

King Fahd University of Petroleum & Minerals  
Department of Mathematical Sciences

MATH 411(101)

**Course Syllabus**

**Course Instructor:** Dr. Assane Lo

**Recommended Text:** “Function of Several Variables” by Wendell Fleming, 2<sup>nd</sup> Ed, Springer (1977)

**Main Topics to be Covered:** Theory of sequences and series of functions. Continuity and differentiability of functions of several variables. Partial derivatives. The Chain rule. Taylor's theorem. Maxima and minima. Integration of functions of several variables. Convergence and divergence of improper integrals. Derivative of functions defined by improper integrals.

**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.

**Course Evaluation Policy:**

Exam I 25% Exam II 25% Final Exam 35% Homework 15%

**Policy about Unexcused Absences:** KFUPM policy on unexcused absences will be followed.

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### Weekly Coverage of Course Material

Wk	Date	Material
1	Feb 12-16	Sequences and Series of Functions: Sequences and Series of numbers, Pointwise and Uniform Convergence of Sequences of Functions
2	Feb 19-23	Power series, the Euclidean space $\mathbf{R}^N$
3	Feb 26-Mar 02	The Euclidean space $\mathbf{R}^N$ (continued) Functions, Limit and Continuity, Sequences in $\mathbf{R}^N$
4	Mar 05-09	Bolzano-Weierstrass Theorem, Relative Neighborhood, continuous transformations
5	Mar 12-16	Directional and Partial Derivatives, Linear Functions, Differentiable Functions, Functions of class $C^{(q)}$
6	Mar 19-23	Minima, Maxima, and Taylor Formula
7	Mar 26-30	Taylor Formula (continued), Convex and Concave Function
8	Apr 02-06	The Inverse Function Theorem, The Implicit Function Theorem
9	Apr 16-20	The Implicit Function Theorem and applications
10	Apr 23-27	Integration of functions of several variables: Integrals over bounded sets, Iterated integrals
11	Apr 30-May 04	Integrals of Continuous Functions, Transformations of Integrals
12	May 07-11	Convergence and divergence of improper integrals, Differentiation under the integral sign
13	May 14-18	Differentiation under the integral sign (continued)
14	May 21-25	$L^p$ -Spaces
15	May 28-June 01	Catching up /or Review