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

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Office Hours: Monday to Friday: **11:00 am - 12:30 pm**
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Course Information:

Course Name: Calculus and Analytical Geometry
Course Code: MATH 111
Prerequisite: MATH 101 or A Level Mathematics or Intermediate Mathematics
Credit Hours: 3
Section: A
Class Timings: Monday, Wednesday and Friday;   10:00 am - 10:50 am
Class Room: S-417

Course Trailer Link: https://www.youtube.com/watch?v=2C_KsOdESZk&t=11s

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 solids of revolution, surface areas of revolution, infinite series and convergence tests and Taylor's series.

Course Objectives: This 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.

Text Books:

- ❖ "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

Recourses:

- ❖ Text book will be uploaded on Moodle.
- ❖ Recorded video lectures and lecture notes will be uploaded on Moodle every week.

Mode of Instruction:

The mode of teaching will be either full in-person (for all students) or basic blended model (in two groups, even and odd roll numbers), subject to the condition that the government allows universities to have 100% attendance on campus or not.

Blended Mode:–

- ❖ The basic blended model will involve **face to face class sessions** (for on-campus students), and **pre-recorded video lectures** on Moodle (for off-campus students), where students will be switched every week with opposite parity roll number for on-

campus and remote learning.

- ❖ **Off-campus students** are expected to watch every video lecture uploaded on Moodle, and to solve related exercises. They can discuss their queries/questions in the **weekly online discussion session on Zoom** and in the given **online office hours**.

<u>Remote:-</u>

- ❖ In case of **fully online teaching**, regular Zoom classes will be conducted along with recorded video lectures and lecture notes uploaded on Moodle.

> **<u>Note:</u>** *Assessments' criteria* will be same for all modes of teaching. Assignments will be conducted on Moodle for every mode. Quizzes, mid-term exam & final exam will be conducted on campus in case of in-person & blended classes. Otherwise for online mode, all assessments will be conducted online on Moodle.

Learning Outcomes: Once the course is successfully completed, the students 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, and surface areas of revolutions.
- ❖ Understand infinite series and convergence Tests, and Taylors Series.

Course Requirements: Course assessment will be through **quizzes; attendance, class participation and behavior; assignment; midterm and final exam**.

Attendance, Class Participation and Behavior:-

- ❖ Students are expected to **attend every class** and to arrive at each class on time and remain in class for the entire class period.
- ❖ Student whose attendance is less than 70% will not be allowed to take the final exam.
- ❖ **Mobile Phones will be turned off or on silent mode** while the student is in the classroom. No cell phone calculators are to be used in quizzes, midterm and final exams.
- ❖ Note that there are **5 marks for attendance, class participation and behavior**, which includes attendance during classes and being active in the course by asking questions.
- ❖ 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** for that day.
- ❖ Individuals are expected to be aware of what a **constructive educational experience** is and respectful of those participating in a learning environment. Failure to do so can result in disciplinary action up to and including expulsion.
- ❖ For **off-campus students**, online attendance is based on **regularly accessing** the course materials on Moodle, and attending **online discussion Zoom sessions** and submitting tasks on time.

Quizzes, Mid-term and Final Exam:-

- ❖ There is **no make up** for the **missed quizzes**, **midterm exam** and **final exam**.
- ❖ Make up for **midterm and final exam** is possible only under **extremes cases** if a student provides **strong documentary evidence** within **3 days after missing the Midterm/ Final exam**.
- ❖ In case of make-up exam there will be a **0 to 20% deduction in marks** depending upon case-to-case basis.

Assignments:-

- ❖ Assignments will be conducted on Moodle. Students are expected to submit the assignments within due date and time. Late submission of assignment will result in deduction of marks from the assignment.

❖ Students' assignments should reflect their understanding of content. There is no make up for the missed assignments.
❖ If needed, students may be asked to explain the submitted work.

Academic dishonesty or cheating: Students are expected to present their own work failure to do this will result in zero points and will be referred to AIC (Academic Integrity Committee) at FCC for necessary action.

Course Evaluation: Grading will be based on following criteria:

➢ **Quizzes** (three quizzes and each having 5% weightage)	**15 %**
➢ **Attendance, class participation and behavior**	**05 %**
➢ **Assignments** (two assignments and each having 5% weightage)	**10 %**
➢ **Mid-term Exam**	**30 %**
➢ **Final Exam**	**40 %**

Grading Criteria:

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

Weekly Lesson Plan:

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** **(Group 1)** Nov 19 (Fri)
4 Nov 22, 24, 26	❖ Continuity **Derivatives** ❖ Limit Definition of Derivative, Differentiability, Evaluating Derivatives by Definition	**Quiz-1** **(Group 2)** Nov 24 (Wed)
5 Nov 29 Dec 01, 03	❖ Techniques of Differentiation, The Product and Quotient rules ❖ Derivative of Trigonometric functions ❖ The Chain Rule	**Assignment 1**
6 Dec 06, 08, 10	❖ Derivative of Exponential and Logarithmic Functions ❖ Logarithmic Differentiation ❖ Implicit Differentiation	
7 Dec 13, 15, 17	**Application of Derivatives:** ❖ Related Rates ❖ L'Hopital's Rule; Indeterminate Forms	**MID TERM** **(Group 1)** Dec 17 (Fri)
8 Dec 20	❖ MIDTERM EXAM	**MID TERM** **(Group 2)** 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	**Quiz-2** **(Group 1)** Jan 21 (Fri)
12 Jan 24, 26, 28	❖ Integration by Trigonometric Substitution ❖ Integrating Rational Functions by Partial Fractions ❖ Definite Integrals, Fundamental Theorems of Calculus, and evaluating Definite Integrals	**Quiz-2** **(Group 2)** Jan 26 (Wed)

13 Jan 31 Feb 02, 04	<u>**Application of Integrals:**</u> ❖ 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) ❖ Surface Areas of Revolutions	**Quiz-3** **(Group 1)** Feb 11 (Fri)
15 Feb 14, 16, 18	<u>**Infinite Series:**</u> ❖ Infinite Series and Convergence Tests ❖ Taylors Series	**Quiz-3** **(Group 2)** Feb 16 (Wed)
Feb 21 – Mar 02	**Final Exam**	