King Fahd University of Petroleum & Minerals
Department of Mathematics and Statistics

Math.411-152

Course Syllabus

Course Instructor: Prof. Abdelkader Boucherif

Text Book. Functions of several variables by W. Fleming.

Recommended New Text: "Functions of Several Real Variables" by M. Moskowitz and F. Paliogiannis, World Scientific, Singapore, 2011

Topics to be Covered: Theory of sequences and series of functions. Real functions of several real variables: limit, continuity, differentiability. Taylor's theorem. Maxima and minima, Lagrange multipliers rule. Elementary notion of integration on $\boldsymbol{R}^N$. 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

Computer Usage: Computer software is not required in this course, however, the student is encouraged to use packages such as Maple, Mathematica, … etc.

Weekly Coverage of Course Material

Wk	Date	Material
1	1.1-1.3	The Euclidean space $\boldsymbol{R}^N$.
2	1.4-1.5	$\boldsymbol{R}^N$ as a metric space. Sequences and series in $\boldsymbol{R}^N$
3		Series in $\boldsymbol{R}^N$
4	2.1-2.2-2.3	Functions on $\boldsymbol{R}^N$. Limit and Continuity,
5	2.4-2.5	Linear transformations-Continuous Functions on compact sets
6	3.1	Differentiable Functions.
7	3.5	The mean value theorem. Taylor's Theorem.
8	3.6-3.7	Minima, Maxima.
9	3.8	The Inverse and Implicit Function Theorems.
10	3.9	Lagrange multiplier-Applications
11	4.1	Integral in $\boldsymbol{R}^N$ - Integrals over bounded sets
12	4.2-4.3	Properties of multiple integrals. Iterated integrals- Fubini's theorem
13	5.1	Change of variables
14	5.2-5.3.1	Convergence and divergence of improper integrals -Differentiation under the integral sign
15		REVIEWS