Course Specifications

Course Title:	**Linear Algebra (2)**
Course Code:	**2304242-3**
Program:	**Bachelor of Mathematics**
Department:	**Mathematics Department**
College:	**Jamoum University College**
Institution:	**Umm Al-Qura University**

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A. Course Identification

1. Credit hours: 3
2. Course type **a.** University [ ] College [ ] Department [√] Others [ ] **b.** Required [√] Elective [ ]
3. Level/year at which this course is offered: Level sixth /Third year
4. Pre-requisites for this course (if any)**:** Linear Algebra (1)
5. Co-requisites for this course (if any)**:** N.A.

6. Mode of Instruction (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	**Traditional classroom**	3 hours weekly	100
2	**Blended**		
3	**E-learning**		
4	**Correspondence**		
5	**Other**		

7. Actual Learning Hours (based on academic semester)

No	Activity	Learning Hours
Contact Hours		
1	**Lecture**	30
2	**Laboratory/Studio**	
3	**Tutorial**	15
4	**Others** (specify)	
	Total	45
Other Learning Hours*		
1	**Study**	75
2	**Assignments**	10
3	**Library**	
4	**Projects/Research Essays/Theses**	20
5	**Others** (specify)	
	Total	105

* 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

The description of this course as follows:
1-Some revisions of vector space, bases, dimension and linearly independence.
2-Ring of linear transformations of a vector space, invariant subspaces.
3-Linear functional and duals and double duals.
4-Elementary canonical forms
5-Rational canonical forms, Jordan canonical forms and Inner product spaces
6-Operators on inner product spaces
7-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 systems of linear equations, matrix algebra, vector spaces, eigenvalues and eigenvectors, orthogonality and diagonalization.

3. Course Learning Outcomes

CLOs		Aligned PLOs
1	**Knowledge:**	
1.1	Interpret existence and uniqueness of solutions geometrically	
1.2	Basic properties of subspaces and vector spaces	
1.3	Understanding of Norms, Orthogonality, Orthogonal bases, Gram-Schmidt orthogonalization, orthogonal and orthonormal bases, the Gram-Schmidt orthogonalization process, orthogonal projections	
2	**Skills :**	
2.1	Ability to explain the ideas in their own words.	
2.2	How to apply the method when some practical problem is given?	
2.3	How to simplify problems and analyze phenomena?	
3	**Competence:**	
3.1	Execute a piece of independent research using mathematical techniques of Linear Algebra.	
3.2	Construct algebraic structures and evaluate in linear algebra	

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. Linear functional and duals and double duals.	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	- To revise vector space, bases, dimension and linearly independence. - To define Ring of linear transformations of a vector space, invariant subspaces. - To list and name Linear functional and duals and double duals. - To recognize Elementary canonical forms	Lectures, tutorials and exams **Brainstorming:** A Method of solving problems in which all members of a group suggest ideas and then discuss them.	Written Exams
1.2	-To describe Rational canonical forms, Jordan canonical forms and Inner product spaces -To describe Operators on inner product spaces -To Define Bilinear forms	Lectures, tutorials and exams	Written exams
2.0	**Skills**		
2.1	- To interpret vector space, bases, dimension and linearly independence. - To reconstruct Ring of linear transformations of a vector space, invariant subspaces. - To interpret and name Linear functional and duals and double duals. -To recognize Elementary canonical forms	Lectures and Tutorials	Mid-term exams
2.2	-To evaluate Rational canonical forms, Jordan canonical forms and Inner product spaces -To explain and develop Operators on inner product spaces -To interpret and evaluate Bilinear forms	Lectures and Tutorials and exams	Mid-term exams
3.0	**Competence**		
3.1	Demonstrate communication skills with the teacher and other students in the class.	Working together	Group study to do homework
3.2	Reading and solving basic facts of linear algebra structures.	Working together	Group study to do homework
3.3	Demonstrate an ability to build mathematical sense and establish linear algebraic structures.	An interview assignments where a specific time limit is given to the student	Students will be evaluated for different assignments by interview.

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 and Its Applications,(4th Edition) Publisher: Pearson; 4 edition (December 26, 2011) Language: English ISBN-10: 0321836146 ISBN-13: 978-0321836144 -Schaum's Outline of Linear Algebra, 5th Edition: 612 Solved Problems + 25 Videos (Schaum's Outlines) :Publisher: McGraw-Hill Education; 5 edition (December 11, 2012) Language: English ISBN-10: 0071794565 ISBN-13: 978-0071794565
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

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	