Forman Christian College Lahore
(A Chartered University)
Department of Mathematics
Fall 2021

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Course Information:

Vector Analysis, MATH 203 (A) , 3 credits , Class Room: S-412
Lectures Time: Monday, Wednesday & Friday (12:00 - 12:50)
Prerequisite: MATH 102
Text Book: Schaum's Outline of "Theory and problems of Vector Analysis and an Introduction to Tensor Analysis" by Murray R. Spiegel.
http://www.uop.edu.pk/ocontents/Vector%20Analysis%20Schaum.pdf

Course Description: This a core course for mathematics major. The topics includes: scalars and vectors, laws of vector algebra, scalar and vector fields, product of two vectors and their applications, scalar and vector triple products, ordinary and partial differentiation of vector fields and its use in basic differential geometry, gradient of a scalar field, divergence and curl of a vector field, ordinary integration of vector fields, line integrals, surface integrals and volume integrals, divergence and Stokes' theorem.

Course Objectives: Vector Analysis had become an essential part of the mathematical background required of mathematicians and physicists. The objective of the course is to introduce and develop the methods of vector analysis. These methods provide a natural aid to the understanding of geometry and some physical concepts. They are also a fundamental tool in many theories of applied mathematics.

Learning Outcomes: Upon successful completion of this course, the student will be able to:

- Differentiate between scalars and vectors.
- Know laws of vector algebra, and product of vectors.
- Do ordinary and partial differentiation of vectors.
- Use properties of vectors in physical phenomena, e.g. work, velocity etc.
- Know the application of vector differentiation to differential geometry.
- Define scalar and vector fields (gradient, divergence, curl).
- Apply gradient, divergence and curl in geometrical problems.
- Understand directional derivatives, and conservative vector field.
- Do ordinary vector integration and solve line integrals.
- Know the applications of line integrals in physical phenomena.
- Evaluate the integrals of functons and vector fields on surfaces and 3-dimensional domains.
- Express and use Stokes's and Divergence Theorems.
- Use the course material in some upper level courses.

Course Requirements:

- **Attendance:** Students are expected to attend every class. Student whose attendance is less than 60% won't be allowed to take the final exam. Students must arrive at class on time, should remain in class for the entire class period and mobile phone should be switched off or on silence. Note that there is 5 marks for attendance and behaviour, if a student arrives more than 10 minutes late or leaves class during lecture or uses mobile in class, he/she will be marked absent.
- **Assessment:** Course assessment will be through quizzes, attendance and behavior, assignments, midterm, and final exam. Quizzes, mid term exam and final exam will be conducted on campus for all students. Assignments will be conducted on Moodle along with its viva on Zoom or in person. There is no make up for missed quizzes but best 3 out of 4 will be counted. Make up for midterm and final exam is possible only under extremes cases if student provides strong documentary evidence within three days. In case of make up exam there will be a 0-20% deduction in marks depending upon case to case basis.
- **Academic dishonesty or cheating:** Academic dishonesty or cheating will result in zero points and will be referred to AIC (Academic Integrity Committee) at FCC for necessary action.

Grades	Quality Points	Numerical Value
A	4.00	93-100
A-	3.70	90-92
B+	3.30	87-89
B	3.00	83-86
B-	2.70	80-82
C+	2.30	77-79
C	2.00	73-76
C-	1.70	70-72
D+	1.30	67-69
D	1.00	60-66
F	0.00	59 or below

Course Evaluation: Grading will be based on following criteria:

Attendance and Behaviour	**05 %**
Assignments (2)	**05 %**
Quizzes (4)	**20 %**
Mid Term	**30 %**
Final Exam	**40 %**

Week	Topics	Assessments
1 Nov 01, 03, 05	**Discussion of Course plan and Overview of Course Syllabus** **Chapter 1 (Vectors and Scalars)** ❖ Scalars and vectors, resultant vector, unit vector, laws of vector algebra, components of a vector, position vector ❖ Related problems	

2 Nov 08, 10, 12	❖ Equation of straight line in vector form ❖ Non-collinear and non-coplanar vectors ❖ Direction angles and direction cosines ❖ Scalar and vector fields	
3 Nov 15, 17, 19	**Chapter 2 (The Dot and Cross Product)** ❖ Dot or scalar products and its applications ❖ Cross or vector products and its applications	**Quiz-1** Nov 17 (Wed)
4 Nov 22, 24, 26	❖ Scalar and vector triple product and its applications ❖ Reciprocal sets of vectors	
5 Nov 29 Dec 01, 03	**Chapter 3 (Vector Differentiation)** ❖ Ordinary derivatives of vectors, space curve ❖ Differentiation formulae and related problems	
6 Dec 06, 08, 10	❖ Partial derivatives of vectors ❖ Application of vector differentiation to differential geometry	**Quiz-2** Dec 08 (Wed)
7 Dec 13, 15, 17	❖ (. . . continued) Application of vector differentiation to differential geometry	**Assignment 1**
8 Dec 20	❖ MID TERM EXAM	**MID TERM** Dec 20 (Mon)
9 Jan 03, 05, 07	**Chapter 4 (Gradient, Divergence and Curl)** ❖ The vector differential operator del , Gradient, Divergence and Curl and related problems ❖ Formulae involving differential operator del and related problems	
10 Jan 10, 12, 14	❖ Unit normal to a surface ❖ Directional derivative ❖ Conservative vector field	
11 Jan 17, 19, 21	**Chapter 5 (Vector Integration)** ❖ Ordinary vector integration and related problems ❖ Line integrals	
12 Jan 24, 26, 28	❖ Applications of line integrals in physical phenomena ❖ Surface integrals and related problems	**Quiz-3** Jan 26 (Wed)
13 Jan 31 Feb 02, 04	❖ (. . . continued) Surface integrals and related problems ❖ Volume integrals and related problems	**Assignment 2**
14 Feb 07, 09, 11	**Chapter 6 (The Divergence and Stokes's Theorem)** ❖ Divergence Theorem ❖ Stokes's Theorem	
15 Feb 14, 16, 18	❖ Problems related to divergence and Stokes's theorem	**Quiz-4** Feb 16 (Wed)