<table>
<tr><td>Program</td><td colspan="2">BS Data Science</td></tr>
<tr><td>Course Code</td><td colspan="2">MD-001</td></tr>
<tr><td>Course Title</td><td colspan="2">Math Deficiency I</td></tr>
<tr><td rowspan="2">Credit Hours</td><td>Theory</td><td>Lab</td></tr>
<tr><td>3</td><td>0</td></tr>
<tr><td>Lecture Duration</td><td colspan="2">90 minutes (1.5 Hours), 2 lectures per week</td></tr>
<tr><td>Semester</td><td colspan="2">1</td></tr>
<tr><td rowspan="2">Pre-requisites</td><td>Courses</td><td>Knowledge</td></tr>
<tr><td>Nil</td><td>Nil</td></tr>
<tr><td>Follow Up Courses</td><td colspan="2"></td></tr>
<tr><td>Aims and Objectives</td><td colspan="2">1. Understand the basic concept of Complex numbers and its arithmetic properties
2. Learn about the idea of sequence and series, and their properties
3. Learn about Permutations and Combinations, Basic Probability
4. Understand the basic concept of Limits of functions, and its properties
5. Understand the basic concept of continuity and discontinuity of functions, and their properties
6. Understand the concept of derivatives, formulas and properties related to derivative
7. Under the concept of Increase, Decrease, Concavity, Relative Extrema, Absolute Maxima and Minima
8. Understand the Basic definitions of definite and indefinite Integrals,</td></tr>
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	9. Learn about the Fundamental Theorem of Calculus 10. Learn how to Evaluate Definite Integrals by Substitution 11. Learn how to Evaluate the integral of Logarithmic and Other Functions
Learning Outcomes	• Students can understand what a computing problem is. • Students can formally define a computing problem. • Students can solve simple to moderate level computing problems. (Students can develop an I-P-O chart for a specific programming problem. Develop an algorithm to solve a specific programming problem by using pseudo-code or flowcharting. Use sequence, selection, and repetition structures to solve a problem. Apply the appropriate design for a specific program. Apply modular designs for programs, including sending arguments and returning values. Implement data validation, internal and external documentation in a program. Use objects and methods to solve problems in an object-oriented programming environment. Incorporate objectoriented tools within a program.)
Syllabus	Defining Set, various types of set representation and operations, Relation and function, Graphical transformation of one and two dimensional functions, Properties of functions, composition and inverses of functions, domain and range of the functions, Maximum and minimum values of functions, increasing and decreasing functions, zeros and intercept of functions, piecewise functions, continuity and Discontinuity of functions, Polynomials and rational functions, Polynomial long division and Synthetic division, Solution of rational functions, Absolute valued function, properties of absolute valued functions, Asymptotes (Horizontal, vertical and oblique), Exponential functions and their properties, Logs functions and their properties, Systems of Two Equations and Two Unknowns,

	Systems of Three Equations and Three Unknowns, Matrix Algebra (Add, subtract and multiply matrices), Row Operations and Row Echelon Forms, Augmented Matrices, Determinant of Matrices (2 x 2 and higher order matrices), Cramer's Rule, Inverse Matrices, Series and Sequences, Trigonometry, Angles in Radians and Degrees, Right Triangle Trigonometry, Law of Cosines & Sines, Area of Triangle, Graphs of Other Trigonometric Functions , Graphs of Inverse Trigonometric Functions, Basic Trigonometric Identities (Pythagorean, Sum and Difference, Double, Half, and Power Reducing), Trigonometric Equations, General Form of a Conic, Parabolas, Circles, Ellipses, Hyperbolas, Degenerate Conics, Polar and Parametric Equations, Polar and Rectangular Coordinates.
Contents	1. Sets 1.1. Defining Set, various types of set 1. representation and operations, 2. Relation and function, 2.1. Graphical transformation of one and two dimensional functions, 2.2. Properties of functions, 2.3. composition and inverses of functions 2.4. Domain and range of the functions 2.5. Maximum and minimum values of functions 2.6. Increasing and decreasing functions 2.7. Zeros and intercept of functions 2.8. Piecewise functions 2.9. Continuity and Discontinuity of functions, 3. Polynomials and rational functions 3.1. Polynomial long division and Synthetic division, 3.2. Solution of rational functions, 3.3. Absolute valued function, 3.4. properties of absolute valued functions, 3.5. Asymptotes (Horizontal, vertical and oblique), 3.6. Exponential functions and their properties, 3.7. Logs functions and their properties, 4. System of equations 4.1. Systems of Two Equations and Two Unknowns, 4.2. Systems of Three Equations and Three Unknowns,

