King Fahd University of Petroleum and Minerals
Department of Mathematics
SYLLABUS
Semester II: 2023-2024 **(232)**

Instructor: Dr. N. Tatar

Course: **MATH 667:** Advanced Partial Differential Equations II

Objectives: This course prepares students to be able to classify 1st order PDEs. Using the Lagrange method and the characteristics method, they should be able to solve some hyperbolic systems of PDEs. They will be also capable of applying these methods to problems arising in wave theory and gas dynamics. Finally, they will be exposed to some existence and uniqueness results and single/double layers (in potential theory).

Course Description: Classification of first order systems. Hyperbolic systems, method of characteristics. Applications to gas dynamics. Dispersive waves; application to water waves. Potential theory, single and double layers, existence theory for Dirichlet and Neumann problems.

Prerequisite: MATH568

Credit: 3 credit hours

References:
1- G. B. Whitham, Linear and Nonlinear Waves, John Wiley & Sons, Inc. New York, Chichester, Weinheim, Brisbane, Singapore, Toronto, 1999
2- H. K. Rhee, R. Aris and N. R. Amundson, First-order Partial Differential Equations Vol. I, Dover Publications, Inc. New York, 1986
3- Li Ta-tsien, Global Classical Solutions for Quasilinear Hyperbolic Systems, John Wiley & Sons, Inc. Chichester, New York, Brisbane, Toronto, Singapore, 1994
4- Handouts

Week		Topics	
1		Preliminaries: Multivariable calculus, ODEs	
2		Classification: 1st-order systems of PDEs	
3-4		Traffic flow, Transport problems, Formation of PDEs	
5		Cauchy problem and IVP, Solving PDEs	
6		Lagrange Method	
7-8		Characteristics Method for hyperbolic systems	
9		Burgers equation, Traffic flow	
10		Gas dynamics	
11-12		Existence theory for Dirichlet and Neumann problems	
13		Dispersive waves, water waves	
14-15		Potential theory: single and double layers	

Grading:

Midterm	25%
CW (HMW + Participation	35%
Final Exam	40%

Instructions:.

1. Students are required to strictly adhere to the university's attendance policy.
2. DN-Grade will be assigned to eligible students after their instructors have issued two warnings.

3. Students are prohibited from carrying mobile phones, smartwatches, or any electronic devices into the exam hall. Any breach of this rule will be treated as an attempted act of cheating.
4. Students must present their KFUPM, National/Iqama ID, or Driver's License Card to gain entry to the exam hall. No student will be allowed to take the exam without these forms of identification.

Missing an Exam: In case a student misses an exam (Exam I, Exam II, or the Final Exam) for a legitimate reason (such as medical emergencies), he/she must bring an official excuse from Students Affairs. Otherwise, he/she will get a score of zero in the missed exam.

Attendance: Students are expected to attend all classes.

If a student misses a class, he/she is responsible for any announcement made in that class.

After warned **twice** by the instructor, a DN grade will be awarded to any student who accumulates

9 unexcused absences. (20%)

15 excused and unexcused absences. (33.3%)

The Usage of Mobiles in Class: Students are not allowed to use mobiles for any purpose during class time. Students who want to use electronic devices to take notes must take permission from their instructor. Violations of these rules will result in a penalty decided by the instructor.

Academic Integrity: All KFUPM policies regarding ethics apply to this course.