# Advanced Calculus I – Math 341 – Term 211

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| **Office Hours** | Online through: https://calendly.com/mshahrani/office-hour | **Website** | https://faculty.kfupm.edu.sa/math/mshahrani |

## Text:

**Introduction to Real Analysis** by Robert G. Bartle and Donald R. Sherbert, 4th Ed, Wiley (2011)

## Description:

- The real number system.
- Continuity, limits, uniform continuity and differentiability of functions of one variable.
- Definition, existence and properties of the Riemann integral.
- The fundamental theorem of calculus.
- Sequences and series of real numbers.

## Student Learning Outcomes:

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

- Analyze 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.

## Resources:

- Blackboard (Course Material)
- YouTube Playlist by Professor Francis Su of Harvey Mudd College. (https://goo.gl/grv7vS)
- YouTube Playlist by Prof. S.H. Kulkarni, Department of Mathematics, IIT Madras. (https://goo.gl/HyuhNc)

## Grading Policy:

- Midterm               30%
- Final (**Comprehensive**)   40%
- Homework           15%
- Term paper          15%

| GRADE | RANGE |
|---|---|
| A+ | [90%, 100%] |
| A | [80%, 90%) |
| B+ | [75%, 80%) |
| B | [70%, 75%) |
| C+ | [65%, 70%) |
| C | [55%, 65%) |
| D+ | [50%, 55%) |
| D | [45%, 50%) |
| F | [0%, 45%) |

## Evaluation:

Final grade is according to the scale

## Course Schedule:

| Week | Topic | Required Reading | |
|------|-------|-----------------|---|
| **0** | Chapter 1: PRELIMINARIES | Optional (but highly recommended) | |
| **1** | Algebraic and Order Properties of R | 2.1 | |
| | Absolute Value and the Real Line | 2.2 | |
| **2** | Completeness Property of R | 2.3 | **Reading Section 2.5 is optional. You may consider it for a term paper** |
| | Applications of the Supremum Property | 2.4 | |
| **3** | Sequences and Their Limits | 3.1 | |
| | Limit Theorems | 3.2 | |
| **4** | Monotone Sequences | 3.3 | **Thursday is National Day Holiday** |
| | Subsequences and the Bolzano-Weierstrass Theorem | 3.4 | |
| **5** | Cauchy Criterion | 3.5 | |
| | Properly Divergent Sequences | 3.6 | |
| **6** | Limits of Functions | 4.1 | |
| | Limit Theorems | 4.2 | |
| **7** | Continuous Functions | 5.1 | |
| | Combinations of Continuous Functions | 5.2 | |
| **8** | Continuous Functions on Intervals | 5.3 | **You may consider Section 5.5 for a term paper** |
| | Uniform Continuity | 5.4 | |
| **9** | Monotone and Inverse Functions | 5.6 | **Midterm** |
| | The Derivative | 6.1 | **Wednesday October 27th, 2021** **11:30AM – 12:45PM** |
| **10** | The Mean Value Theorem | 6.2 | **You may consider a term paper on the contributions of the Bernoulli Family to Mathematics** |
| | L'Hospital's Rules | 6.3 | |
| **11** | Taylor's Theorem | 6.4 | **You may consider a term paper on the contributions of Riemann** |
| | Riemann Integral | 7.1 | |
| **12** | Riemann Integrable Functions | 7.2 | |
| | **MIDTERM BREAK (28 Nov - 2 Dec 2021)** | | **You may consider a term paper on some topics of chapter 8** |
| **13** | The Fundamental Theorem | 7.3 | |
| **14** | Absolute Convergence | 9.1 | |
| | Tests for Absolute Convergence | 9.2 | |
| **15** | Tests for Nonabsolute Convergence | 9.3 | **You may consider a term paper on some topics of chapter 10** |
| | Series of Functions | 9.4 | |

<p style="text-align:center"><strong>FINAL EXAM – see the registrar website</strong></p>