اعتماد
NCAAA

VISION 2030
المملكة العربية السعودية
KINGDOM OF SAUDI ARABIA

هيئة تقويم التعليم والتدريب
Education & Training Evaluation Commission

Course Specifications

Course Title:	**Linear Algebra (2)**
Course Code:	**30113404-3**
Program:	**BSc. Mathematics 301100**
Department:	**Mathematics**
College:	**Al-Leith University College**
Institution:	**Umm Al Qura University**

Table of Contents

A. Course Identification

1. Credit hours:	3 hours	

2. Course type

a. University ☐ College ☐ Department ☑ Others ☐

b. Required ☑ Elective ☐

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

4. Pre-requisites for this course (if any)**:** Linear Algebra (1) 30112402-4

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**	3 hours weekly	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**	(3 hours)x(15 weeks)
2	**Laboratory/Studio**	
3	**Tutorial**	
4	**Others** (specify) Final exam, midterm exam, 4 quizzes	8 hours
	Total	53 hours
Other Learning Hours*		
1	**Study**	(2 hours)x(15 weeks)
2	**Assignments**	(2 hours)x(15 weeks)
3	**Library**	(2 hours)x(15 weeks)
4	**Projects/Research Essays/Theses**	5 hours
5	**Others** (specify)	
	Total	95 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: Ring of linear transformations of a vector space, invariant subspaces, Linear functional and duals and double duals, Elementary canonical forms, Rational canonical forms, Jordan canonical forms and Inner product spaces, Operators on inner product spaces, Bilinear forms.

2. Course Main Objective

Critically analyze and construct mathematical arguments that relate to the study of linear algebra and use computational techniques and algebraic skills essential for the study of canonical forms, orthogonality and diagonalization and operators on Inner Product Spaces.

3. Course Learning Outcomes

	CLOs	Aligned PLOs
1	**Knowledge:**	
1.1	Examine the main structures of operators	K2
1.2	Recognize the relationship between the null space and the range of a linear map and its adjoint	K1
1.3	State the basic properties of Inner Product spaces	K4
1.4	Outline bilinear forms and their properties	K1
2	**Skills :**	
2.1	Write summation and difference of squares of a quadratic form	S9
2.2	Apply properly the Cauchy-Schwarz Inequality	S5
2.3	Use correctly Gram–Schmidt Procedure	S4
2.4	Derive many important applications of inner product spaces outside of pure mathematics	S8
3	**Competence:**	
3.1	Analyze quantitative data verbally, graphically, symbolically and numerically	C2
3.2	Integrate appropriately technology into mathematical processes	C5
3.3	Generalize mathematical concepts in problem-solving through integration of new material and modeling	C4

C. Course Content

No	List of Topics	Contact Hours
1	Some revisions of vector space, bases, dimension and linearly independence. Ring of linear transformations of a vector space, invariant subspaces.	6
2	Elementary canonical forms	6
3	Rational canonical forms	9
4	Jordan canonical forms	6
5	Inner product spaces	6

6	Operators on inner product spaces	6
7	Bilinear forms	6
Total		45

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	Examine the main structures of operators	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	Recognize the relationship between the null space and the range of a linear map and its adjoint	Lecture Tutorials	
1.3	State the basic properties of Inner Product spaces	Lecture Tutorials	
1.4	Outline bilinear forms and their properties	Lecture Tutorials	
2.0	**Skills**		
2.1	Write summation and difference of squares of a quadratic form	Lecture	Exams (Quizzes, Midterm and Final). Homework
2.2	Apply properly the Cauchy-Schwarz Inequality	Individual or group work	
2.3	Use correctly Gram–Schmidt Procedure	Lecture	
2.4	Derive many important applications of inner product spaces outside of pure mathematics	Individual or group work	
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	Integrate appropriately technology into mathematical processes	Lecture Individual or group work	
3.3	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	Percentage of Total Assessment Score
1	Midterm Test (1)	7th week	20%
2	Homework + Reports + Quizzes		5%
3	Midterm Test 2)	12th week	20%
4	Homework + Reports + Quizzes		5%
5	Final Examination	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 :
-Each group of students is assigned to a particular faculty where he or she will provide academic advising
  during specific academic hours. Each staff will provide at least one session/week.
-There will be an academic advisor how will be a responsible for helping the student by doing the general
  supervision .
-The people in the library will support the students during the time of the course.

F. Learning Resources and Facilities

1.Learning Resources

Required Textbooks	Linear Algebra (2nd Edition) by Kenneth M Hoffman, Ray Kunze; Publisher: Pearson; 2 edition (April 25, 1971) Language: English ISBN-10: 0135367972 ISBN-13: 978-0135367971
Essential References Materials	Linear Algebra Done Right (Third Edition) Sheldon Axler ISBN 978-3-319-11079-0
Electronic Materials	ABSTRACT ALGEBRA ONLINE STUDY GUIDE (http://www.math.niu.edu/~beachy/abstract_algebra/study_guide/contents.html) https://en.wikipedia.org/wiki/Set_theory https://en.wikipedia.org/wiki/Algebraic_structure http://mathworld.wolfram.com/topics/LinearAlgebra.html
Other Learning Materials	-Mathematica -Magma -Gap -Matlab -Maple

2. Facilities Required

Item	Resources
Accommodation (Classrooms, laboratories, demonstration rooms/labs, etc.)	Lecture theatre which can accommodate 30 students for lectures and tutorials and Computer laboratory.
Technology Resources (AV, data show, Smart Board, software, etc.)	Data Show (projector)
Other Resources (Specify, e.g. if specific laboratory equipment is required, list requirements or attach a list)	

G. Course Quality Evaluation

Evaluation Areas/Issues	Evaluators	Evaluation Methods
Strategies for Obtaining Student Feedback on Effectiveness of Teaching	Program Instructor and Head of the Department.	student questionnaire feedback form
Strategies for Evaluation of Teaching	Students and Head of the Department.	staff questionnaire feedback form
Processes for Verifying Standards of Student Achievement.	Program Instructor and the committee responsible for quality check	Compare the standards of students achievements' with standards archived elsewhere (inside KSA or students from outside the kingdom) by checking the marking of a sample of some student work : tests, course work
Describe the planning arrangements for periodically reviewing course effectiveness and planning for improvement	Staff members of UQU and other staff members of the university.	Reviewing feedback on the quality of course report from staff members, other university' staffs.

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	
Reference No.	
Date	

Council / Committee	Council of the Mathematics Department	The mathematical sciences (college of applied sciences) and the mathematics (Al Leith university college) department's first meeting of the coordinative committee
Reference No.	4101050782	First meeting
Date	Sunday, 17 November 2019	Thursday, 17 October 2019

Department Head

Dr. Ali Hassani