Information Technology University
Department of Electrical Engineering

MT110: Calculus & Analytic Geometry			
Course Code	MT110	**Semester**	1st
Credit Hours	3	**Term**	Fall 2018
Instructor	Usama Bin Sikandar	**Pre-reqs**	None
Office	Room 9, 4th floor	**E-mail**	usama.sikandar@itu.edu.pk
Department	Electrical Engineering	**Discipline**	Mathematics
Teaching Assistants	Amna Gillani, Mohsin Ali	**Office Hours**	Thu 2:30-4:30 pm

Course Description

The course starts off with basic geometry and algebra of single variable functions and then builds on the idea of derivative and integration from first principles. The students will be taught how to apply calculus to calculate rates of change in different real-world scenarios, velocities, areas under curves, and distances.

Course Outcomes/Objectives

By the end of the course, the students should be able to

- Understand the derivative as 'rate of change' computed as a limit of ratios, and the integral as a 'sum' computed as a limit of Riemann sums.
- Use both the limit definition and rules of differentiation to differentiate functions.
- Sketch the graph of a function using asymptotes, critical points, the derivative test for increasing/decreasing functions, and concavity.
- Apply differentiation to solve applied max/min problems and related rates problems.
- Evaluate integrals both by using Riemann sums and by using the Fundamental Theorem of Calculus.
- Evaluate integrals using advanced techniques of integration, such as inverse substitution, partial fractions, and integration by parts.
- Use L'Hospital's rule to evaluate certain indefinite forms.

Books

Textbook:	*Single Variable Calculus: Early Transcendentals* (7th ed.) by James Stewart.
Reference Book:	*Calculus and Analytic Geometry* (9th ed.) by George B. Thomas and Ross L. Finney

Course Assessment Distribution:

Quizzes:	15 % (15 recitation worksheets)
Assignments:	20 % (6 homework assignments)
Midterm Exam:	25 %
Final Exam:	40 % (cumulative final exam)

Weekly Lecture Breakdown			
Week 1:	Introduction to Sets and Functions	Week 10:	Applications of Differentiation
Week 2:	Elementary Functions	Week 11:	Applications of Differentiation
Week 3:	Elementary Functions	Week 12:	Applications of Differentiation
Week 4:	Limits	Week 13:	Antiderivatives
Week 5:	Limits	Week 14:	Integration
Week 6:	Limits	Week 15:	Techniques of Integration
Week 7:	Derivatives	Week 16:	Techniques of Integration
Week 8:	Differentiation Rules	Week 17:	Prep week
Week 9:	**Midterm exam**	Week 18:	**Final exam**

Chapter	Topics	Lectures
Stewart Ch 1	• Fundamental problems in Calculus ○ Velocity problem ○ Area and distance problem • Functions ○ What is a function? ○ Four ways to represent a function ○ Sketching by hand ○ Transforming functions ○ Polynomials ○ Trigonometric functions ○ Inverse functions ○ Exponential and Logarithmic functions	5
Stewart Ch 2	• Limits ○ Tangent and velocity problem ○ Limit of a function ○ Limits from left and right ○ Limit laws ○ Continuity ○ Types of discontinuities ○ Intermediate values theorem ○ Precise definition (epsilon-delta) ○ Limits at infinity and infinite limits • Derivatives ○ Rates of change ○ Derivative from first principles ○ Derivative as a function	10
Midterm Exam		
Stewart Ch 3 3.1 - 3.9	• Differentiation Rules ○ Derivatives of polynomials and exponential function ○ Product and quotient rules ○ Derivatives of trigonometric functions ○ The chain rule ○ Implicit differentiation ○ Derivatives of logarithmic functions	4

	• Rates of change
	  ○ Natural science models
	  ○ Social science models
	  ○ Exponential growth and decay
	  ○ Related rates	

Stewart
Ch 4
4.1-4.5
4.7
4.9
	• Applications of Differentiation
	  ○ Stationary points
	  ○ The mean value theorem
	  ○ L'Hospital's rule
	  ○ Curve sketching
	  ○ Optimization problems
	  ○ Antiderivatives
		4

Stewart
Ch 5
6.5
	• Integration
	  ○ Area problem
	  ○ Reimann sums
	  ○ Integration from Reimann sum
	  ○ Midpoint rule
	  ○ The definite integral
	  ○ The fundamental theorem of Calculus
	  ○ Indefinite integral and net change theorem
	  ○ The substitution rule
	  ○ Average value of a function
		3

