Forman Christian College, Lahore
(A Chartered University)
Department of Mathematics
Spring 2023

Estd 1864

Instructor Information:

Dr. Ashar Ghulam
Ph.D (Applied Mathematics)   Louisiana State University U.S.A.
M.S (Mathematics)   Louisiana State University U.S.A.
M.Phil. (Mathematics)   NCBA & E Lahore, Pakistan
M.Sc. (Mathematics)   Dept. of Mathematics University of Punjab, Lahore, Pakistan
Assistant Professor
Office: S-114 (Armacost Science Building)
Office Hours: Mon., Wed., Fri. 10:00 am –10:50 am, Tue, Thur: 11:00 am- 12:20 pm or by appointment
Email: asharghulam@fccollege.edu.pk
Cell# 0332-4049602 (8:00 pm- 9:00 pm)

Course Information:

Course Title: Vector Analysis
Course Code: MATH203
Credit hours: 3
Prerequisite: MATH 102
Room # S-416
Section: A
Timing: Mon., Wed. Fri. : 12:00 noon --12:50 pm
Mode of teaching: On campus

Resources:
Notes and recorded lectures will be provided on Moodle.
Recommended Texts**:**
"VECTOR ANALYSIS AND AN INTRODUCTION TO TENSOR ANALYSIS" By Murray R. Spiegel, published by McGraw-Hill, Inc. U.S.A.

"CALCULUS EARLY TRANSCENDENTALS, By James Stewart, seventh edition, published by Thomson Learning Inc. U.S.A.

Course Contents:
Scalars and Vectors, Product of two vectors (scalar and vector) with applications, Product of more than two vectors, ordinary and partial differentiation of vectors, application of vector differentiation to differential geometry, Divergence, Curl, Gradient and their applications, Ordinary vector integration, Line integrals, surface integrals, volume integrals, the Divergence and Stoke's theorem.

Course Objectives

Vector Analysis has become an essential part of the mathematical background required for mathematicians and physicists. This course demands understanding of basic mathematical concepts and properties associated with vectors. Vectors provide not only a concise notation for presenting equations arising from mathematical formulation of physical problems, but it is also a natural aid in forming mental pictures of physical ideas. The course will develop these ideas by the investigation of specific examples. This is a demanding course, which will equip the students for other sciences and further work in Mathematics.

Course Expectations

❑ Students must arrive at class on time, should remain in class for the entire class period and mobile phones should be switched off. All students whose attendance is less than 70% (on campus attendance) won't be allowed to take the final exam. Note that there are **05 marks for attendance and in class participation.** If a student arrives more than 10 minutes late or leaves class during lecture or uses mobile phone in class, he/she will be marked absent. Habitual late comers will not be allowed to enter the class after 10 minutes. In case a late comer with **genuine reason** is not allowed to enter the class, he or she can see the professor in office hours for briefing about the lecture.

❑ Course assessment will be through quizzes, midterm, assignments, attendance & in class participation and final exam. There will be one bonus question in the final term examination. **If needed, students may be asked to explain the submitted work**. All assignments are to be completed by the date mentioned on the assignment paper**. Late submission of assignment will result in deduction of points for the assignment**. There is no make up for missed quizzes. In extreme cases average marks for the missed quizzes might be given provided students should submit strong evidence **within 3 days** after missing the quiz. Makeup for midterm and final exam. is possible only under extremes cases if student provides strong documentary evidence within **3 days after missing the Mid/Final exam.** In case of makeup examination, there will be a 0-20% deduction in marks depending upon case to case. Medical certificate will be acceptable if it is verified by the medical officer of FCCU.

❑ **Academic dishonesty or cheating** will result in zero points (grade F) and will be referred to AIC (Academic Integrity Committee) at FCCU for necessary action. (Page number 20 of 4-year Baccalaureate degree Program Catalog 2018-2019)

❑ **Note: All the quizzes, midterm and final term examination will be conducted in class while all the assignments will be conducted through Moodle.**

Learning Outcome

Students will be able to:

❑ differentiate between scalars and vectors.
❑ use properties of vectors in physical phenomena e.g. work, velocity, acceleration etc.
❑ do ordinary and partial differentiation of vectors.
❑ apply gradient, divergence and curl in geometrical problems.
❑ do ordinary vector integration, and solve line integrals, surface and volume integrals.

- ❑ apply line integral to calculate work done along a curve.
- ❑ use the course material in some upper-level courses of Mathematics and Physics.

Course Evaluation

Grading will be based on following criteria:

Attendance & in class performance including behavior	05 %
Assignments (2)	10 %
Quizzes (3 out of 4)	15 %
Mid Term	30 %
Final Exam	40 %

Grades	Quality Points	Numerical Value	Meaning
A	4.00	93-100	Superior
A-	3.70	90-92	
B+	3.30	87-89	
B	3.00	83-86	Good
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

Course Outline

Week	Topics	Assessments
1	Introduction to course policies, requirements, grading criteria. **Chapter 1 (Vectors and Scalars)** Vectors, Scalars, Vector algebra, Laws of vector algebra, Unit vectors, Rectangular unit vectors.	
2	**Chapter 1 (Vectors and Scalars)** Components of a vector, Scalar fields, Vector fields. **Chapter 2 (The Dot and Cross Product)** Dot or scalar product and its applications, Cross or vector product and its applications.	
3	**Chapter 2 (The Dot and Cross Product)** Triple products, Applications of triple product.	**Assignment-1**

4	Continue applications of triple products	
5	**Chapter 3 (Vector Differentiation)** Ordinary derivatives of vectors, Space curve, Differentiation formulas.	**Quiz-1**
6	**Chapter 3 (Vector Differentiation)** Partial derivatives of vectors	
7	**Chapter 3 (Vector Differentiation)** Frenet-Serret Formulas, Applications of vector differentiation.	**Quiz-2**
8	**Chapter 4 (Gradient, Divergence and Curl)** The vector differential operator del, Gradient of a scalar function and related problems, Divergence, Curl, and related problems.	**Mid-Term** **5th April**
9	**Chapter 4 (Gradient, Divergence and Curl)** Divergence of a vector function and related problems.	
10	**Chapter 4** Curl of a vector function and related problems.	
11	**Chapter 5 (Vector Integration)** Ordinary integration of vectors	**Quiz-3**
12	**Chapter 5 (Vector Integration)** Applications of ordinary integration of vectors, line integral	
13	**Chapter 5 (Vector Integration)** Applications of line integrals in physical phenomena.	
14	**Chapter 5 (Vector Integration),** Surface integrals and related problems, Volume integrals and related problems. (**Sec. 16.7 Book-2**).	**Assignment-2**
15	Stoke's theorem and related problems (**Sec. 16.7 Book-2**).	**Quiz-4**
16	**Chapter 16 (Vector Calculus: book 2): 16.8** Divergence theorem of Gauss and related problems.	
	Final examination period is from 12th June 2023 – **21st June 2023.**	