Forman Christian College Lahore
(A Chartered University)
Department of Mathematics
Fall 2021

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Course Information:
Calculus and Analytic Geometry, MATH 111 (B) , 3 credits , Class Room: S-412
Lectures Time: Monday, Wednesday & Friday (02:00 - 02:50)
Prerequisite: MATH-101 / A-level / FSc pre-engineering
Text Book: "Calculus" by Howard Anton, Irl Bivens and Stephen Davis, 10th edition
https://www.academia.edu/34762815/Calculus_10th_edition_H_Anton
Reference Book: "Calculus" by Thomas and Finney, 13th edition.

Course Description: This a supporting course and compulsory course for computer science major. The focus of this course is the study of the inverse relationship that exists between differential and integral calculus.

Course contents include: Fundamentals of functions, limits and continuity, derivatives, problem solving using differentiation (extreme value problems, curve sketching, related rates problems, etc), integrations techniques, Fundamental Theorem of Calculus, computation of areas and volumes by slicing, volumes of revolution and surface areas of revolution, infinite series and convergence tests and Taylor's series.

Course Objectives: The course will help students to:

- Learn the fundamentals of calculus along with its application to interesting problems in science and engineering and develop an appreciation of calculus as a coherent body of knowledge and as a human accomplishment.
- Recall the fundamentals of functions.
- Understand the fundamental concept of limit, and how it is computed.
- Understand the concept of rate of change in the form of derivative and to evaluate various differentiation techniques.
- Understand how derivative helps us with optimization, rates of change, and the shape of a graph.
- Get familiar with the techniques of evaluating integrals.
- Understand the relationship between the derivative and the definite integral as expressed in the Fundamental Theorem of Calculus, and relate definite integral to area.
- Understand the application of integration.
- Understand the infinite series, convergence test and Taylor series.

<u>Learning Outcomes:</u> Upon successful completion of this course, the student will be able to:

- Understand the basics of function, its domain, range, intercepts, and graph, functions operations, composition function, inverse function, and function transformations.
- Familiar with basics of conic section: circle, ellipse, parabola and hyperbola.
- Familiar with the notion of limit and compute limits by graphs, compute limits of various functions, such as polynomials, rational functions, functions involving radicals, piecewise functions, and trigonometric functions, and know the concepts of continuity.
- Know the limit definition of derivative and how to evaluate derivatives by definition.
- Know the basic rules of differentiation and use them to find derivatives of products and quotients.
- Evaluate the derivatives of power, trigonometric, exponential, logarithmic and inverse trigonometric functions, and know the chain rule and use it to find derivatives of composite functions.
- Know implicit and logarithmic differentiation.
- Familiar with application of derivatives such as, related rates, to find limits in indeterminate forms by a repeated use of L'Hˆopital's rule, to find absolute extrema on a closed interval, to find relative extrema using the first derivative test, to find critical points and intervals where a function is increasing or decreasing, to find inflection points and intervals where a function is concave up or concave down, to use the second derivative test to find local extrema, and to solve applied optimization problems.
- Understand the concept of indefinite integral as anti-derivative, and know standard indefinite integrals and basic rules of indefinite integration.
- Evaluate integrals by substitution and by a repeated use of integration by parts.
- Evaluate integrals of rational functions by partial fractions.
- Understand the concept of definite integral and Fundamental Theorems of Calculus, and know the basic properties of definite integrals and that how to evaluate definite Integrals.
- Use integration to find the area under the curve, the area between two curves, the length of a plane curve, volume by slicing, the volumes of solids obtained by rotating the curve.
- Understand infinite series and convergence Tests, and Taylors Series

<u>Course Requirements:</u>

- **Attendance:** Students are expected to attend every class. Student whose attendance is less than 60% won't be allowed to take the final exam. Students must arrive at class on time, should remain in class for the entire class period and mobile phone should be switched off or on silence. Note that there is 5 marks for attendance and behaviour, if a student arrives more than 10 minutes late or leaves class during lecture or uses mobile in class, he/she will be marked absent.

