# Course Specification
## (Bachelor)

| | |
|---|---|
| Course Title: | **Linear Algebra** |
| Course Code: | **326 Math-3** |
| Program: | **BS in Computer and Network Engineering** |
| Department: | **Computer Science** |
| College: | **Computer Science and Information Technology** |
| Institution: | **Jazan University** |
| **Version:** | **2024** |
| **Last Revision Date:** | **9/2024** |

## Table of Contents

A. General information about the course: 3
1. Teaching mode (mark all that apply) 3
2. Contact Hours (based on the academic semester) 4
C. Course Content 5
D. Students Assessment Activities 6
1. References and Learning Resources 6
2. Required Facilities and equipment 7
F. Assessment of Course Quality 7
G. Specification Approval Data 7

## A. General information about the course:

### 1. Course Identification

| | |
|---|---|
| 1. Credit hours: | 3 |

2. Course type

| | | | | | |
|---|---|---|---|---|---|
| A. | University ☐ | College ☒ | Department☐ | Track☐ | Others☐ |
| B. | Required ☒ | Elective☐ | | | |

3. Level/year at which this course is offered: Level 6 / Year 3

4. Course general Description

**This course is designed to provide students with**

- **Vector spaces over a field**: Definition, Theorem and Examples of definition of vector space. Linear combinations of vectors and spanning set.
- **Subspaces**: Definition and examples, related theorem, Sum and direct sum of two subspaces, Intersection of two subspaces.
- **Linear independence and linear combination**: Definition and examples, Basis and Dimension of vector space, Dimension of vector spaces.
- **Spaces related to matrices**: Row Space, Column Space, Null Space, Rank and nullity.
- **Linear Transformations**: Definition and examples, and theorem of definition, Kernel and Range of Linear transformations.
- **Eigenvalues and Eigenvectors:** Definition and Examples, method of finding eigenvalues and eigenvectors.
- **Applications of Linear Algebra:** Some applications in computer science such as in computer graphics.

5. Pre-requirements for this course (if any): Math-106

6. Co- requirements for this course (if any): None

7. Course Main Objective(s):

After finishing the course, the student is expected to be familiar with::

- Knowing the basic topics of Linear Algebra such as Matrices, vectors.
- Knowing Spaces, Linear Transformations, Basis and Dimension.
- Knowing how to find Eigenvalues and Eigenvectors.

### 2. Teaching mode (mark all that apply)

| No | Mode of Instruction | Contact Hours | Percentage |
|---|---|---|---|
| 1. | Traditional classroom | 45 | 100% |
| 2. | E-learning | | |

| No | Mode of Instruction | Contact Hours | Percentage |
|---|---|---|---|
| 3. | Hybrid<br>• Traditional classroom<br>• E-learning | | |
| 4. | Distance learning | | |

## 3. Contact Hours (based on the academic semester)

| No | Activity | Contact Hours |
|---|---|---|
| 1. | Lectures | 42 |
| 2. | Laboratory/Studio | |
| 3. | Field | |
| 4. | Tutorial | 3 |
| 5. | Others (specify) | |
| | Total | 45 |

## B. Course Learning Outcomes (CLOs), Teaching Strategies and Assessment Methods

| Code | Course Learning Outcomes | Code of CLOs aligned with program | Teaching Strategies | Assessment Methods |
|---|---|---|---|---|
| 1.0 | Knowledge and understanding | | | |
| 1.1 | Distinguish mathematical concepts relevant to vector space, subspace, linear combination and span, linear independence, inner product, eigenvalue and eigenvector. | K1 | Lectures, Web based work, Classroom Discussion. | Written exam (Problem solve, MCQ, Proof, Short answer), Quizzes, Assignments. |
| 1.2 | Identify background science, features and structures of Mathematics problems in vector space, subspace. | K2 | Lectures, Web based work, Classroom Discussion. | Written exam (Problem solve, MCQ, Proof, Short answer), Quizzes, Assignments. |
| 1.3 | Explain notations and concepts required for the solution of linear combination and span, linear independence, inner product, eigenvalue and eigenvector. | K3 | Lectures, Web based work, Classroom Discussion. | Written exam (Problem solve, MCQ, Proof, Short answer), Quizzes, Assignments. |
| 2.0 | Skills | | | |

