

College of Science
Department of Mathematics
Course syllabus: Ordinary Differential Equations 2
First semester 2019/2020

1. Instructor Information:

Instructor Name	Safwan Al-Shara'		
Office Hours	Tuesday	10:00 – 11:00	
		12:00 – 1:00	
	Monday, Wednesday	12:30 – 2:00	
Office Number and Telephone Extension	2201		
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2. Course Description:

Existence and uniqueness theory. Theory of systems of linear differential equations. Phase plane for autonomous linear systems and their critical points. Stability of solutions of linear and nonlinear systems.

3. Course Information:

Course number: 401403	Course Title: Ordinary Differential Equations 2	Level : Fourth year
Course Nature: Theoretical	Prerequisite: Real analysis 1 (401301) + Ordinary differential equations 1 (401203)	Lecture time: -
Academic year: 2019 – 2020	Semester: First	Credit Hours: 3

4. Course Objectives:

This course sheds light on the existence and uniqueness theorems of ODE's , use Frobenius method to find series solutions for some types of second order ODEs about regular singular points, Find series solutions for the Bessel differential equation, find the solutions for some types of linear systems with constant coefficients and the stability of some nonlinear DE's.

5. Intended Student Learning Outcomes:

- Students should be able to solve some types of linear ODE's.
- Students should be able to write a mathematical proof of the existence and uniqueness theorem. -Students should be able to find a series solution for some 2nd order ODE's about regular points using Frobenius method.
- Students should be able to find the solutions for some types of linear systems with constant coefficients.
- Students should be able to study the stability of the solution for some nonlinear ODE's.

6. Course Content:

Course Content	<i>Pages</i>	<i>Assignments</i>
Chapter 2 : First Order Differential Equations: ❖ 2.8 The Existence and Uniqueness theorem	105-115	All Odd Problems
Chapter 5 : Series Solutions of Second Order Linear Equations ❖ 5.1 Review of Power Series ❖ 5.2 Series Solutions near an Ordinary Point, Part I ❖ 5.3 Series Solutions near an Ordinary Point, Part II ❖ 5.4 Regular Singular Points ❖ 5.5 Euler Equations ❖ 5.6 Series Solutions near a Regular Singular Point, Part I ❖ 5.7 Series Solutions near a Regular Singular Point, Part II ❖ 5.8 Bessel's Equation	231-291	All Odd Problems

Chapter 7 : Systems Of First Order Linear Equations: <ul style="list-style-type: none"> ❖ 7.4 Basic Theory Of Systems of First Order Linear Equations ❖ 7.5 Homogeneous Linear Systems with Constant Coefficients ❖ 7.6 Complex Eigenvalues ❖ 7.7 Fundamental Matrices ❖ 7.8 Repeated Eigenvalues ❖ 7.9 Nonhomogeneous Linear Systems 	368-418	All Odd Problems
Chapter 9 : Nonlinear Differential Equations and Stability: <ul style="list-style-type: none"> ❖ 9.1 The Phase Plane: Linear Systems ❖ 9.2 Autonomous Systems and Stability ❖ 9.3 Almost Linear Systems 	459-491	All Odd Problems

7. Teaching and learning Strategies and Evaluation Methods

Learning Outcomes	Teaching Strategies	learning Strategies	Evaluation Methods
- Solve some types of linear (ODEs). Write a mathematical proof of the existence and uniqueness theorem. Use Frobenius method to find series solutions for some types of second order ODEs about regular singular points for the three cases (whenever the different between the two exponents is not an integer, zero, or an integer).	- Writing on the blackboard - Ask students questions and discuss them - Solve various issues	Give homework assignments	- Classroom presentations - Discussion - First exam
-Find series solutions for the Bessel differential equations, and determine the properties of the Bessel functions.	- Writing on the blackboard - Ask students questions and discuss them - Solve various issues	Give homework assignments	- Classroom presentations - Discussion - Second exam
-Find the solutions for some types of linear systems with constant coefficients. - Study the stability of the solution for some nonlinear ODE's.	- Writing on the blackboard - Ask students questions and discuss them - Solve various issues	Give homework assignments	- Classroom presentations - Discussion - Second exam

8. Assessment:

Assessment	Grade Proportion	Week/Dates
Class Work (Quizzes, Homework and Attendance of the lecture)	6 %	
First exam	22 %	
Second exam	22 %	
Final exam	50 %	End of Semester
Total	100 %	

9. Text Book:

The main reference	Elementary Differential Equations and Boundary Value Problems
Author(s)	William E. Boyce & Richard C. DiPrima
Publisher	JOHN WILEY & SONS, INC.
Year	2000
The edition	7 th edition
The reference website	www.wiley.com/college/Boyce

10. References and additional resources:

1)	Edwards C. H. , Elementary Differential Equations with Boundary Value Problems .
2)	Cambell S. L. , Introduction to Differential Equations with Boundary Value Problems
3)	Kreszing E. , Advanced Engineering Mathematics