

KING FAHD UNIVERSITY OF PETROLEUM AND MINERALS
Department of Mathematics and Statistics
Math. 465-01 Term 141 **Syllabus**

Instructor: Prof. Abdelkader Boucherif

Course No.: Math.465

Course Title: Ordinary Differential Equations : Introduction and Qualitative Theory

Textbook: The Qualitative Theory of Ordinary Differential Equations, An Introduction
by F. Brauer and J. A. Nohel, *Dover Publications, Inc. NY (1969)*

Reference: A First Course in the Qualitative Theory of Differential Equations,
by J. Hetao Liu. *Prentice Hall-Pearson Education, Inc. (2003)*

Course Description: Existence, uniqueness and continuation of solutions to initial value problems (scalar, 1st order systems and linear systems).

Linear systems: Solution matrix. Fundamental matrix. Variation of constants method. Phase space analysis.

Autonomous systems. Definitions of stability. Stability for linear and almost linear systems.

Basic concepts of Lyapunov's method for nonlinear systems.

Learning Outcomes: At the end of this course, students should be able to:

- Demonstrate the understanding of existence and uniqueness theory for initial value problems, asymptotic behavior of linear and almost linear systems and the theory of Lyapunov stability.
- Solve linear systems of differential equations, including higher order equations with constant coefficients.
- Find and classify critical points of autonomous systems.

Week	Section #	Topic
1-4	Chapter 1	Systems of Differential Equations
5-7	Chapter 2	Linear Systems with an Introduction to Phase Space Analysis
8-10	Chapter 3	Existence Theory
11-13	Chapter 4	Stability of Linear and Almost Linear Systems
14-15	Chapter 5	Lyapunov's Second Method