King Fahd University of Petroleum and Minerals
Department of Mathematical Sciences
SYLLABUS
Semester I, 2020-2021 (201)
Prof. Monther R. Alfuraidan

Course #: Math 531
Title: Real Analysis
Textbook: Real Analysis by H.L. Royden and P.M. Fitzpatrick.
Additional Reading: Real and Abstract Analysis by E. Hewitt and K. Stromberg
Lecturer: **Name: Monther Alfuraidan** **Office:** Math 531 Microsoft Teams
E-mail: monther@kfupm.edu.sa (The best way to reach me)
Office hours: 1:20 – 2:00PM (MW) (Other times by appointment)

Objectives: The course is designed to introduce graduate students to measure theory. Stress will be particularly given to the Lebesgue measure, integration, and the classical L^p spaces.

Week	Date	Sec. #	Topics
1	Aug 30-Sep 03	2.1-2.2	Introduction, Lebesgue outer Measure
		2.3	The σ-Algrbra of Lebesgue Measurable sets
2	Sep 06-10	2.4	Outer and Inner Approximation of Lebesgue Measurable
		2.5	Countable Additivity, Continuity, and the Borel-Cantelli Lemma
3	Sep 13-17	3.1,3.2	Sums, Products, and Compositions Sequential Pointwise Limits and Simple Approximation
		3.3	Littlewood's Three Principles, Egoroffs Theorem, and Lusin's Theorem
4	Sep 20- 24	-----	Review and catch up
		Exam I	**Tuesday, Sep 22, 2020, Material (2.1-3.3)**
		4.1	The Riemann Integral
5	Sep 27-Oct 1	4.2	The Lebesgue Integral of a Bounded Measurable Function over a Set of Finite Measure
		4.3	The Lebesgue Integral of a Measurable Nonnegative Function
6	Oct 04-08	4.4	The General Lebesgue Integral
		4.5	Countable Additivity and Continuity of Integration
7	Oct 11-15	4.6	Uniform Integrability: The Vitali Convergence
		5.1	Uniform Integrability and Tightness: A General Vitali Convergence Theorem
8	Oct 18-22	5.2	Convergence in Measure
		5.3	Characterizations of Riemann and Lebesgue Integrability
9	Oct 25-29	------	**Review and catch up**
		Exam II	**Wednesday, Oct. 28, 2020, Material (4.1-5.3)**
10	Nov 01-05	6.1 6.2	Continuity of Monotone Functions Differentiability of Monotone Functions: Lebesgue's Theorem
		6.3 6.4	Functions of Bounded Variation: Jordan's Theorem Absolutely Continuous Functions
11	Nov 08-12	6.5	Integrating Derivatives: Differentiating Indefinite Integrals
		6.6	Convex Functions

12	Nov 15- 19	7.1 7.2	Normed Linear Spaces .... The Inequalities of Young, Holder, and Minkowski
		7.3	L^p is Complete: The Riesz-Fischer Theorem
13	Nov 22-26	----	Review and Catch up
			Tuesday, Nov. 24, 2020, Material (6.1-7.3)
		17.1	Measures and Measurable Sets
14	Nov 29- Dec 03	17.2	Signed Measures: The Hahn and Jordan Decompositions
		18.1	Measurable Functions
15	Dec 06- Dec 10	18.2	Integration of Nonnegative Measurable Functions
		-----	Review and Catch up
16	Dec 13 Dec 14		Normal Wednesday Classes Normal Thursday Class - Last day of classes for the term
Final Exam: TBA Material: Comprehensive			

Supplemental Instruction:
The students will find supplemental instruction material prepared by Prof Khamsi at:
http://www.drkhamsi.com/classe/RA/ This webpage contains many exercises which deal with the content of this course.

Outcomes:
It is expected that the student shall be able to know and use the concept of Lebesgue measure on real line, general measure theory, convergence theorems, Lusin's theorem, Egorov's theorem, L^p-spaces, Fubini's theorem, functions of bounded variation, absolutely continuous functions and Lebesgue differentiation theorem.

Evaluation Scheme:
Student will be evaluated and graded on the basis of:

- Three Major Exams (15 points each) 45%
- Homework I (Chapters 2 & 3) 7.5%
- Homework II (Chapters 4 & 5) 7.5%
- Homework III (Chapters 6 & 7) 7.5%
- Homework IV (Chapters 17 & 18) 7.5%
- Final Exam 25%

*** If it is needed, evaluation Scheme can be revised.