Department of Mathematic

College of Basic Education

Salahaddin University

Subject: Linear Algebra

Course Book – *Second* Year – First semester

Lecturer's name: Payman A. Rashed

Academic Year: 2023-2024

Course Book

1. Course name	**Linear Algebra**
2. Lecturer in charge	**Payman A. Rashed**
3. Department/ College	**Mathematic Department / College of Basic Education**
4. Contact	**e-mail :** payman.rashed**@su.edu.krd**
5. Time (in hours) per week	**Theory: 3**
6. Office hours	
7. Course code	
8. Teacher's academic profile	Specialization Pure Mathematic /Algebraic graph theory Degrees & Certificates • B. Sc. in Mathematics, Mathematics Department - College of Science – Mosul University - Mosul in 1987. • M. Sc. in Mathematics. Mathematics Department - College of Science Salahaddin University - Erbil in 2002. • Ph. D. in Mathematics. Mathematics Department - College of Computer Sciences and Mathematics – University of Mosul in 2015.
9. Keywords	Vector spaces & Vector subspace, Linear independence and Linear dependence, Bases and Finite Dimensional Vector Spaces.

10. Course overview:

Linear algebra is a branch of mathematics. The concepts of linear algebra are extremely useful in physics, economics and social sciences, natural sciences, and engineering. Due to its broad range of applications, linear algebra is one of the most widely taught subjects in college-level mathematics (and increasingly in high school).

11. Course objective:

To learn important concept of linear algebra. The course unit aims to introduce the basic ideas and techniques of linear algebra for use in many other lecture courses. Linear algebra is an essential cornerstone of mathematics. Its powerful tools are applied in virtually every area of pure and applied mathematics. A strong foundation in linear algebra is essential for success in every mathematical endeavour. Throughout this course you will encounter many new theoretical ideas and a wide range of practical applications. Working with applications helps to solidify your theoretical understanding, strengthen your computational skill, and build your self-confidence.

12. Student's obligation

- **Questions on the exams**

will be drawn from homework, reading, and lectures. I also encourage you to ask questions and participate in class. 10% of your final grade will be based on class participation.

- **Homework**: A list of homework problems will be given on the course web

page every few weeks. Not all homework will be collected. Nonetheless, it is important for you to do all the homework to keep up with the material we are learning and to prepare for exams.

13. Forms of teaching

Using one of the following or may be using all of the following:

1. The lecture method.
2. Discussion method.
3. The method of exploration.

White board, notes of teacher

14. Assessment scheme

The assessment is divided up as follows:
1. 30% from two 2-hour class tests during the year;
2. 10% from example classes.

15. Student learning outcome:

After successfully completing the course the student will be able to apply concepts of Linear Algebra to solve a variety of practical problems also you will have a good understanding of the following topics and their applications:

- Vector spaces & Vector subspace.
  - Prove algebraic statements about vector addition, scalar multiplication, inner products, projections, norms, orthogonal vectors, linear independence, spanning sets, subspaces, bases, dimension and rank
  - Write the relationships between A (being invertible) , det A, AX = 0 having a solution, the rank of A and linear independence.

16. Course Reading List and References:

- **Key references**:

1. David A. Santos, Linear Algebra, 2008
2. K. R.Matthews, Elementary Linear Algebra, 2010

المصادر العربية:

د.جورج ضايف السبتي ،الجبر الخطي.

17. The Topics:

Chapter one:

1.1: Groups and fields

1.2: Vectors in plane and space (operations of vector)

1.3: Vector spaces

1.4: Vector subspace

1.5: Union and intersection of vector subspaces

1.6: Direct sum of subspaces

1.7: Linear independence and Linear dependence

1.8: Bases and Finite Dimensional Vector Spaces

Chapter two: Linear combination

2.1 Linear transformation
2.2 Kernal of transformation
2.3 Range, rank and nulity

Chapter three: Some Theorems with application/

3.1: Coordinates and Change of bases

3.2: Some Theorems with application

19. Examinations:

Q1// Is R^2 with addition and scalar multiplication defined as

$(x_1, y_1) + (x_2, y_2) = (x_1 + x_2, y_1 + y_2),\ r(x_1, y_1) = (r^2 x_1, r^2 y_1)$ vector space or not?

Q// Let $M = \{(x, y, z); x + y + z = 0\}$ and $N = \{(x, y, z); y + z = 0\}$ then answer each of the following:

1. Is $M \oplus N = R^3$? Explain your answer.
2. Find a basis and dimension of M.

Q/ Is x^2 linear combination of $\{1 + x,\ 2x^2\}$?

20. Extra notes:

Note About office Hours: I encourage you to come by my office if you have any questions, need help with homework problems, or would just like to talk about the material. I will be in my office during my office hours, but if you plan to come by it may help to send an email before to let me know to expect you. If you want to meet with me but cannot make it to office hours, email me and we can set up a mutually convenient time to meet.

21. Peer review