

**Scheme of B. Sc. Mathematics**

Year	Course Code	Subject Name	Theory/ Practical	Total Credit	Total Marks	
					Max	Min
First year	MATH-1T	Calculus	Theory	4	50	33
	MATH-2T	Algebra	Theory	4	50	
	MATH-1P	Lab 1 : Calculus and Algebra	Practical	2	50	17
	(Any One)	Project 1 : History of Mathematicians	Project	2	50	17

Part A: Introduction			
Program: Certificate Course		Class: B. A. / B.Sc. Part I	Year: 2022 Session: 2022-2023
		Paper – MATH- 1T	
1	Course Code		
2	Course Title	Calculus	
3	Course Type	Theory	
4	Pre-requisite ( if any)	No	
5	Course Learning Outcome (CLO)	<p>This Course will enable the students to:</p> <ul style="list-style-type: none"> <li>• Calculate the limit and examine the continuity and understand the geometrical interpretation of differentiability.</li> <li>• Understand the consequences of various mean value theorems.</li> <li>• Draw curves in cartesian and polar coordinate systems.</li> <li>• Understand conceptual variations while advancing from one variable to several variables in calculus.</li> <li>• Inter-relationship amongst the line integral, double and triple integral formulations.</li> <li>• Realize importance of Green, Gauss and Stokes' theorems in other branches of mathematics.</li> </ul>	
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	<b>Sequences, Continuity and Differentiability:</b> Notion of convergence of sequences and series of real numbers, $\epsilon$ - $\delta$ 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	<b>Expansion of Functions:</b> 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	<b>Curvature, Asymptotes and Curve Tracing:</b> 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

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	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=tfirtzUhmw&list=PL7oBzLzHZlwXBSiJEggz\\_iwVoLiY8qhbv](https://www.youtube.com/watch?v=tfirtzUhmw&list=PL7oBzLzHZlwXBSiJEggz_iwVoLiY8qhbv)
3. [https://www.youtube.com/watch?v=XzaeYnZdK5o&list=PLtKWB-wrvn4nA2h8TFxzWL2zy8O9th\\_fy](https://www.youtube.com/watch?v=XzaeYnZdK5o&list=PLtKWB-wrvn4nA2h8TFxzWL2zy8O9th_fy)
4. <https://www.youtube.com/watch?v=zxblHsPB8m-M&list=PLBCEh9iawVM75FaeqS-z7olBKtSLfAC4A>

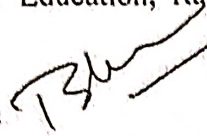



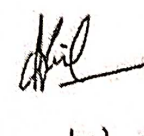
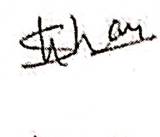


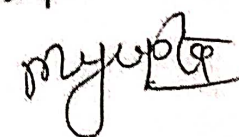
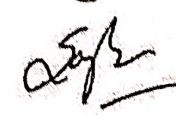

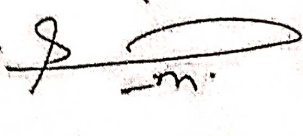
Part D: Assessment and Evaluation


Suggested Continuous Evaluation Methods:  
Maximum Marks:

50 Marks

Declaration

This is to certify that the syllabus is framed by the Central Board of Studies (Mathematics) as per the guidelines (TOR) of the Department of Higher Education, Raipur Chhattisgarh.

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Govt. College, Arjunda, Balod  
13. Dr. Chandrajeet Singh Rathore

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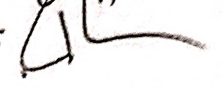
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15. Dr. Raghu Nandan Patel

-

Member



Asst. Prof.  
Govt. MLS College, Seepat

Part A: Introduction			
Program: Certificate Course		Class: B. A. / B.Sc. Part I	Year: 2022 Session: 2022-2023
1	Course Code	Paper – MATH-21	
2	Course Title	Algebra	
3	Course Type	Theory	
4	Pre-requisite (if any)	No	
5	Course Learning Outcome (CLO)	<p>This Course will enable the students to:</p> <ul style="list-style-type: none"> <li>• Employ De Moivre's theorem in a number of applications to solve numerical problems.</li> <li>• Learn about the fundamental concepts of groups, subgroups, normal subgroups, isomorphism theorems, cyclic and permutation groups.</li> <li>• Recognize consistent and inconsistent systems of linear equations by the row echelon form of the augmented matrix, using rank.</li> <li>• Find eigen values and corresponding eigen vectors for a square matrix.</li> <li>• Understand real vector spaces, subspaces, basis, dimension and their properties.</li> </ul>	
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 $n^{\text{th}}$ 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

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	(quaternion 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	<b>Cyclic and Permutation Groups:</b> 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	<b>Row Echelon Form of Matrices and Applications:</b> 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, Hermitian, skew-Hermitian 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	<b>Vector Spaces and Linear Transformations:</b> 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* (2<sup>nd</sup> edition). Pearson 2014.
2. John B. Fraleigh. *A First Course in Abstract Algebra* (7<sup>th</sup> edition). Pearson 2007.
3. Stephen H. Friedberg, Arnold J. Insel & Lawrence E. Spence. *Linear Algebra* (4<sup>th</sup> edition). Prentice-Hall of India Pvt. Ltd. 2003
4. Joseph A. Gallian. *Contemporary Abstract Algebra* (9<sup>th</sup> edition). Cengage. 2017
5. Kenneth Hoffman & Ray Kunze. *Linear Algebra* (2<sup>nd</sup> edition). Prentice-Hall. 2015

