KINGDOOM OF SAUDI ARABIA
Ministry of Education
Al-Imam Mohammad Ibn Saud Islamic University
College of Sciences
Department of Mathematics & Statistics

المملكة العربية السعودية
وزارة التعليم
جامعة الإمام محمد بن سعود الإسلامية
كلية العلوم
قسم الرياضيات والإحصاء

SYLLABUS

Course Code	*Course Num.*	*Course Name*	*Credit Hours*	*Lec.*	*Lab.*	*Tut.*	*Private study*	*Pre-requisites*	*Course Level*	*Teaching Language*
MAT	**633**	**Ordinary Differential Equations**	**4**	**3**	**0**	**1**	**9**		**2^1-2^2**	**English**

A. Course Description

This course deals with the mathematical structure of differential equations rather than applications and mathematical modeling. Nevertheless, the course covers the rigorous, abstract theory of ordinary differential equations aiming at understanding mathematical models and make "real-world predictions" described by differential equations; it deals with the study well-posedness, existence of solution(s), and uniqueness. Next, once a model is well-posed, it is of interest to know how to find and/or compute its solution and to provide a straightforward way in the study of differential equations through a package of theorems like Picard–Lindelöf theorem, Cauchy-Peano Theorem, and Knesser Theorem.

B. Course Outcomes

At the end of this course the student will be able to*:*

1. Get a deep exposition of the theory of ordinary differential equations (ODEs) and systems and ODEs.
2. Master theoretical, analytical techniques, and their applications.
3. Prove existence, uniqueness, the stability, and behavior of ODEs and systems of ODEs.

C. References:

1. **P.F. Hasieh, Y. Sibuya**, Basic *Theory of Ordinary Differential Equations*. Universitext. *Springer-Verlag, New York*, 1999. (Main Reference)

Required Textbook

2. **L. Perko**, *Differential Equations and Dynamical Systems; Texts in Applied Mathematics*, vol. 7, Springer, 3rd Edition, 2001.
3. **M.W. Hirsch, S. Smale, and R.L. Devaney**, *Differential Equations, Dynamical Systems, and Introduction to Chaos*; Academic Press, Elsevier, 3rd Edition, 2013.
4. **F. Brauer, J. Nohel**, The Qualitative Theory of ODE, An Introduction, Dover Publications, 1989.

Course Website: Google Classroom Webpage:http://www.imamm.org/

D. Topics Outline

1. **Fundamentals of ODEs:** Existence of Local and Global Solutions, Dependence on Data, Maximal and Minimal Solutions, Comparison Theorem, Gronwall's Inequality, Sufficient Conditions for Uniqueness.
2. **Systems of Linear ODEs:** Solutions of Linear Systems with Constant Coefficients, Linear Systems with Periodic Coefficients, Floquet's Theory, Linear Hamiltonian Systems, Poincare's Map.
3. **Dynamical Systems:** Stability of Dynamical Systems, Lyapunov Functions, Stability of Linear and Perturbed Linear Systems, Lyapunov's Direct Method, Asymptotic Behavior and Stability, Stability of Periodic Orbits, Poincare-Bendixon Theorem

E. Office Hours

Office hours give students the opportunity to ask in-depth questions and to explore points of confusion or interest that cannot be fully addressed in class.

F. Exams & Grading System

The semi-official dates of the exams for this course are:

- **Midterm :** 8^{th} or 9^{th} week.
- **Quizzes & Homeworks:** During the semester.
- **Final Exam:** 16^{th} week.

Your course grade will be based on your semester work as follows:

Midterm : 30 %	**Final Exam:** 40 %
Quizzes, Homework, Attendance & Participation: 30 %	

The grading distribution:

A^+	A	B^+	B	C^+	C	F
[95, 100]	[90, 95)	[85, 90)	[80, 85)	[75, 80)	[70, 75)	[0, 70)

G. Student Attendance/Absence

Only three situations will be considered as possible excused absences:

- Occurrence of a birth or death in the immediate family will be excused. ("Immediate family" is defined by the University as spouse, grandparents, parents, brother, or sister).
- Severe illness in which a student is under the care of a doctor and physically unable to attend class will be excused. Students are not excused for a doctor's appointment. Do not make appointments that conflict with rehearsals. Notes from the University Health Center will be accepted.

Executive Rules for Study Regulations and Examsgoo.gl/ykm7t3

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