

King Fahd University of Petroleum & Minerals
Department of Mathematics

Math 441- Term 222

Course Syllabus

Course Instructor: Dr. Adel Khalfallah , B#5, 201-5, khelifa@kfupm.edu.sa

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 \mathbb{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”.

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

1. Recall basic geometry and topology of Euclidean space.
2. Discuss notion of limit of a function of several variables to state directional, partial and Frechet derivatives.
3. Discuss Inverse and Implicit function theorems.
4. Determine nature of critical points using Hessian matrix.
5. Apply method of Lagrange multipliers to extremum problems with constraints.
6. Use Fubini's theorem to compute multiple integrals.
7. Discuss convergence of improper integrals.

Grading Policy

HW	10%
Project	5%
Exam I	25%
Exam II	25%
Final	35%

Weekly Coverage of Course Material

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