	5. Matrix Algebra (Add, subtract and multiply matrices), 5.1. Row Operations and Row Echelon Forms, 5.2. Augmented Matrices, Determinant of Matrices (2 x 2 and higher

	order matrices), 5.3. Cramer's Rule, 5.4. Inverse Matrices, 6. Series and Sequences, 7. Trigonometry, 7.1. Angles in Radians and Degrees, 7.2. Right Triangle Trigonometry, 7.3. Law of Cosines & Sines, 7.4. Area of Triangle, 7.5. Basic Trigonometric Identities (Pythagorean, Sum and Difference, Double, Half, and Power Reducing), 8. Graphs of Other Trigonometric Functions, 8.1. Graphs of Inverse Trigonometric Functions, 8.2. Trigonometric Equations, 9. General Form of a Conic, 9.1. Parabolas, 9.1.1. Circles, Ellipses, Hyperbolas, 9.1.2. Degenerate Conics, 9.1.3. Polar and Parametric Equations, 10. Polar and Rectangular Coordinates.
Teaching-learning Strategies	• Interactive class session • Hands on practices in class • Brainstorming and Group discussion sessions
Assignments	• Paper based written assignments
Assessment and	

Sr. #	Elements	Weightage	Details

Examinations	1	Formative Assessment	25%	It is continuous assessment. It includes: classroom participation, attendance, assignments and presentations, homework, attitude and behavior, hands-on-activities, short tests, quizzes etc.
	2	Midterm Assessment	35%	It takes place at the midpoint of the semester.
	3	Final Assessment	40%	It takes place at the end of the semester. It is mostly in the form of a test, but owing to the nature of the course the teacher may assess their students based on term paper, research proposal development, field work and report writing etc.
Textbooks	• Textbook of Algebra and Trigonometry Class XI is published by Punjab Textbook Board (PTB) Lahore, Pakistan. • Calculus and Analytic Geometry, MATHEMATICS 12 (Mathematics FSc Part 2 or HSSC-II), Punjab Text Book Board Lahore, Pakistan			

Reference Material/Suggested Readings	• Gilbert, S. S., B. C. Andy and B. Andrew, B. 2005. Linear Algebra and Its Applications. 4th Ed. Thomson Brooks/Cole, Belmont, CA, USA. • Chung, S. K. 2014. Understanding basic calculus. Create Space Independent Publishing Platform, 173-175. • Howard, Anton, Irl Bivens, Stephen Davis, Calculus, 10th Ed,2011, John Wiley & Sons, Inc. (1318 Pages) • https://www.maa.org/sites/default/files/images/upload_library/4_6/Pengelley_projects/Project-5/set_theory_project.pdf (An introduction to Elementary Set Theory by Guram Bezhanshvili and Eachan Landreth) • Howard Anton and Chris Rorres. Elementary linear Algebra, Wiley; 10th edition (April 12, 2010) • http://mecmath.net/trig/Trigonometry.pdf (Trigonometry Michael Corral)
Notes	• Academic integrity is expected of all students. Plagiarism or cheating in any assessment will result in at least an F grade in the course, and possibly more severe penalties.
	• You bear all the responsibility for protecting your assignments from plagiarism. If anyone else submits your assignment or uses your code in his/her assignment, you will be considered equally responsible. • The instructor reserves the right to modify the grading scheme/marks division and course outline during the semester. • Introductory knowledge of using the computers is assumed for this course. All code written in quizzes, assignments, homework's, and exams must be in JavaScript. Code must be intelligently documented (commented). Undocumented code may not be given any credit. • The IDE use is not allowed, Notepad++ has to be used for coding. • There is no makeup for a missed sessional grading instruments like quizzes, assignments, and homework's.

