Course Specifications

Course Title:	**Linear Algebra (1)**
Course Code:	**23042243-4**
Program:	**Bachelor of Mathematics**
Department:	**Mathematics Department**
College:	**Jamoum University College**
Institution:	**Umm Al-Qura University**

Table of Contents

A. Course Identification

1. Credit hours: 4 hours
2. Course type **a.** University ☐ College ☐ Department ■ Others ☐ **b.** Required ■ Elective ☐
3. Level/year at which this course is offered: Third Level / Second Year
4. Pre-requisites for this course (if any)**:** Does not exist
5. Co-requisites for this course (if any)**:** Does not exist

6. Mode of Instruction (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	**Traditional classroom**	4 Hours / Week	100%
2	**Blended**	0	0%
3	**E-learning**	0	0%
4	**Correspondence**	0	0%
5	**Other**	0	0%

7. Actual Learning Hours (based on academic semester)

No	Activity	Learning Hours
Contact Hours		
1	**Lecture**	(4 hours) x (15 weeks)
2	**Laboratory/Studio**	0
3	**Tutorial**	(1 hour) x (15 weeks)
4	**Others** (specify)	0
	Total	75 hours
Other Learning Hours*		
1	**Study**	(1 hour) x (15 weeks)
2	**Assignments**	(1 hour) x (15 weeks)
3	**Library**	(1 hour) x (15 weeks)
4	**Projects/Research Essays/Theses**	(1 hour) x (15 weeks)
5	**Others** (specify)	0
	Total	60 hours

* The length of time that a learner takes to complete learning activities that lead to achievement of course learning outcomes, such as study time, homework assignments, projects, preparing presentations, library times

B. Course Objectives and Learning Outcomes

1. Course Description

Linear Algebra is an area of mathematics that deals with the properties and applications of vectors, matrices, and other related mathematical structures. Interestingly, these topics readily lend themselves to a very rigorous study of the underlying mathematical theory, as well as to a broadly applications-oriented study of concepts, methods and algorithms. This course will place roughly equal emphasis on theory and applications.

Main topics we will cover include linear systems and their solutions; linear transformations; matrix and vector algebra; vector spaces; determinants; eigenvalues and eigenvectors; and orthogonality. We will study a variety of interdisciplinary applications and related strategies throughout the course.

2. Course Main Objective

The first goal of the course is to teach students how to use linear algebra as a powerful tool for computation. The second goal is to show how these computations can be conceptualized in a geometric framework. The final goal is to give a gentle introduction to the theory of abstract vector spaces.

3. Course Learning Outcomes

	CLOs	Aligned PLOs
1	**Knowledge:**	
1.1	Identify systems of linear equations	
1.2	State Row reduction and echelon forms	
1.3	Describe the different matrix operations	
1.4	Memorize determinants and their properties	
1.5	Outline vector and sub-vector spaces and their properties	
1.6	Name bases and dimension of vector spaces	
2	**Skills :**	
2.1	Write a system of linear equations in matrix form	
2.2	Determine whether a system of linear equations is consistent or inconsistent.	
2.3	Perform matrix operations and solve matrix equations	
2.4	Calculate an eigenvalue and an eigenvector of a given matrix	
2.5	Determine whether a given matrix is diagonalizable, symmetric, or orthogonal	
3	**Competence:**	
3.1	Analyze quantitative data verbally, graphically, symbolically and numerically	
3.2	Communicate quantitative data verbally, graphically, symbolically and numerically	
3.3	Integrate appropriately technology into mathematical processes	
3.4	Generalize mathematical concepts in problem-solving through integration of new material and modeling	

C. Course Content

No	List of Topics	Contact Hours
1	Linear equations in linear algebra: systems of linear equations, consistent and inconsistent systems of linear equations, examples	8
2	Elementary row operations, row reduction and echelon forms: examples	8
3	Matrix Algebra: Matrix operations, Properties of matrix multiplication, the inverse of a matrix (invertible matrix theorem), elementary matrices, column space and null space of a matrix: examples	12
4	Determinants: Recursive definition of determinants, properties of determinants. Applications: Cramer's rule and volume.	8
5	Vector spaces: Definition, examples, substructures, and linear transformations of vector spaces examples	8
6	Linearly independence and basis of a vector space: examples	8
7	Eigen values and Eigenvectors of matrices , Orthogonality and least Squares	8
Total		60

