Department of Mathematics

College of Basic education

University of Salahaddin University -Erbil

Subject: Vector Analysis

Course Book: Second Year

Lecturer's name: Aween S. Karim

Academic Year: 2023-2024

Course Book

1. Course name	Vector Analysis
2. Lecturer in charge	Awen S.abdollah Karim
3. Department/ College	Mathematics/ Basic Education
4. Contact	e-mail:awen.karim@su.edu.krd
5. Time (in hours) per week	Theory: 4
6. Office hours	
7. Course code	
8. Teacher's academic profile	B.Sc degree in mathematics from the University of Urmia in 2008 M.Sc degree in Numerical Analysis at the University of Urmia in 2012
9. Keywords	Vector Analysis (vector space, Cross & dot product, Limits and Continuity of function with two variables, Partial Derivative, Gradient Vectors...)

10. Course overview:

Calculus weaves together previous study of algebra, geometry, and functions. The course focuses on the mastery of critical skills and exposure to new skills necessary for success in subsequent math courses. Calculus is a foundational course; it plays an important role in the understanding of science, engineering, economics, and computer science, among other disciplines. Calculus also provides important tools in understanding functions and has led to the development of new areas of mathematics including real and complex analysis, topology, and non-euclidean geometry.

This introductory calculus course covers differentiation and integration of functions of two variable, with applications.

After completing this course, students should have developed a clear understanding of the fundamental concepts of single variable calculus and a range of skills allowing them to work effectively with the concepts.

The general objective of this course is to deeper understanding and working knowledge of mathematics. also we have other aims such as awareness of applications of calculus in mathematics and physics and to develop understanding of mathematics. moreover one of the goals of the course is learn to think creatively, be able to attack a problem you have not seen before, develop tools for that, develop a mathematical model for a given 'real life' situation.

11. Course objective:

1. Analyze vectors in space
2. Introduce basic ideas of parametric equations.
3. Define functions of several variables
4. Define limits and continuity to function of two variables
5. Generalize the techniques of single variable differential and integral calculus to two or three variables;

12. Student's obligation
- Attend and participate in lecture discussions
- Attend class prepared, ready to hand in homework and ready to work.
- Attend in exams

13. Forms of teaching

White board, Colorful markers, PowerPoint, data show.

14. Assessment scheme

Mid-course Exams 40%
Final exam 60%

15. Student learning outcome:

At the end of the course, all students will be able to do the following:

1. Find the angle between two vectors using the dot product
2. Find the cross product of two vectors in space
3. Write a set of parametric equations for a line in space
4. Find the distance between points, planes, and lines in space
5. Recognize and write equations for different surfaces
6. Sketch the graph and level curves of a function of two variables
7. Understand the limit, continuity, and differentiability of a function of two variables
8. Find partial derivative and higher-order partial derivatives of a function of two variables
9. Use the Chain Rule for functions of several variables
10. Find partial derivatives implicitly
11. Find and use directional derivatives and gradient of a function of two variables
12. Apply double integrals to represent the volume of a solid region and to find surface area

16. Course Reading List and References:

▪Key references:

1. Thomas A., Calculus with Diff. Equation.11ed, Addison Wesley Pub. Comp., 2010
2. Adams R. & Christopher E. , Calculus Several Variables. 7ed , Pearson Edu. Canada, 2010

▪Useful references:

1. David B, Calculus Demystified, McGraw-Hill Comp., 2007
2. Stewart J, Essential Calculus early transcendentals, Bob Pirtle pub. Canada, 2007
3. Staley I. Grossman , Calculus .5ed , Saunders College Pub., 1997
4. Kaplan W. , Advanced Calculus .5ed , Addison Wesley Pub. Comp., 2000
5. Any other textbook in calculus or advance calculus

17. The Topics:	Lecturer's name
Course book & Review	Week 1
Three-dimensional Coordinate Systems	Week 2
Length of the vector & vector Algebra	Week 3

Dot Product	Week 4
Vector projection & Cross Product.	Week 5
Plane Curve (Curves and Parametric Equations)	Week 6
Quadratic surface	Week 7
Function of two variables (Domain & range, graphs, level curves)	Week 8
Limits and Continuity in Higher Dimensions	Week 9
Partial Derivatives	Week 10
The Chain Rule	Week 11
Directional Derivatives and Gradient Vectors, Tangent Planes and Differentials	Week 12
Extreme Values and Saddle Points	Week 13
Implicit differentiation	Week 14

19. Examinations:

Q1/ if w $= e^{xyz}$, x $= 3u + v$, y $= 3u - v$ and z $= u^2v$, find $\frac{\partial w}{\partial u}$ and $\frac{\partial w}{\partial v}$ using chain rule.

Q2/ Find direction derivative and gradient if $f(x, y) = ln(1 + x^2 + y)$

Q3/ Sketch the graph of $r = 1 + 2cos\theta$, in polar coordinate.

Q4/ Find the distance and cosine between the vectors v=(1,-1,-2) and u=(-4,0,2), and prove that $cos\alpha^2 + cos\beta^2 + cos\gamma^2 = 1$.

20. Extra notes:

Here the lecturer shall write any note or comment that is not covered in this template and he/she wishes to enrich the course book with his/her valuable remarks.

21. Peer review

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