Department of Mathematics

College of Science

Salahaddin Univesity-Erbil

Subject: Linear Algebra

Module leader: Dr.Wuria Muhammad Ameen Hussein

Academic Year: 2022-2023 (Semester I)

Course Book

1. Course name	**Linear Algebra**
2. Lecturer in charge	**Dr.Wuria Muhammad Ameen**
3. Department/ College	**Mathematics/Science**
4. Contact	**e-mail: wuria.hussein@su.edu.krd** **Tel:**
5. Time (in hours) per week	**Theory: 3** **Practical: 2**
6. Office hours	
7. Course code	
8. Teacher's academic profile	**-Name: Wuria Muhammad Ameen Hussein** **- Place-Date of birth: Erbil-14/2/1971** **-Academic title: Lecturer** **-PhD in Mathematics at Plymouth University-United Kingdom in 2016** **-M.Sc. in Mathematics at Salahaddin University in 2002** **-B.Sc. in Mathematics at Salahaddin University in 1994 -** **General field: Mathematics** **-Specific field: Application of Algebraic Geometry** **-Job title and address: Lecturer in Mathematics Department/College of Science/Salahaddin University**
9. Keywords	**Vector, Matrix, Linear system of equations, Vector space.**

10. Course overview:

Linear algebra is a branch of mathematics. It deals fundamentally with linear combinations. In linear algebra, we study the theory of matrices, system of linear equations vector spaces and linear transformations. Linear algebra is also widely used in the fields of Science, and Engineering.

The aim of this course is to help students understand theory of matrices in order to use it in solving linear system of equations. Vector space is another topic of this course. Students will be provided with definitions and theoretical tools that are needed to understand various topics in linear algebra. We will supply the readers with some applications.

11. Course objective:

This course will cover the following topics:

- Matrix theory.
- System of linear equations.
- Vector space.
- Some applications.

12. Student's obligation

1. Students are required to attend each lecture on time, staying and listening until the end. Students can leave the class for a short time if necessary.
2. Students are not allowed to be out of attendance for more than 9 hours.
3. Any discussion among the students during the lectures is not allowed unless they get permission.

13. Forms of teaching

1. We use the slide visualiser if available, otherwise the white board.
2. Data show projector.

14. Assessment scheme

Students are required to get at least %50 in order to pass this module.
The marks are counted as follows:

1- %40 (%30 for theory+%10 for tutorial).
2- %60 for the final exam.
3- Students will take at least two exams to get the annual average; each exam will be out of %30. If students take three exams, we will count the best two for those who get more than 45. Otherwise, all three exams will be counted for the annual average.

15. Student learning outcome:

دوای ئەوەی قوتابی ئەم کۆرسە دەخوێنێت و بە سەرکەوتوویی تەواوی دەکات، بنچینەییەکی پتەو بە دەست دەهێنێت لەسەر matrix وچۆنیەتی بەکارهێنانی لە شیکارکردنی سیستەمی هاوکێشەی هێڵی.

ئەو کۆرسە دەست پێدەکات بە خوێندنی بابەتی پێکهاتەی جەبری و پێناسەی (vector) و خوێندنی تیۆری (matrix) و بەکارهێنانی لە بابەتی شیکارکردنی سیستەمی هاوکێشەی هێڵی. بابەتی (vector space) یەکێکە لە بابەتە هەرە گرنگەکانی ئەو کۆرسە. چەند جێبەجێکردنێک لەسەر بابەتە جیاوازەکانی ئەو کۆرسە لە کۆتایی دەخوێندرێت.

16. Course Reading List and References:

1. Kolman B. and Hill D. R., Elementary Linear Algebra with Applications (9th edition). Pearson, Prentice Hall, 2008.
2. Kuttler K., A first Course in Linear Algebra (An open text book). By Lyryx, 2017.
3. Lipschutz S.and Lipson M.L., Linear Algebra (Forth edition). Schaum's outline series. McGraw Hill companies. 2009.
4. Nicholson W. K., Linear Algebra with Applications (Third edition). PWS company, Boston, USA, 1990.

Syllabus of Linear Algebra

2022-2023 (Semester I)

Semester I

Chapter 0: Introduction (What is linear algebra)

Chapter 1: Algebraic structures and vectors

1.1 Algebraic structures

- Binary operation.
- Fields.

1.2 **Vectors**

- Magnitude and direction of vectors.
- Vector addition and scalar multiplication of vectors.
- Unit vector.

Chapter 2: Matrix Theory

2.1 Basic definitions

- Row and column vectors, square matrix, zero matrix.
- Main diagonal of matrix, trace of matrix, diagonal matrix, identity matrix, transpose of matrix.

2.2 Matrix operation

2.2.1 Addition of matrices

2.2.2 Multiplication of matrix by a scalar

2.2.3 Multiplication of matrices

2.3 Determinant of matrix

2.4 Invertible matrix: Singular and non-singular matrix.

2.5 Some types of matrices:

- Symmetric and skew symmetric matrix - Triangular matrix 2.6 Rank of matrix 2.7 Echelon form and reduced echelon form. Chapter 3: System of linear equations 3.1 Basic definitions - Homogeneous and non-homogeneous systems. - Augmented matrix - Consistent and inconsistent system of linear equations - Degenerate and non-degenerate linear equation. - Row elementary operations 3.2 Solving system of linear equations 3.2.1 Gaussian elimination method 3.2.2 Gauss-Jordan method - Finding the inverse of matrix 3.3 Homogeneous system of linear equations Chapter 4: Vector space 4.1 Basic definitions 4.2 Linear combination and span 4.3 Subspaces 4.4 Linear independence 4.5 Basis and dimension 4.6 Direct sums 4.7 Coordinates	

18. Practical Topics (If there is any)	

19. Examinations:

1. Compositional: In exams, the questions are usually started with: Prove that …, or solve the following system …, or find … .
For example: Prove that the sum of any two odd integers is even.

2. True or false type of questions:

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

20. Extra notes:

1. Students should work in groups.
2. Solving examples as much as he/she can.