D. Teaching and Assessment

1. Alignment of Course Learning Outcomes with Teaching Strategies and Assessment Methods

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
1.0	**Knowledge**		
1.1	Identify systems of linear equations	Lecture Tutorials	Exams (Quizzes, Midterm and Final). Written and possibly oral exam at the end of the course. In addition, compulsory work may be given during the course
1.2	State Row reduction and echelon forms	Lecture Tutorials	
1.3	Describe the different matrix operations	Lecture Tutorials	
1.4	Memorize determinants and their properties	Lecture Tutorials	
1.5	Outline vector and sub-vector spaces and their properties	Lecture Tutorials	
1.6	Name bases and dimension of vector spaces	Lecture Tutorials	
2.0	**Skills**		
2.1	Write a system of linear equations in matrix form	Lecture Individual or group work	Exams (Quizzes, Midterm and Final). Homework
2.2	Determine whether a system of linear equations is consistent or inconsistent.	Lecture Individual or group work	
2.3	Perform matrix operations and solve matrix equations	Lecture Individual or group work	
2.4	Calculate an eigenvalue and an eigenvector of a given matrix	Lecture Individual or group work	
2.5	Determine whether a given matrix is diagonalizable, symmetric, or orthogonal	Lecture Individual or group work	

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
3.0	**Competence**		
3.1	Analyze quantitative data verbally, graphically, symbolically and numerically	Lecture Individual or group work	Exams (Quizzes, Midterm and Final). Research Essays
3.2	Communicate quantitative data verbally, graphically, symbolically and numerically	Lecture Individual or group work	
3.3	Integrate appropriately technology into mathematical processes	Lecture Individual or group work	
3.4	Generalize mathematical concepts in problem-solving through integration of new material and modeling	Lecture Individual or group work	

2. Assessment Tasks for Students

#	Assessment task*	Week Due	Pentage of Total Assessment Score
1	Midterm 1	6th week	20%
2	Midterm 2	12th week	20%
3	Homework + reports + Quizzes	During semester	10%
4	Final exam	End of semester	50 %

***Assessment task** (i.e., written test, oral test, oral presentation, group project, essay, etc.)

E. Student Academic Counseling and Support

Arrangements for availability of faculty and teaching staff for individual student consultations and academic advice :

All faculty members are required to be in their offices outside teaching hours. Each member allocates at least 4 hours per week to give academic advice to students and to better explain the concepts seen during the lectures.

F. Learning Resources and Facilities

1.Learning Resources

Required Textbooks	Guide to Abstract Algebra by: Carol Whitehead, Edited by David Towers Edition 2nd Edition ISBN:9780333794470
Essential References Materials	Strang, Gilbert. Introduction to Linear Algebra. 5th ed. Wellesley, MA: Wellesley-Cambridge Press, February 2016. ISBN: 9780980232776
Electronic Materials	None
Other Learning Materials	None

2. Facilities Required

Item	Resources
Accommodation (Classrooms, laboratories, demonstration rooms/labs, etc.)	Large classrooms that can accommodate more than 30 students
Technology Resources (AV, data show, Smart Board, software, etc.)	Data Show, Smart Board
Other Resources (Specify, e.g. if specific laboratory equipment is required, list requirements or attach a list)	None

G. Course Quality Evaluation

Evaluation Areas/Issues	Evaluators	Evaluation Methods
Effectiveness of teaching and assessment	Students	Direct
Quality of learning resources	Students	Direct
Extent of achievement of course learning outcomes	Faculty Member	Direct

Evaluation areas (e.g., Effectiveness of teaching and assessment, Extent of achievement of course learning outcomes, Quality of learning resources, etc.)
Evaluators (Students, Faculty, Program Leaders, Peer Reviewer, Others (specify)
Assessment Methods (Direct, Indirect)

H. Specification Approval Data

Council / Committee	Council of the Mathematics Department
Reference No.	
Date	