

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

MATH 311

Course Description and Syllabus

**Course Instructor:** Prof. Abdelkader Boucherif

**Recommended Text:** Introduction to Real Analysis” by Robert G. Bartle & Donald R. Sherbert, 3rd Ed, Wiley (2000)

**Topics to be Covered:**

The real number system. Sequences and series of real numbers. Theory of sequences and series of functions.\* Real functions of one real variable: limit, continuity and differentiability. Fundamental theorems for functions defined on a compact real interval. The Riemann integral and the fundamental theorem of calculus. The first and second mean value theorems of integral calculus.\*

- **Course Objectives:** This course is designed to provide a rigorous mathematical basis for the analysis of “Functions of One Variable”. Theorems usually stated without proof in elementary calculus courses will be completely proved in this course.
- **Students Learning Outcome:** After completion of the course, the students should be able to:
  - Analyse a mathematical statement
  - Identify hypothesis and conclusion(s) from the statement of a mathematical result
  - Identify the set of mathematical results that lead to the proof of a statement
  - Compose the arguments leading to the proof of a mathematical statement
  - Acquire, whenever appropriate, a geometrical feeling of a statement
  - 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.

**\*: added in the new course description.**

### Weekly Coverage of Course Material

Wk		Material
1	2.1-2.2	The algebraic and order properties of the absolute value -The real line
2	2.4	Mathematical Induction- Applications of the Supremum property
3	3.1	Sequences and their limits
4	3.4-4.1	Subsequences and Bolzano-Weierstrass Theorem - Limits of functions
5	4.2- 5.1	Limit Theorems- Continuous functions
6	5.4	Continuous functions on a compact interval- intermediate value theorem-
7		Uniform continuity- Maximum and Minimum
8	5.6	Monotone and Inverse functions-Applications
9	6.1 6.2	The Derivative in $\mathbb{R}^1$ . Rolle's Theorem
10	6.4	The Mean Value Theorem -Taylor's Theorem
11	7.1	The Riemann Integral
12	7.2-7.3	Riemann integrable Functions The Fundamental Theorem of Calculus
13		First and Second mean value theorems of integral calculus
14	9.1-9.2	Theory of sequences and series of functions
15	9.3-9.4	Uniform Convergence