- **Assessment:** Course assessment will be through quizzes, attendance and behavior, assignments, midterm, and final exam. Quizzes, mid term exam and final exam will be conducted on campus for all students. Assignments will be conducted on Moodle along with its viva on Zoom or in person. There is no make up for missed quizzes but best 3 out of 4 will be counted. Make up for midterm and final exam is possible only under extremes cases if student provides strong documentary evidence within three days. In case of make up exam there will be a 0-20% deduction in marks depending upon case to case basis.

- **Academic dishonesty or cheating:** Academic dishonesty or cheating will result in zero points and will be referred to AIC (Academic Integrity Committee) at FCC for necessary action.

Grades	Quality Points	Numerical Value
A	4.00	93-100
A-	3.70	90-92
B+	3.30	87-89
B	3.00	83-86
B-	2.70	80-82
C+	2.30	77-79
C	2.00	73-76
C-	1.70	70-72
D+	1.30	67-69
D	1.00	60-66
F	0.00	59 or below

Course Evaluation: Grading will be based on following criteria:

Attendance and Behaviour	**05 %**
Assignments (2)	**10 %**
Quizzes (4)	**15 %**
Mid Term	**30 %**
Final Exam	**40 %**

Week	Topics	Assessments
1 Nov 01, 03, 05	**Discussion of Course plan and Overview of Course Syllabus** **Review of Basic Concepts** ❖ Functions, Types and Their Domains ❖ Operations on Functions, Composition of Functions, Inverse Function ❖ Graphing the Basic Functions	
2 Nov 08, 10, 12	**Brief Review of Conic Section** ❖ Introduction to Circle, Ellipse, Parabola and Hyperbola **Limits** ❖ Finding Limits by Graphs ❖ Computational Techniques of Limits	
3 Nov 15, 17, 19	❖ Limits of Piecewise Functions ❖ Limits of Trigonometric Function ❖ Finding Limits at Infinity Using Graphs ❖ Computing Limits at infinity	**Quiz-1** Nov 17 (Wed)
4 Nov 22, 24, 26	❖ Continuity **Derivatives** ❖ Limit Definition of Derivative, Differentiability, Evaluating Derivatives by Definition	
5 Nov 29 Dec 01, 03	❖ Techniques of Differentiation, The Product and Quotient rules ❖ Derivative of Trigonometric functions ❖ The Chain Rule, Higher Derivatives	
6 Dec 06, 08, 10	❖ Derivative of Exponential and Logarithmic Functions ❖ Logarithmic Differentiation ❖ Implicit Differentiation	**Quiz-2** Dec 08 (Wed)

7 Dec 13, 15, 17	**Application of Derivatives:** ❖ Related Rates ❖ L'Hopital's Rule; Indeterminate Forms	**Assignment 1**
8 Dec 20	MID TERM EXAM	**MID TERM** Dec 20 (Mon)
9 Jan 03, 05, 07	❖ Increasing and Decreasing Curves ❖ First and Second Derivative test ❖ Maxima and Minima Problems	
10 Jan 10, 12, 14	❖ Concavity and Curve Sketching ❖ Applied Optimization Problems	
11 Jan 17, 19, 21	**Integrals:** ❖ Introduction to Anti-derivative, The Indefinite Integral and Techniques of Integration ❖ Integration by Parts ❖ Integration by Trigonometric Substitution	
12 Jan 24, 26, 28	❖ Integrating Rational Functions by Partial Fractions ❖ Definite Integrals, Fundamental Theorems of Calculus, and evaluating Definite Integrals	**Quiz-3** Jan 26 (Wed)
13 Jan 31 Feb 02, 04	**Application of Integrals:** ❖ Computation of Areas ❖ Length of a Plane Curve	**Assignment 2**
14 Feb 07, 09, 11	❖ Volume by Slicing ❖ Volume of Solids of Revolution (Disk and Washer Method)	
15 Feb 14, 16, 18	❖ Surface Areas of Revolution **Infinite Series:** ❖ Infinite Series and Convergence Tests ❖ Taylors Series	**Quiz-4** Feb 16 (Wed)