
# Department of Mathematics

# College of Science

# University of Salahaddin

# Subject: Dynamical systems I

# Course Book: Third Year Mathematics

# Lecturer's name: Chiman M. Qadir

# Academic Year: 2022/2023 First session

# Course Book

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| **1. Course name** | **Dynamical systems I** |
| **2. Lecturer in charge** | Chiman M. Qadir |
| **3. Department/ College** | **College of Science- Department of Mathematics** |
| **4. Contact** | **e-mail: chiman.qadir@su.edu.krd**<br>**Tel: (optional)** |
| **5. Time (in hours) per week** | **Theory: 3 discussion: 0**<br>**Practical: 0** |
| **6. Office hours** | **Tuesday (10:00-12:00)** |
| **7. Course code** | |
| **8. Teacher's academic profile** | **Name:Chiman M.qadir**<br>Work Address: Mathematics Department, College of Science, Salahaddin University-Erbil.<br>**Employment**<br>October 2010– up to now: Mathematics Department, College of Science, Salahaddin University-Erbil<br>**Qualifications & background**<br>B. Sc., Salahaddin University-Erbil, College of Science, Mathematics Department, Iraq.<br>M. Sc., Salahaddin University -Erbil, College of Science, Mathematics Department, Iraq.<br>**General specialization:** Mathematics. **Specific specialization:** Differential Equations.<br>**Assignments**<br>2010-2022: Assistant Lecturer, Department of Mathematics, Salahaddin University -Erbil, Iraq. |
| **9. Keywords** | Dynamics, Systems of Differential equations, linear, autonomous, eigenvalue, eigenvector, Planar, autonomous system, phase portrait, node, spiral (focus), centre.,first integrals. |

**10. Course overview:** Dynamical systems describe the time evolution of systems which arise from physics, biology, chemsitry and other areas. As mathematical objects they are ordinary differential equations, usually nonlinear and therefore not usually able to be explicitly solved. The aim of the course is to see how to make a qualitative analysis of a dynamical system using many different analytic tools. Students should be able to analyze planar systems to understand their global dynamics and how these might change as parameters of the system are varied.

**11. Course objective:**

The module aims to introduce key methodological techniques illustrated by examples, working up from low dimensions to implications in higher dimensions. The course will feature a mixture of traditional lectures complemented by responseware walkthroughs of key selected examples.

**12. Student's obligation**

Class attendance is mandatory. Although I do not have a rigid policy, anyone who has missed lots of class and is doing poorly in the course should not expect much sympathy from me. If you do miss a class, it is your responsibility to make up the material and make sure your homework is turned in on time

## 13. Forms of teaching

Many tools will use during the lecture.

## 14. Assessment scheme

The academic year contain two obligatory exams with average 30% degree and 10% Quizzes. The other will be reserved for final exam .

## 15. Student learning outcome:

1)To introduce students to the basic mathematical skills for the qualitative solving of low dimensional systems of ordinary differential equations in continuous time, including dimensionless forms, phase portraits.

2)To provide a brief introduction to the way ordinary differential equations can be used to model, explain and interpret real world problems.

3)To provide a brief introduction to the theory and concepts that underpin the field of dynamical systems.

## 16. Course Reading List and References:

1) The Theory of Differential Equations, Second Edition. By Walter G. Kelley and Allan C. Peterson.
2) Theory of Ordinary Differential Equations, Existence, Uniqueness and stability. By Jishan Hu and Wei- Ping Li..
3) Ordinary Differential Equations. By D. K. Arrowsmith and C. M. Place.
4) Ordinary Differential Equations. By Otto Plaat.
5) An Introduction to Ordinary Differential Equations. By C. Earl A. Coddington.

| 17. The Topics: | Lecturer's name | NO. HOUER |
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| **1 Review of some concepts** 1<br>1.1 Revision of Eigenvalues and Eigenvectors<br>1.2 linear system of first order differential equations<br>1.3 Linear Dependence/Independence of vectors<br>1.4 general solution of homogeneous system<br>**2 Homogeneous Linear Systems with Constant Coefficients**<br>**2.1** Homogeneous Linear Systems with Constant Coefficients<br>2.1.1 Case 1: Real and distinct eigenvalues<br>2.2.2 Case 2: Complex eigenvalues<br>2.2.3 Case 3: Repeated eigenvalues<br>2.2 Non-homogeneous Linear Systems<br>3-First integrals. | | |

| **18. Practical Topics (If there is any)** | |
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| In this section The lecturer shall write titles of all practical topics he/she is going to give during the term. This also includeS a brief description of the objectives of each topic, date and time of the lecture | Lecturer's name<br>ex: (3-4 hrs)<br><br>ex: |

## 19. Examinations:

***1. Compositional:*** In this type of exam the questions usually starts with Explain how, What are the reasons for…?, Why…?, How….?
With their typical answers
Examples should be provided

***2. True or false type of exams:***

In this type of exam a short sentence about a specific subject will be provided, and then students will comment on the trueness or falseness of this particular sentence. Examples should be provided

***3. Multiple choices:*** In this type of exam there will be a number of phrases next or below a statement, students will match the correct phrase. Examples should be provided.

## 20. Extra notes:

Here the lecturer shall write any note or comment that is not covered in this template and he/she wishes to enrich the course book with his/her valuable remarks.

## 21. Peer review