Stewart
Ch 7
7.1-7.5
7.8
	• Techniques of Integration
	  ○ By parts
	  ○ Trigonometric integrals
	  ○ Trigonometric substitution
	  ○ Rational functions by partial fractions
	  ○ General Strategy for integration
	  ○ Improper integrals
		4

Final Exam		

Course Learning Objectives (CLOs):			
CLO	**Description**	**BT**	**PLOs**
1	Sketch the graph of a function using asymptotes, critical points, the derivative test for increasing/decreasing functions, and concavity.	3	1, 2, 5, 9
2	Use both the limit definition and rules of differentiation to differentiate functions.	3	1, 3, 9
3	Evaluate integrals using advanced techniques of integration, such as inverse substitution, partial fractions and integration by parts.	3	1, 2, 9
4	Apply integration to compute arc lengths, volumes of revolution and surface areas of revolution.	3	1, 3, 5, 9

Mapping of CLOs to Assessment Modules:				
Assessments	**CLO1**	**CLO2**	**CLO3**	**CLO4**
Worksheets	✓	✓	✓	✓
Assignments	✓	✓	✓	✓
MidTerm	✓	✓		
Final Exam	✓	✓	✓	✓

Mapping of CLOs to Program Learning Outcomes (PLOs):				
PLOs/CLOS	**CLO1**	**CLO2**	**CLO3**	**CLO4**
PLO 1 (Engineering Knowledge)	✓	✓	✓	✓
PLO 2 (Problem Analysis)	✓		✓	
PLO 3 (Development of Solutions)		✓		✓
PLO 4 (Investigation)				
PLO 5 (Modern tool usage)	✓			✓
PLO 6 (The Engineer and Society)				
PLO 7 (Environment and Sustainability)				
PLO 8 (Ethics)				
PLO 9 (Individual and Team Work)	✓	✓	✓	✓
PLO 10 (Communication)				
PLO 11 (Project Management)				
PLO 12 (Lifelong Learning)				

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<tr><th colspan="2">Grading Policy:</th></tr>
<tr><td>Worksheet Policy:</td><td>To provide the students with an opportunity to solve problems under guided supervision, students will solve one worksheet in each of the weekly recitation sessions. Students will work in groups of two. They can only seek help from the textbook, lecture notes and the TAs. Each worksheet will constitute 1% of the grade. Out of 15 worksheets, best 14 will be counted towards the final grade.</td></tr>
<tr><td>Assignment Policy:</td><td>In order to develop a comprehensive understanding of the subject and push the students out of their comfort zone in the subject, challenging problems will be assigned as homework. The students must do the homework individually. Copying of homework or any kind of plagiarism is highly discouraged and violations will be dealt with severely by referring any occurrences to the disciplinary committee and a straight-away zero. Homework submitted late by one day will be penalized by 20%, but after that nothing will be accepted. All homework assignments will count towards the total (no ‘best-of’ policy). The problems in the assignment are meant to be challenging to raise the students’ caliber in the subject, give them confidence and enable them to prepare not just the exams but the real world scenarios.</td></tr>
<tr><td>Plagiarism:</td><td>The course has a zero-tolerance policy towards plagiarism. While collaboration in this course is highly encouraged, you must ensure that you do not claim other people’s work/ ideas as your own. Plagiarism occurs when the words, ideas, assertions, theories, figures, images, programming codes of others are presented as your own work. You must cite and acknowledge all sources of information in your assignments. Failing to comply with the plagiarism policy will lead to strict penalties including a failing grade in the course and referral to the Disciplinary Committee for a strict action, which may possibly lead to failing grades in all the courses of the semester.</td></tr>
<tr><td>Grading</td><td>Absolute grading
<table>
<tr><th>Grades</th><td>A+</td><td>A</td><td>A-</td><td>B+</td><td>B</td><td>B-</td><td>C+</td><td>C</td><td>C-</td><td>D+</td><td>D</td><td>F</td></tr>
<tr><th>Cutoffs</th><td>>85</td><td>>75</td><td>>70</td><td>>65</td><td>>60</td><td>>55</td><td>>50</td><td>>45</td><td>>40</td><td>>35</td><td>>30</td><td><30</td></tr>
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