National University of Sciences & Technology (NUST)
School of Electrical Engineering and Computer Science (SEECS)
Department of Electrical Engineering

Calculus-I

Course Code:	MATH-111	**Semester:**	1st
Credit Hours:	3+0	**Prerequisite Codes:**	Nil
Instructor:	Muhammad Nadeem	**Class:**	BSCS-6ABC
Office:		**Telephone:**	
Lecture Days:	Wed, Thurs, Friday	**E-mail:**	muhammad.nadeem@seecs.edu.pk
Class Room:		**Consulting Hours:**	
Lab Engineer:		**Lab Engineer Email:**	
Knowledge Group:		**Updates on LMS:**	After every lecture

Course Description:

The course reviews the concepts of basic calculus; including Limits, continuity, differentiation and integration. A brief account of three dimensional geometry and complex numbers is also included as pre-calculus review. Stress is laid on applications of differentiation and integration to practical/engineering problems. Convergence/divergence of the sequence and series are included towards the end of the syllabus.

Course Objectives:

The course objective is that its successful completion should develop understanding of the basic concepts of analytical geometry involving limits, continuity, differentiation and integration for solving the real world problems and analyzing the convergence/divergence of sequence and series.

Course Learning Outcomes (CLOs):

At the end of the course the students will be able to:	PLO	BT Level*
1. Understand the concepts of analytical geometry, limits and continuity.	1	C-2
2. Apply techniques of differentiation and integration to real world problems.	2	C-3
3. Compute the convergence analysis of sequences and series.	1	C-3

* BT= Bloom's Taxonomy, C=Cognitive domain, P=Psychomotor domain, A= Affective domain

Mapping of CLOs to Program Learning Outcomes

PLOs/CLOs	CLO1	CLO2	CLO3
PLO 1 (Engineering Knowledge)	√		√
PLO 2 (Problem Analysis)		√	
PLO 3 (Design/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)			

Mapping of CLOs to Assessment Modules and Weightages (In accordance with NUST statutes)

To be filled in at the end of the course.

Assessments/CLOs	CLO1	CLO2	CLO3	CLO4	CLO5
Quizzes: 10%					
Assignments: 10%					
OHT-1: 15%					
OHT-2: 15%					
End Semester Exam:50%					
Total : 100 %					

Books:

Text Book: Calculus and Analytic Geometry (9th Edition) by George B. Thomas, Jr. and Ross L. Finney.

Reference Books:
- Calculus (6th Edition) by Swokowski, Olinick and Pence
- Calculus (3rd Edition) by Robert T. Smith & Roland B. Minton

Main Topics to be Covered:

The course spans over a number of different topics as under:

Vectors& Geometry	**Integration**
Coordinate System	Method of Substitution
Lines and Planes in space.	Integration by parts
Complex Numbers.	Walli's Formulas
Introduction	Riemann sum
Polar Form, Euler's Formula	Improper Integrals
Demoivre's Theorem	Application as area
Limits and Continuity	volumes of solids of revolution
	Arc lengths of plane curves by integration
Formal definition of limit	**Infinite Series**
Techniques of finding limits	Idea of Convergence of sequences
Continuity of functions	positive term series
Derivative of a function	Tests for Convergence
Definition as limit	Alternating series
Geometric interpretation	absolute and conditional convergence
Techniques of differentiation	Power series
Tangent lines and rates of change	Taylor and Maclaurin series
Extreme values L Hôpital rule	
Optimization	

Lecture Breakdown:

Chapter	Topics	Sections Lectures	
10	Review of vectors, scalars and vector products. Three Dimensional Coordinate System and equation of planes and straight lines with vector treatment.	10.3 to 10.5 & Notes/Handout	3
Appendix	Complex numbers, Argrand Diagrams, Polar Form of Complex Numbers. Applications of De Moivre's Theorem. Hyperbolic Functions.	Thomas Appendix A-3 & Handouts	4
1	Concept of Limits. Rules and techniques of finding limits. Left Hand and Right Hand Limits and existence/non-existence of Limits.	1.2, 1.4	3
1&2	Continuity. Continuity at a point and continuity in an interval. Definition of Derivative and its calculation by definition. Geometric Interpretation of derivative.	Thomas 1.5, 2.1	3
2	Techniques of Differentiation: Basic Rules, Algebraic Functions, Trigonometric Functions, hyperbolic functions, Implicit Functions, Exponential and Logarithmic Functions. The Chain Rule. Rates & Related Rates of Change	2.2 , 2.3 to 2.7 & handout	6
3&6	Local and Absolute Maxima and Minima. Rolle's Mean Value Theorem. First and second derivative tests for local maxima/minima. Concavity and convexity, Optimization Problems using differentiation. L' Hopital Rule. Indeterminate Forms	3.1 to 3.6, 6.6	6
7(*Swokowski*)&4	Indefinite Integration, Method of Substitution, Method of Parts and other techniques of integration. Integration of Rational and Irrational Functions. Introduction to Improper Integrals.	4.1,4.3 and handout, *Swokowski* Sec 7.4,7.5, 7.7	7
5	Definite Integration. Finding areas between Curves in Cartesian Coordinates.	5.1 to 10.5	3
9	Polar Coordinates, Polar Curves and finding their areas using integration.	9.6, 9.7,9.9	4
5	Arc Lengths of plane curves. Volumes of solids of revolution using integration. Disc Method and Cylindrical Shell Method.	5.3 to 5.5	3
8	Sequences and Series. Convergence/divergence of positive term series by Integral Test, p-test, Ratio Test, Root Test and Comparison Test. Alternating Series. Absolute and Conditional Convergence. Power Series. Taylor's and Maclaurin series.	8.8,8.3 to 8.9	6
		Total:	**48**

Tools / Software Requirement:
Matlab /Maple/Mathematica could be used for visualizing the graphs.

Grading Policy:	
Quiz Policy:	The quizzes will be unannounced and normally last for ten minutes. The question framed is to test the concepts involved in last few lectures. Number of quizzes that will be used for evaluation is at the instructor's discretion. Grading for quizzes will be on a fixed scale of 0 to 10. A score of 10 indicates an exceptional attempt towards the answer and a score of 1 indicates your answer is entirely wrong but you made a reasonable effort towards the solution. Scores in between indicate very good (8-9), good (6-7), satisfactory (4-5), and poor (2-3) attempt. Failure to make a reasonable effort to answer a question scores a 0.
Assignment Policy:	In order to develop comprehensive understanding of the subject, assignments will be given. Late assignments will not be accepted / graded. All assignments will count towards the total (No 'best-of' policy). The students are advised to do the assignment themselves. Copying of assignments is highly discouraged and violations will be dealt with severely by referring any occurrences to the disciplinary committee. The questions in the assignment are meant to be challenging to give students confidence and extensive knowledge about the subject matter and enable them to prepare for the exams.
Plagiarism:	SEECS maintains 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 SEECS plagiarism policy will lead to strict penalties including zero marks in assignments and referral to the academic coordination office for disciplinary action.