



Course Specification

— (Bachelor)

Course Title	Linear Algebra
Course Code:	Math 324
Program:	B.Sc. in Math
Department:	Mathematics
College:	Science
Institution:	Jazan University
Version:	2023
Last Revision Date:	2/2023

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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 8, Year 3

4. Course general Description

This course is designed to provide students with

- **Vector Spaces over a Field:** Definition, theorem and examples of vector space.
- **Linear Combination of Vectors and Spanning Set.**
- **Sub-Spaces:** Definition and theorem, examples of sub-space, subset generated by vector space, sub-space generated by subset from vector space, sum and direct sum of two subspaces, intersection of two subspaces.
- **Linear Independence and Correlation:** Definition and examples, basis and dimension of vector space, linear dependence.
- **Coordinate Matrices and Change of Basis.**
- **Inner Product Space:** Definition and examples, orthogonality, angle and distance between two vectors in inner product space.
- **Linear Transformations:** definition, examples and theorems on linear transformation, kernel and range of linear transformations, matrices of general linear transformations.
- **Eigen values,** Eigen vectors and diagonalization.

5. Pre-requirements for this course (if any): **Math 223**

6. Co- requirements for this course (if any):

7. Course Main Objective(s)

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

- Basic topics of linear algebra such as matrices and vectors
- Spaces, linear transformations, basis and dimension
- Methods for solving linear equations in n variables
- Methods of solving systems of linear equations and algebraic properties of matrices and determinants
- Methods to find eigenvalues and eigenvectors.

1. Teaching mode (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1.	Traditional classroom	33	100%
2.	E-learning		



No	Mode of Instruction	Contact Hours	Percentage
3.	Hybrid <ul style="list-style-type: none"> Traditional classroom E-learning 		
4.	Distance learning		

2. Contact Hours (based on the academic semester)

No	Activity	Contact Hours
1.	Lectures	33
2.	Laboratory/Studio	
3.	Field	
4.	Tutorial	
5.	Others (specify)	
	Total	33

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, true/false, Proof, Short answer), Quizzes, Assignments
1.2	Identify required notations and concepts of vector space, subspace, linear combination and span, linear independence, inner product, eigenvalue and eigenvector.	K2	Lectures, Web based work, Classroom discussion.	Written exam (Problem solve, MCQ, true/false, 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, linear combination and span, linear independence, inner product, eigenvalue and eigenvector.	S1	Lectures, problem solving, web based work, Classroom discussion.	Written exam (Problem solve, MCQ, true/false, Proof, Short answer), Quizzes, Assignments
2.2	Apply various math rules, techniques and theorems in vector space, subspace, linear combination and span, linear independence, inner product, eigenvalue and eigenvector.	S3	Lectures, problem solving, web based work, Classroom discussion.	Written exam (Problem solve, MCQ, true/false, Proof, Short answer), Quizzes, Assignments
2.3	Solve mathematical problem using critical thinking in vector space, subspace, linear combination and span, linear independence, inner product, eigenvalue and eigenvector.	S4	Lectures, problem solving, web based work, Classroom discussion.	Written exam (Problem solve, MCQ, true/false, Proof, Short answer), Quizzes, Assignments
3.0	Values, autonomy, and responsibility			
3.1	Realize the importance of responsibilities through different modes of practice, competition and related activities.	V2	Group work, problem solving, web based work	Assignments
3.2	Inculcating values and ethics in thought, expression and deed.	V3	Group work, problem solving, web based work	Assignments
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C. Course Content

No	List of Topics	Contact Hours
1.	Vector spaces over a field, Definition, Theorem and Examples	6
2.	Sub-spaces: Definition and Theorem, Examples of sub-space, subset generate vector space, sub-space generated by subset from vector space, Sum and direct sum of two subspaces- Intersection of two subspaces.	7
3.	Linear combinations of vectors and spanning set. Linear independence and dependence: Definition and examples, Basis and dimension of vector space, linear dependence. Coordinate matrices and Change of Basis	7
4.	Inner product space: Definition and examples, Orthogonality, Angle and Distance between two vectors in Inner product space	3
5.	Linear Transformations: definition and examples, and theorems, Kernel and Range of Linear transformations, Matrices of general Linear transformations	3
6.	Eigenvalues, Eigenvectors and diagonalization	7
Total		33

D. Students Assessment Activities

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
1.	Homework and Quiz	3	5
2.	First exam.	6	20
3.	Homework and Quiz	8	5
4.	Second exam.	10	20
5.	Final exam.	12	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). - Elementary Linear Algebra, R. E. Larson and B. E. Edwards, Edition Heath 5th, D.H. and Company, (2004)
Supportive References	-Theory and problems of Linear Algebra, S. Lipschutz, Schaum's Outline Series (2000) - Linear Algebra and its Applications, David C. Lay, Addison Wesley (2003).
Electronic Materials	- Web sites dedicated to Linear Algebra available on the internet





Other Learning Materials

2. Required Facilities and equipment

Items	Resources
facilities (Classrooms, laboratories, exhibition rooms, simulation rooms, etc.)	Classroom, Computer Lab.
Technology equipment (projector, smart board, software)	Data show; Smart Board, Mathematics software
Other equipment (depending on the nature of the specialty)	None

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.	2306
DATE	07/09/1444 A. H.; 29/03/2023 A. D.