| Code | Course Learning Outcomes | Code of CLOs aligned with program | Teaching Strategies | Assessment Methods |
|---|---|---|---|---|
| 2.1 | Apply theoretical, computational or practical aspect relevant to vector space, subspace | S1 | Lectures, Web based work, Classroom Discussion. | Written exam (Problem solve, MCQ, Proof, Short answer), Quizzes, Assignments. |
| 2.2 | Compute numerical quantities for various parameters to approximate the solution in linear combination and span, linear independence, inner product, eigenvalue and eigenvector. | S2 | Lectures, Web based work, Classroom Discussion. | Written exam (Problem solve, MCQ, Proof, Short answer), Quizzes, Assignments. |
| 2.3 | Apply various mathematical rules, techniques and theorems in Application in vector space, subspace. | S3 | Lectures, Web based work, Classroom Discussion. | Written exam (Problem solve, MCQ, Proof, Short answer), Quizzes, Assignments. |
| 2.4 | Solve mathematical problem using critical thinking for Linear combination and span, linear independence, inner product, eigenvalue and eigenvector. | S4 | Lectures, Web based work, Classroom Discussion. | Written exam (Problem solve, MCQ, Proof, Short answer), Quizzes, Assignments. |
| 3.0 | Values, autonomy, and responsibility | | | |
| 3.1 | Cultivate a mathematical attitude and nurture the interest. | V1 | Lectures/Presentations Group Discussion | Assignments Discussion |
| 3.2 | Realize the importance of responsibilities through different modes of practice, competition and related activities. | V2 | Group work, problem solving, web based work | Assignments, Discussion |
| 3.3 | Inculcating values and ethics in thought, expression and deed. | V3 | Group work, problem solving, web based work | Assignments, Discussion |

## C. Course Content

| No | List of Topics | Contact Hours |
|---|---|---|

| | | |
|---|---|---|
| 1. | **Vector spaces over a field**: Definition, Theorem and Examples of definition of vector space. Linear combinations of vectors and spanning set. | 6 |
| 2. | **Subspaces**: Definition and examples, related theorem, Sum and direct sum of two subspaces, Intersection of two subspaces. | 6 |
| 3 | **Linear independence and linear combination**: Definition and examples, Basis and Dimension of vector space, Dimension of vector spaces. | 9 |
| 4 | **Spaces related to matrices**: Row Space, Column Space, Null Space, Rank and nullity. | 6 |
| 5 | **Linear Transformations**: Definition and examples, and theorem of definition, Kernel and Range of Linear transformations. | 6 |
| 6 | **Eigenvalues and Eigenvectors:** Definition and Examples, method of finding eigenvalues and eigenvectors. | 6 |
| 7 | **Applications of Linear Algebra:** Some applications in computer science such as in computer graphics. | 6 |
| Total | | 45 |

## D. Students Assessment Activities

| No | Assessment Activities * | Assessment timing (in week no) | Percentage of Total Assessment Score |
|---|---|---|---|
| 1. | Home Assignment and Quiz | 3 | 5% |
| 2. | Mid Exam 1 | 6 | 20% |
| 3. | Home Assignment and Quiz | 10 | 5% |
| 4 | Mid Exam 2 | 12 | 20% |
| 5 | Final Exam | 15 | 50% |

*Assessment Activities (i.e., Written test, oral test, oral presentation, group project, essay, etc.)

## E. Learning Resources and Facilities

### 1. References and Learning Resources

| | |
|---|---|
| Essential References | - Elementary Linear Algebra, H. Anton, John Wiley (2001).<br>- Elementary Linear Algebra, R. E. Larson and B. E. Edwards, Edition Heath 5th, D.H. and Company, (2004) |
| Supportive References | 2. List Essential References Materials (Journals, Reports, etc.)<br>-Theory and problems of Linear Algebra, S. Lipschutz, Schaum's Outline Series (2000)<br>1. - Linear Algebra and its Applications, David C. Lay, Addisson Wesley (2003). |
| Electronic Materials | Web sites dedicated to Linear Algebra available on the internet -YouTube. |
| Other Learning Materials | None |

## 2. Required Facilities and equipment

| Items | Resources |
|---|---|
| Facilities<br>(Classrooms, laboratories, exhibition rooms, simulation rooms, etc.) | Classroom equipped with projector, whiteboard, and sufficient seating arrangements. |
| Technology equipment<br>(Projector, Smart board, Software) | Power point presentations and other hand-outs posted on the course web site. |
| Other equipment<br>(depending on the nature of the specialty) | |

# F. Assessment of Course Quality

| Assessment Areas/Issues | Assessor | Assessment Methods |
|---|---|---|
| Effectiveness of teaching | Students, Peer and program leader | Indirect (Course Evaluation Survey)- Indirect peer evaluation |
| Effectiveness of students assessment | Students, Program assessment committee | Direct/ Indirect |
| Quality of learning resources | Students, Faculty members | Indirect |
| The extent to which CLOs have been achieved | Instructor | Direct/Indirect |
| Other | | |

Assessor (Students, Faculty, Program Leaders, Peer Reviewer, Others (specify)

Assessment Methods (Direct, Indirect)

# G. Specification Approval Data

| | |
|---|---|
| COUNCIL /COMMITTEE | **Board Of Mathematics Department** |
| REFERENCE NO. | **2417** |
| DATE | **29/03/1446 A. H.; 02/10/2024 A. D.** |