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King Fahd University of Petroleum and Minerals
Department of Mathematics and Statistics
Math 485: Wavelets and Applications (Term 151)

Policies relating to this course are governed by the College of Sciences.

General Information:

- **Instructor:** Mohameed El-Gebeily.
- **Office:** Building 5-325.
- **Extension #:** 3728.
- **Office Hours:** Sun Mon Thu from 10:00-11:00 am; also by appointment.
- **Email:** mgebeily@kfupm.edu.sa.

Textbooks:

1. *An Introduction to Wavelet Analysis* by David Walnut, Birkhauser Boston, 2002. (Official Textbook)
2. *Wavelet Methods for Elliptic Partial Differential Equations* by Urban Karesten, 2009. (Recommended)

Software: MATLAB is a must for this course.

Course Description: Wavelets. Wavelet transforms. Multiresolution Analysis. Discrete Wavelet transform. Fast wavelet transform. Wavelet decomposition and reconstruction. Applications such as boundary value problems, data compression, etc.
Prerequisite: Math 301 or EE 207 or SE 315

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

- understand the fundamental ideas of mathematical theory of wavelets
- display competency in computations and examples of wavelets
- work with the most commonly used wavelets
- use wavelets for solving scientific and engineering problems

Final Grade: Your final grade will depend on the following components with these proportions:

Homework	10%
Quizzes	15%
Exam 1	20%
Exam 2	20%
Final Exam	35%

DN Grade: In accordance with university rules, 9 unexcused absences will automatically result in a grade of DN.

1. All major exams are in class.

2. You will be required to submit/upload programs for your work
3. Homework problems are to be done individually (do not collaborate with your classmates)

Weekly Coverage of Course Material

Week	Date	Section	Topic
1	Aug 23-27	1.1 1.2	Functions Convergence of Sequences of Functions
2	Aug 30-Sep 3	2.1	The Haar System
Quiz # 1 (1.1, 1.2)			
3	Sep 06-10	2.2	Piecwise linear Systems
4	Sep 13-17	2.3 2.4	Similar properties Multiresolution analysis on the real line
Eid AlAdha vacation (Sep 18-28)			
5	Sep 29-Oct1	2.5 2.6	Daubechies orthonormal scaling functions B-splines
Quiz # 2 (2.1-2.4)			
6	Oct 04-08	2.7 2.8	Dual scaling functions associated to B-splines Multilevel projectors
Exam # 1 (1.1-2.6)			
7	Oct 11-15	2.9 2.10	Approximation properties Plotting scaling functions
8	Oct 18-22	5.1 5.2	Detail spaces Orthogonal wavelets
Quiz # 3 (2.7-2.9)			
9	Oct 25-29	5.3 5.4	Biorthogonal wavelets Fast Wavelet Transform (FWT)
10	Nov 01-05	5.5 5.6	Vanishing moments and compression Norm equivalences
Exam # 2 (2.7-5.4)			
11	Nov 08-12	5.7	Other kinds of wavelets
12	Nov 15-19		Application to Signal Processsing
Quiz # 4 (5.5, 5.6)			
13	Nov 22-26		Application to image Processing
14	Nov 29-Dec 03		Application to Differential Equations
15	Dec 06-10		Aplication to differential Equations