KING FAHD UNIVERSITY OF PETROLEUM & MINERALS

Department of Mathematics

Math 441 - Term 252

Course Syllabus

Course Information

Course Instructor: Dr. Adel Khalfallah

Office Location: Building 5, Room 201-5

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Textbook

Functions of Several Real Variables by M. Moskowitz and F. Paliogiannis, World Scientific, Singapore, 2011

Topics to be Covered

Real functions of several real variables: limit, continuity, differentiability. Taylor's theorem. Maxima and minima, Lagrange multipliers rule. Elementary notion of integration on R^N. Change of variables in multiple integrals, Fubini's theorem. Implicit and inverse function theorems. Convergence and divergence of improper integrals. Differentiation under the integral sign.

Course Objectives

This course is designed to provide a rigorous mathematical basis for the analysis of ***Functions of several variables***.

Student Learning Outcomes

After completion of the course, the students should be able to:

0. Recall basic geometry and topology of Euclidean space.
1. Discuss notion of limit of a function of several variables to state directional, partial and Frechet derivatives.
2. Discuss Inverse and Implicit function theorems.
3. Determine nature of critical points using Hessian matrix.
4. Apply method of Lagrange multipliers to extremum problems with constraints.

5. Use Fubini's theorem to compute multiple integrals.
6. Discuss convergence of improper integrals.

Grading Policy

Assessment	Weight
Homework	15%
Project	20 %
Midterm	30%
Final Exam	35%

Weekly Coverage of Course Material

Week	Sections	Material	Homework
1	1.1-1.3	The Euclidean space R^n	p.23: 1, 4
2	1.4-1.6	R^n as a metric space	p.42: 1, 3, 7, 9
3	2.1	Sequences and series in R^n	p.60: 1.8.14, 1.8.17
4	2.2-2.3	Functions on R^n	p.69: 2(c,e), 4, 7
5	2.4-2.5	Limit and Continuity	p.78: 3, 8, 9, 10, 11, 12
6	3.1-3.2	Linear transformations, Continuous Functions on compact sets	p.100: 8, 10, 13, 15
7	3.4	Differentiable Functions, Partial and directional derivatives	p.126-128: 6, 7, 10, 13, 20
8	3.5	The mean value theorem, Higher order derivatives	p.142: 11, 12, 13, 15
9	3.6-3.7	Taylor's theorem	p.158: 1, 3b
10	3.8	Minima, Maxima	p.175: 4, 20
11	3.9	The Inverse and Implicit Function Theorems	p.190: 1, 2, 15, 18
12	4.1	Lagrange multiplier-Applications	p.208: 2, 6, 16, 18
13	4.2-4.3	Integral in R^n, Integrals over bounded sets	p.259: 5, 6
14	5.1	Properties of multiple integrals, Fubini's theorem	p.278: 2, 4
15	5.2-5.3.1	Iterated integrals, Change of variables, Convergence and divergence of improper integrals, Differentiation under the integral sign	p.327: 9, 11