

## Math.441-202

### Course Syllabus

**Course Instructor:** Dr. Adel Khalfallah

**Text Book.** “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

- Gain familiarity with functions of several variables
- Be able to understand and write proofs of theorems
- Apply the results to solve exercises, mostly theoretical in nature
- Prepare the students for higher level analysis courses

### Grading Policy

HW	20%
Project	10%
Midterm Exam	30%
Final Exam	40%

## Weekly Coverage of Course Material

Wk	Sections	Material	HW
1	1.1-1.3	The Euclidean space $\mathbb{R}^n$	p.23: 1, 4
2	1.4-1.5	$\mathbb{R}^n$ as a metric space. Sequences and series in $\mathbb{R}^n$	p.42: 1-9,14 p.60: 1.8.14, 1.8.17
3	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
4	2.4-2.5	Linear transformations Continuous Functions on compact sets	p.100: 8, 10, 13, 15
5	3.1 -3.2	Differentiable Functions. Partial and directional derivatives	p.126-128: 6, 7, 10, 13, 20
6	3.4	The mean value theorem	
7	3.5	Higher order derivatives	p.142: 11, 12, 13, 15
8	3.6 3.7	Taylor's theorem Minima, Maxima.	p.158: 1, 3b p: 175: 4, 20
9	3.8	The Inverse and Implicit Function Theorems.	p.190: 1, 2, 15, 18
10	3.9	Lagrange multiplier-Applications	p.208: 2, 6, 16, 18
11	4.1	Integral in $\mathbb{R}^n$ Integrals over bounded sets	p.259: 5, 6
12	4.2-4.3	Properties of multiple integrals. Iterated integrals- Fubini's theorem	p.278: 2, 4
13	5.1	Change of variables	p.327: 9, 11
14	5.2-5.3.1	Convergence and divergence of improper integrals -Differentiation under the integral sign	
15		REVIEWS	