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

Calculus-II

Course Code:	**MATH-112**	**Semester:**	2nd
Credit Hours:	3+0	**Prerequisite Codes:**	MATH-111
Instructor:		**Class:**	BSCS
Office:		**Telephone:**	
Lecture Days:		**E-mail:**	
Class Room:		**Consulting Hours:**	
Lab Engineer:		**Lab Engineer Email:**	
Knowledge Group:	Calculus	**Updates on LMS:**	After every lecture

Course Description:

In this course first order and higher order differential equations are included so that the students feel comfortable in making mathematical models of physical systems. Laplace Transform and its applications to solve Ordinary Differential equations are included to give them an additional tool to apply in their engineering studies like circuit analysis etc. Fourier series are included to make them capable of tackling periodic signals etc. The course introduces functions of several variables, partial differentiation with applications. Double and triple integration are included with applications to find areas and volumes..

Course Objectives:

The successful completion of the course should develop the ability to solve ordinary Differential Equations and apply them in Mathematical Modeling. The understanding of Laplace Transform and its applications to solve initial and boundary value problems. The handling with partial differentiation and functions of several variables and the expansion of periodic functions in Fourier series.

Course Learning Outcomes (CLOs):

At the end of the course the students will be able to:	PLO	BT Level*
1. Evaluating first order and higher order differential equations.	1	C-1, C-3
2. Carry out Laplace Transform and Inverse Laplace transforms.	1	C-3
3. Solving Initial value problems involving piece-wise continuous functions.	1	C-3
4. Solve problems involving functions of several variables.	1	C-3
5. Solve problems involving Fourier 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	Level of Emphasis of PLO (1: High, 2: Medium, 3: Low	CLO1	CLO2	CLO3	CLO4	CLO5
PLO 1 (Engineering Knowledge)	3	√	√	√	√	√
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)
Thomas's Calculus (11th Edition)
Advanced Engineering Mathematics (9th Edition)

Reference Books:
- Differential Equations with Boundary Value Problems- Zill & Cullen {7th Edition}

Lecture Breakdown:

week	Ch. Sect	Topics
1	Text -3(1.1 ,1.3)	**First Order Ordinary Differential Equations.** Basic concept and Modeling. Solution by separation of variables.
2	Text-3(1.4, 1.5)	Exact ODEs. Linear ODEs. Bernoulli Equation. Orthogonal Trajectories
3	Text-3(1.6 , 2.1, 2.2,2.3)	**Second Order Linear ODEs** Linear ODEs of Second and Higher Order with constant coefficient using Differential Operators.
4	Text-3(2.5, 2.7,2.10)	Method of Undetermined Coefficients, Cauchy Euler Equations, Method of Variation of Parameters, applications to Electronic Circuits
5	Text-3(3.2)/ Notes/Handout Kreyszig Sec 6.1	Introduction of Laplace Transform, Laplace Transform of elementary functions. First shifting theorem & its application Laplace Transform of derivatives Laplace Transform of Integral, Inverse Transforms
6	**1st One Hour Test**	
7	Notes/Handout Kryszig Sec 6.2, , 6.3, 6.4	Solution of differential Equations by Laplace Transform. Unit step function, second shifting Theorem, Dirac delta function, initial& final Value Theorem, Laplace Transform of Periodic functions, Convolution, System of differential Equations.
8	Text-1(10.5, 10.6) **Or** Text-2(12.5, 12.6)	**Quadric Surfaces** Cylinders and Quadric Surfaces, Cylindrical & Spherical coordinates
9	Text-1(10.7, 12.2) **Or** Text-2(14.2)	**Multivariable functions and partial derivatives** Introduction to function of more than one variable. Partial Derivatives, Chain Rules.
10	Text-1(12.3, 12.4) **Or** Text-2(14.3)	Geometric interpretation of partial derivatives. Absolute, relative and percentage changes using Differentials
11	Text-1(12.4, 12.5) **Or** Text-2(14.3, 14.4)	Predicating change with differentials and sensitivity to change. The chain rule, tangent plane s and normal lines to a surfaces.
12	**2nd One Hour Test**	
13	Text-1(12.8,12.10) **Or** Text-2(14.7, 14.10)	Extreme values and saddle point, Taylor's Theorem for function of two variables.
14	Text-1(13.1, 13.2, 13.3) **Or** Text-2(15.1, 15.3)	**Multiple Integrals** Double integrals, areas by double integration using Cartesian as well as Polar coordinates. Volumes in rectangular coordinates using Triple integrals
15	Text-1(13.6,14.5) **Or** text-2(15.6,16.5)	Volumes in cylindrical and spherical coordinates using Triple integrals. Surface areas using double integrals.
16	Text-3(11.1,11.2)	**Fourier Series** Fourier Series for periodic functions having period 2π. Derivation of Euler Formulas. Fourier Series for periodic functions having any period.
17	Text-3(11.3,11.4)	Even and Odd Functions and Half-Range Expansions. Complex Fourier Series

18	**End Semester Exam**

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.