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6. I. N. Herstein. *Topics in Algebra* (2<sup>nd</sup> edition). Wiley India. 2006
7. Nathan Jacobson. *Basic Algebra I* (2<sup>nd</sup> 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=PL7oBzLzHZ1wXQvO938Wgl-soq09GywgOw](https://www.youtube.com/watch?v=9h_Q-R6sXbM&list=PL7oBzLzHZ1wXQvO938Wgl-soq09GywgOw)
3. Group theory  
<https://www.youtube.com/watch?v=pMzclG6s3z0&list=PLEAYkSg4uSQ1YhXu2U-BxtRjZEIrfVVcO>

#### Part D: Assessment and Evaluation

Suggested Continuous Evaluation Methods:  
Maximum Marks:

50 Marks

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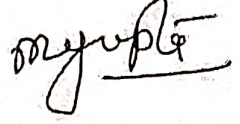


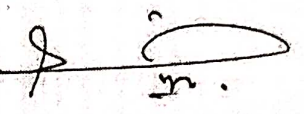

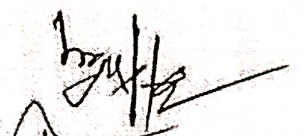
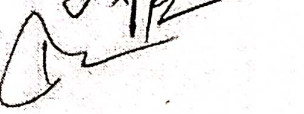
- Member

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| 15. Dr. Raghu Nandan Patel  |   |        |   |
| Asst. Prof.<br>Govt. MLS College, Seepat                          |   |        |   |

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 <ul style="list-style-type: none"> <li>• Learn Free and Open Source Software (FOSS) tools for computer programming</li> <li>• Solve problems on Calculus and Algebra theories studied in Mathematics Paper 1 and 2 by using FOSS softwares.</li> <li>• Acquire knowledge of applications of Calculus and Algebra through FOSS.</li> </ul>	
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 for computer programs, such as GeoGebra/Maxima/Scilab/ Octave /Python/R. <b>Course Objectives:</b> <ul style="list-style-type: none"> <li>• To learn Free and Open Source Software (FOSS) tools for computer programming</li> <li>• Acquire knowledge of applications of algebra and calculus through FOSS</li> </ul> <b>List of Practicals: (At least 15 practicals )</b> <ul style="list-style-type: none"> <li>• Programs to illustrate left hand and right hand limits for discontinuous functions.</li> <li>• Program to illustrate continuity of a function</li> <li>• Program to illustrate differentiability of a function</li> <li>• Program to verify Rolle's theorem</li> <li>• Program to verify Lagrange's theorem</li> <li>• Programs to verify Cauchy's mean value theorem and finding Taylor's theorem for a given function.</li> <li>• Program to illustrate nth derivative without Leibnitz rule.</li> </ul>

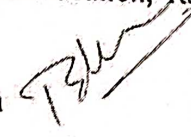

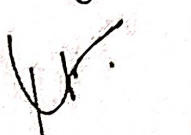
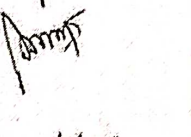
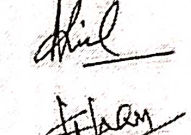
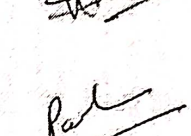
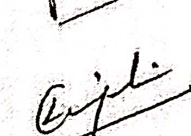
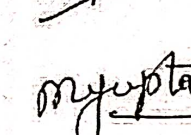
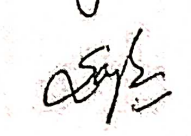

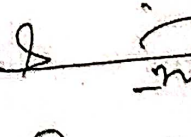
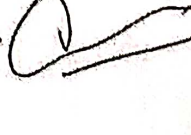


	<ul style="list-style-type: none"> <li>• Examples on integral domains and fields.</li> <li>• Examples on subrings, ideals and subrings which are not ideals.</li> <li>• Homomorphism and isomorphism of rings- illustrative examples.</li> <li>• Solving polynomial equations.</li> <li>• Finding G.C.D of polynomials.</li> <li>• Finding product of two matrices</li> <li>• To test linear independency of a given set of a vectors in a vector space.</li> </ul>
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<b>Part C - Learning Resource</b>		
Text Books, Reference Books, Other Resources		
<p><b>SUPPORT FROM THE GOVT FOR STUDENTS AND TEACHERS IN UNDERSTANDING AND LEARNING FOSS TOOLS:</b></p> <p>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: <a href="http://spoken-tutorial.org;">http://spoken-tutorial.org</a>;) (email: <a href="mailto:info@spokentutorial.org">info@spokentutorial.org</a>; <a href="mailto:contact@spoken-tutorial.org">contact@spoken-tutorial.org</a>)</p>		
<b>Part D: Assessment and Evaluation</b>		
<p><b>Suggested Continuous Evaluation Methods:</b>  Maximum Marks: 50  Continuous Comprehensive Evaluation (CCE): Not Applicable  University Exam(UE): 50 Marks</p>		
<b>Internal Assessment:</b> Continuous Comprehensive Evaluation (CCE)	Class Test/Assignment/Presentation	Not Applicable

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Asst. Prof.  
Govt. MLS College, Seepat

- Member

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