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

Vector Calculus		
Course Code:	**MATH-243**	**Semester: 3rd**
Credit Hours:	**3+0**	**Prerequisite Codes: MATH-101 (Calculus & Analytical Geometry)**
Instructor: Dr. Naila Amir		**Discipline: BEE-12ABC**
Office: 306-A		**Telephone: 051-90852355**
Lecture Days: Tuesday, Wednesday, Friday		**E-mail: naila.amir@seecs.edu.pk**
Class Room: 16, 17, 18 (IAEC)		**Consulting Hours: Monday & Thursday: 09:00 AM – 04:30 PM**
Knowledge Group: Calculus		**Updates on LMS: Before every lecture**

Course Description:

The course introduces Analytical Geometry in 3-space. Important quadric surfaces are included while students also become familiar with 3-dimensional cylindrical and spherical coordinate systems. Parametric equations of curves and the concept of directional derivative are also part of this course. Double and triple integration are included with applications to find areas and volumes. In the second part advanced topics in vector analysis like calculus of del operator, gradient, curl and divergence along with their physical interpretations are covered. Moreover, partial differential equations are included in the course to provide students strong mathematical tools to solve Engineering/Technology problems.

Course Objectives:

On the successful completion of course students should develop understanding of vector valued functions, partial differential equations and multiple integrals. The applications will be covered from several engineering problems. The other objective is to learn basic vector differential operators, gradient, divergence and curl along with their applications to calculate surface integrals, flows and flux across surfaces. The understanding of partial differential equations is developed which is a strong tool for various mathematical models. Objective is to learn solution techniques of partial differential equations. In particular, methods of obtaining solutions by using Fourier series are dealt rigorously.

Course Learning Outcomes (CLOs):

After successful completion of this course, a student should be able to:	PLO	BT Level*
[CLO - 1] Interpret the consequences of del (nabla) operator on scalar and vector fields.	2	C-6
[CLO - 2] Solve line- and surface integrals directly or by using known integrals theorems.	2	C-3
[CLO - 3] Develop analytical solutions of partial differential equations.	3	C-5

*** 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)			

Books:

Text Books:

- Thomas's Calculus (11th Edition) George B. Thomas, Jr.
- Calculus (6th Edition) James Stewert.
- Advanced Engineering Mathematics (9th Edition) Ervin Kreyszig
- Calculus (6th Edition) Swokowski, Olinick and Pence

Reference Books:

Borisenko & Taranov, Vector and Tensor Analysis with Applications.

Sr. No	Main Topics to be covered	Estimated Contact Hours
1	Analytical Geometry in 3-space	3
2	Quadratic Surfaces	2
3	Cylindrical and Spherical coordinates	1
4	Parametric representation of curves, Arc length Curvature & Torsion	5
5	Gradient of a Scalar Field and directional derivatives	3
6	Divergence of a Vector Field.	2
7	Curl of a Vector Field.	2
8	Line integral, integration around closed curves.	3
9	Application of double integrals, Green's theorem.	3
10	Surface Integrals.	3
11	Triple integrals, Divergence theorem of Gauss.	3
12	Stokes's theorem.	3
13	Partial differential equations solvable as ODEs (separation of variables)	3
14	Modeling a Vibrating String, Derivation of Wave Equation	3
15	Solution by the Method of Separation of Variables using Fourier Series.	3
16	Heat Equation; its Solution by Fourier Series.	3

Weightages:	
Quizzes:	10%
Assignments:	10%
OHT-1:	15%
OHT-2:	15%
Final Exam:	50%

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.