text Books and Reference Books:

1. Howard Anton, I. Bivens & Stephan Davis. Calculus (10th edition). Wiley India. 2016
2. Gabriel Klambauer. Aspects of Calculus. Springer-Verlag. 1986
3. Wieslaw Krawcewicz & Bindhyachal Rai. Calculus with Maple Labs. Narosa. 2003
4. Gorakh Prasad Differential Calculus (19th edition). Pothishala Pvt. Ltd. 2016
5. George B. Thomas Jr., Joel Hass, Christopher Heil & Maurice D. Weir. Thomas' Calculus (14th edition). Pearson Education 2018
6. Jerrold Marsden, Anthony J. Tromba & Alan Weinstein. Basic Multivariable Calculus, Springer India Pvt. Limited.2009
7. James Stewart. Multivariable Calculus (7th edition). Brooks/Cole. Cengage 2012.
8. Monty J. Strauss, Gerald L. Bradley & Karl J. Smith. Calculus (3rd edition). Pearson Education. Dorling Kindersley (India) Pvt. Ltd. 2011

E- Resources :

1. Suggested Equivalent **online courses:** Web link NPTEL/ SWAYAM/ MOOCs
2. https://www.youtube.com/watch?v=tffrrtzUhmw&list=PL7oBzLzHZ1wXBSiJEgqz_iwVoLiY8qhbv
3. https://www.youtube.com/watch?v=XzaeYnZdK5o&list=PLtKWB-wrvn4nA2h8TFxzWL2zy8O9th_fy
4. https://www.youtube.com/watch?v=zxbHsPB8m-M&list=PLBCEh9iawVM75FaeqS-z7olBKTSLfAC4A

Part D: Assessment and Evaluation	
Suggested Continuous Evaluation Methods: Maximum Marks:	50 Marks

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Part A: Introduction				
Program: Certificate Course		Class: B. A. / B.Sc. Part I	Year: 2022	Session:2022-2023
1	Course Code	Paper – MATH-2T		
2	Course Title	Algebra		
3	Course Type	Theory		
4	Pre-requisite (if any)	No		
5	Course Learning Outcome (CLO)	**This Course will enable the students to:** • Employ De Moivre's theorem in a number of applications to solve numerical problems. • Learn about the fundamental concepts of groups, subgroups, normal subgroups, isomorphism theorems, cyclic and permutation groups. • Recognize consistent and inconsistent systems of linear equations by the row echelon form of the augmented matrix, using rank. • Find eigen values and corresponding eigen vectors for a square matrix. • Understand real vector spaces, subspaces, basis, dimension and their properties.		
6	Credit Value	4		
7	Total Marks	Maximum Marks : 50	Minimum Passing Marks :	

Part B: Content of the Course Total Periods: 60		
Unit	Topics	No. of Periods
I	**Set Theory and Theory of Equations:** Sets, Relations, Equivalence relations, Equivalence classes; Finite, countable and uncountable sets; The division algorithm, Divisibility and the Euclidean algorithm, Modular arithmetic and basic properties of congruence's; Elementary theorems on the roots of polynomial equations, Imaginary roots, The fundamental theorem of algebra (statement only); The n^{th} roots of unity, De Moivre's theorem for integer and rational indices and its applications.	12
II	**Groups, Subgroups, Normal Subgroups and Isomorphism Theorems :** Definition and properties of a group, Abelian groups, Examples of groups including D_n (dihedral groups), Q_8	12

	(quarternian group), $GL(n, \mathbb{R})$ (general linear groups) and $SL(n, \mathbb{R})$ (special linear groups); Subgroups and examples, Cosets and their properties, Lagrange's theorem and its applications, Normal subgroups and their properties, Simple groups, Factors groups; Group homomorphisms and isomorphisms with properties; First, second and third isomorphism theorems for groups.	
III	**Cyclic and Permutation Groups:** Cyclic groups and properties, Classifications of subgroup of cyclic groups, Cauchy theorem for finite abelian groups; Centralizer, Normalizer, Center of a group, Product of two subgroups, Permutation group and properties, Even and odd permutations, Cayley's theorem.	12
IV	**Row Echelon Form of Matrices and Applications:** Systems of linear equations, Row reduction and echelon forms, The rank of a matrix and its applications in solving system of linear equations; Matrix operations, Symmetric, skew- symmetric, self-adjoint, orthogonal, Hermition, skew-Hermition and unitary matrices; Determinant of a square matrix, The inverse of a square matrix, Eigen vectors and eigen values, The characteristic equation and the Cayley□Hamilton theorem, Applications of matrices to computer graphics and search engines.	12
V	**Vector Spaces and Linear Transformations:** Definitions of field and vector space with examples, Subspaces, Linear span, Quotient space and direct sum, Linearly independent and dependent sets, Bases and dimension, Linear transformation and matrix of a linear transformation, Change of coordinates, Rank and nullity of linear transformation, Rank-nullity theorem.	12

Part C - Learning Resource

Text Books and Reference Books

1. Michael Artin *Algebra* (2nd edition). Pearson 2014.
2. John B. Fraleigh. *A First Course in Abstract Algebra* (7th edition). Pearson 2007.
3. Stephen H. Friedberg, Arnold J.Insel& Lawrence E. Spence. *Linear Algebra* (4thedition). Prentice-Hall of India Pvt. Ltd. 2003
4. Joseph A. Gallian. *Contemporary Abstract Algebra* (9th edition). Cengage. 2017
5. Kenneth Hoffman & Ray Kunze. *Linear Algebra* (2nd edition). Prentice-Hall. 2015

6. I. N. Herstein. *Topics in Algebra* (2nd edition). Wiley India. 2006
7. Nathan Jacobson. *Basic Algebra* I (2nd edition). Dover Publications. 2009
8. Ramji Lal. *Algebra 1: Groups, Rings, Fields and Arithmetic*. Springer. 2017
9. I.S. Luthar & I.B.S. Passi. *Algebra: Volume 1: Groups*. Narosa. 2013

E- Resources

1. Suggested Equivalent **online courses:** Web link NPTEL/ SWAYAM/ MOOCs
2. Linear Algebra
   https://www.youtube.com/watch?v=9h_Q-R6sXbM&list=PL7oBzLzHZ1wXQvQ938Wg1-soq09GywgOw
3. Group theory
   https://www.youtube.com/watch?v=pMzcLG6s3z0&list=PLEAYkSg4uSQ1Yhxu2U-BxtRjZElrfVVcO

Part D: Assessment and Evaluation	
Suggested Continuous Evaluation Methods: Maximum Marks:	50 Marks

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