<table>
<tr><td>Program</td><td colspan="2">ADP Data Science</td></tr>
<tr><td>Course Code</td><td colspan="2">GE-210</td></tr>
<tr><td>Course Title</td><td colspan="2">Calculus and Analytical Geometry</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">3</td></tr>
<tr><td rowspan="2">Prerequisites</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">Differential Equations</td></tr>
<tr><td>Aims and Objectives</td><td colspan="2">1. Students should be able to work with functions represented in a variety of Ways: graphical, numerical, analytical, or verbal. They should understand the Connections among these representations.
2. Students should understand the meaning of the derivative in terms of a rate of change and local linear approximation and should be able to use derivatives to solve a variety of problems.
3. Students should understand the meaning of the definite integral both as a limit of Riemann sums and as the net accumulation of a rate of change and should be able to use integrals to solve a variety of problems</td></tr>
<tr><td>Learning Outcomes</td><td colspan="2">At the end of the course, you should be able to:
• Use a variety of methods in solving real-life, practical, technical, and theoretical problems.
• Select and use an appropriate problem-solving strategy.
• Explain the limit process and that calculus centers around this concept.
• Identify the two classical problems that were solved by the discovery of calculus, The tangent problem and the area problem.
• Describe the two main branches of calculus, Differential calculus and Integral calculus.</td></tr>
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Syllabus	Limits and Continuity; Introduction to functions, Introduction to limits, Techniques of funding limits, Indeterminate forms of limits, Continuous and discontinuous functions and their applications, Differential calculus; Concept and idea of differentiation, Geometrical and Physical meaning of derivatives, Rules of differentiation, Techniques of differentiation, Rates of change, Tangents and Normal lines, Chain rule, implicit differentiation, linear approximation, Applications of differentiation; Extreme value functions, Mean value theorems, Maxima and Minima of a function for single-variable, Concavity, Integral calculus; Concept and idea of Integration, Indefinite Integrals, Techniques of integration, Riemann sums and Definite Integrals, Applications of definite integrals, Improper integral, Applications of Integration; Area under the curve, Analytical Geometry; Straight lines in R3, Equations for planes.
Contents	**1. Limits and continuity** **1.1.** An intuitive approach to limits **1.2.** Two sided limits and one sided limit. **1.3.** Techniques of computing limits **1.4.** Limits at infinity **1.5.** Limit discussed more rigorously **1.6.** Introduction to continuity **1.7.** Techniques of checking continuity **1.8.** Continuity 1.8.1. Trigonometric function 1.8.2. Inverse Trigonometric function **1.9.** Limits and continuity of trigonometric functions **1.10.** Exponential and Logarithmic functions **1.11.** Applications of continuity **1.12.** Examples of applications **2. The Derivative** **2.1.** Differential calculus 2.1.1. Motivation of derivatives 2.1.2. Tangent line **2.2.** Geometrical and Physical meaning of derivatives 2.2.1. Derivative of a function 2.2.2. Rules of differentiation 2.2.3. Differentiation by parts **2.3.** Concept and idea of differentiation **2.4.** Differentiation by part 2.4.1. Techniques of differentiation 2.4.2. Derivative of trigonometric functions

2.5. Product and quotient rule
2.6. Inverse Trigonometric function
2.7. Application of derivatives as rates of change,
2.8. Derivatives of trigonometric functions
2.9. The chain rule

3. Topics in Differentiation

3.1. Implicit differentiation
3.2.
3.3. Derivatives of logarithmic functions
3.4. Implicit differentiation
3.5. Derivatives of logarithmic functions.
3.6. Derivatives of exponential and inverse trigonometric function
3.7. Local linear approximation,
3.8. Differentials
3.1.1. L'hospital rules
3.1.2. Indeterminate form

4. The derivative in Graphing and application

4.1. Analysis of functions
4.1.1. Increasing function
4.1.2. Decreasing Functions
4.2. Relative extrema
4.3. Graphing a function
4.3.1. Concavity
4.3.2. Rational functions
4.3.3. Cusps
4.3.4. Vertical tangents
4.4. Relative extrema
4.4.1. Absolute maxima
4.4.2. Absolute minima
4.4.3. Applied Maximum and minimum problem
4.4.4. Mean value theorem
4.4.5. Mean value theorem
4.4.6. Roll's theorem

5. Integration

5.1. What is integration
5.1.1. An overview of area problems
5.2. The indefinite integrals
5.2.1. Integration by substitution
5.2.2. Area as a limit
5.3. The definite integral
5.3.1. Riemann sums and Definite Integrals,
5.3.2. The fundamental theorem of calculus

	5.3.3. The definite integral by substitution **5.3.4.** Transcendental functions integral **5.3.5.** An overview of integration methods **5.3.6.** Integration by parts **5.3.7.** Integration Trigonometric Functions **5.4. Principal of integral evaluation** **5.4.1.** An overview of integration methods **5.4.2.** Integration by parts **5.4.3.** Integration Trigonometric Functions **5.4.4.** Trigonometric substitution **5.4.5.** Integration by partial fractions **5.4.6.** Area between two curves **6. Three dimensional spaces** **6.1.** Parametric equations of line **6.2.** Evaluation of parametric equations of lines **6.3.** Planes in 3D space **6.4.** Distance between planes **6.5.** Distance between line and plane **6.6.** Planes in 3D space **6.7.** Distance between planes **6.8.** Distance between line and plane **6.9.** Planes in 3D space **6.9.1.** Distance between planes **6.9.2.** Distance between line and plane **7. Partial differentiation** **7.1.** Partial derivative concepts **8. Multiple integrals** **8.1.** Multiple integral concepts **9. Mathematical modeling with differential equations** **9.1.** Modeling with differential equations **9.2.** Types of differential equations
Teachinglearning Strategies	• Hands on practices in class • Brainstorming and Group discussion sessions on applications of the topics.
Assignments	• Paper based written assignments 6 • Paper based Quiz 10

Assessment and Examinations	Sr. #	Elements	Weightage	Details

	1	Formative Assessment	25%	It is continuous assessment. 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 mid-point 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.
Textbooks	***A.*** Thomas, G. B., Finney, R. L., Weir, M. D., & Giordano, F. R. (2003). Thomas' calculus. Reading: Addison-Wesley.			
Reference Material	**B:** Anton, H., & Nicoletti, G. (1988). Calculus (Vol. 10). New York: Wiley. **C:** Zill, D. G. (2016). Differential equations with boundary-value problems. Cengage Learning. **D:** Online Material: www.mathworld.com			
Notes	• The instructor reserves the right to modify the grading scheme/marks division and course outline during the semester. • Instructor can change the order of topics to provide ease to students to understand.			