Detailed Lecture wise plan

Week	Lecture	Topic	Source eBook (Ch#)	Recommendation for Learning Activities
1	1	**Introduction to Sets:** Sets, subset relation, equality relation, set operations, set identities, Venn Diagrams, power sets.	R4	
	2	Russell's paradox, Cartesian products, relations, functions, one-to-one correspondences, functions equality, set equivalence.	R4	**Assign-1**
2	3	Cardinality of set, cardinal numbers, finite and infinite sets, countable sets, uncountable sets, independent and dependent variables in functions.	R4, R3(1)	**Quiz#1**
	4	Graphs of functions, vertical line test, the absolute value function and its properties.	R3(4)	
3	5	Piecewise defined functions, domains and ranges, the effect of algebraic operations on domain, domain and ranges in applied problems, issues of scale and units.	R3(6)	**Assign-2**
	6	Arithmetic operations on functions, composition of functions, translations, reflections, stretches and compressions, symmetry, even and odd functions.	R3(15)	**Quiz#2**
4	7	Polynomials, rational functions, algebraic functions, inverse functions, a method for finding inverse function, existence of inverse functions, graphs of inverse functions, restricting domains for invertibility.	R3(32, 38)	
	8	Exponential and logarithmic functions, solving equations involving exponentials and logarithms, change of base formula for logarithms, logarithmic scales in science and engineering, exponential and logarithmic growth.	R3(52)	
5	9	A brief review of polynomials, the remainder theorem, the factor theorem, synthetic division, using one factor to find other factors, methods for finding roots.	R3(A27)	

	10	**Matrices:** Linear equations, linear system with 2 and 3 unknowns, consistent and inconsistent systems, augmented matrix, elementary row operations.	R5(1.1)	**Assign-3**

Week	Lecture	Topic	Source eBook (Ch#)	Recommendation for Learning Activities
6	11	Row echelon and reduced row echelon forms, Gaussian elimination, Gauss-Jordan elimination, free variables, one/two etc. parameter family of solution, homogenous linear systems, trivial and non-trivial solutions.	R5(1.2)	**Quiz#3**
	12	Formal definition of a matrix, operations on matrices, matrix product as linear combinations, transpose of a matrix, trace of a matrix.	R5(1.3)	
7	13	Properties of matrix arithmetic, Inverse of a matrix, singular and invertible matrices, inverse of 2×2 matrix, solution of a system of 2 equations in 2 unknowns by matrix inversion.	R5(1.4)	
	14	Method to find inverse of matrix by row operations, matrices those are not invertible, analyzing homogeneous systems, definition of determinants as a mapping, minors, cofactors, determinants by cofactor expansion, useful techniques to evaluate 2×2 and 3×3 determinants.	R5(1.5, 2.1)	**Assign-4**
8	15	Evaluating determinants by row reduction, properties of determinants.	R5(2.2, 2.3)	**Quiz#4**
	16	Adjoint of a matrix, inverse of a matrix by adjoint method, Cramer's rule	R5(2.3)	
9	17	**Trigonometry:** Angles, types of triangles, Pythagorean theorem, Pythagorean triple, Euclid's formula to generate Pythagorean triples.	R6(1)	
	18	Trigonometric functions of an acute angle, cofunction theorem, solving right angled triangles, applications of right angle triangles.	R6(7)	
10	19	Trigonometric functions of any angle, rotation and reflections of angles, general triangles, the law of sines.	R6(24)	**Assign-5**

	20	The law of cosines, the law of tangents, the area of a triangle, Heron's formula.	R6(44)	**Quiz#5**
11	21	Circumscribed and inscribed circles, basic trigonometric identities, sum and difference formulas, double angle and half angle formulas.	R6(59)	
	22	Other identities, radians and degree, arc length, area of a sector.	R6(82)	
Week	**Lecture**	**Topic**	**Source eBook (Ch#)**	**Recommendation for Learning Activities**
12	23	Graphing the trigonometric functions, properties of graphs of trigonometric functions, domains, ranges, periodicity.	R6(103)	**Assign-6**
	24	Inverse trigonometric functions, their domains and ranges, one-to-one correspondences, graphs of inverse trigonometric functions.	R6(120)	**Quiz#6**
13	25	Solving trigonometric equations, Polar Coordinates, relationship between polar and rectangular coordinates.	R6(129) R3(705)	
	26	Graphs in polar coordinates, symmetry tests, family of circles, family of rose curves, family of cardioids and limaçons, family of spirals.	R3(707)	
14	27	Conic sections; definitions of parabola, ellipse, and hyperbolas; directrix, focus (foci, plural), vertex and axis of symmetry, equations of parabolas in standard position, a technique for sketching parabolas.	R3(730)	**Assign-7**
	28	Equations of ellipses in standard position, a technique for sketching ellipses.	R3(734)	**Quiz#7**
15	29	Equations of hyperbolas in standard position, conjugate axis, asymptotes of hyperbolas, a technique for sketching hyperbolas.	R3(737)	
	30	Translated conics, Reflection properties of the conics, application of the conic sections.	R3(740)	
16	31	Rotation of axes; second degree equations, rotation of axes, eliminating the cross-product term.	R3(748)	**Assign-8**
	32	Conic sections in polar coordinates	R3(754)	**Quiz#8**