

SULTAN QABOOS UNIVERSITY COURSE OUTLINE PROGRAM: Bachelor of Science Mathematics

1. Course Code	MATH2202					
2. Course Title	Linear Algebra I					
3. Credits	Credits: 3					
	Workload: 9 hours (4 contact hours in clas	sroom and 5 hours self-study)				
4. Pre-requisite Course(s)	FPMT 0105/0109					
5. Co-requisite Course(s)						
6. Equivalent Course(s)						
7. Incompatible Course(s)	MATH3171					
8. Course Category	□University Requirement	□ University Elective				
	College Requirement	□College Elective				
	☑ Department Requirement □Department Elective					
	□ Specialization Requirement	□ Specialization Elective				
	Other (specify):					
9. Course Owner	College: Science	Department: Mathematics				
10. Course Type		□ Lecture/Lab				
	□Lecture/Seminar	Lecture/Studio				
	⊠ Lecture/Tutorial	Lecture/Lab/Tutorial or Seminar				
	□Tutorial	Laboratory (Practical)				
	Field or Work Placement					
	Seminar Internship					
	□Workshop	□Project				
11. Language of	English					

12. Course Description

This is an introductory course in linear algebra. The emphasis is on developing matrix techniques for solving systems of linear equations, introducing vector spaces and discussing various applications. The course covers the use and applications of matrices for the solution of systems of linear equations, determinants, vector spaces, linear transformations, eigenvalues and eigenvectors.

13. Teaching/Learning Strategies

1) Problem solving and Practice exercises

2) Lecture-Discussion method

3) Peer Tutoring

4) Cooperative Learning

5) Organize formative and summative assessments

6) Analyze students' work and provide feedback

14. Assessment Components and Weight [%]							
🖾 Quizzes	15%			□Other (specify):			
		🗵 Mini Project	10%				
\boxtimes In-term examination(s)	25%	⊠ Final examination	50%				
15. Grading Method							
\boxtimes A-F Scale \square Pass/Not passed							
16. Textbook(s) and Supplemental Material							
Textbook: David C. Lay, Steven R. Lay, and Judi J. McDonald, "Linear Algebra & Its Applications", 5th Edition Pearson							

17.	17. Matching Course Objectives with Program Outcomes and SQU Graduate Attributes						
	SQU Graduate Attributes						
A.	SQU graduates should be able to:	В.	SQU graduates possess	C.	SQU graduates should		
 1. 2. 3. 	apply the knowledge and skills relevant to the specialization communicate effectively and use information and communication technologies critically analyze complex	1. 2.	interpersonal communication skills and alignment with the culture of the international labor market to assist them in practical life and in living successfully skills and motivation for independent learning and engagement in lifelong		relish good citizenship qualities, be conscious of their national identity and be socially responsible, engage in community affairs, and		
	information and present it in simple clear manner	3. 4.	learning and research work ethics and positive values, and intellectual independence and autonomy teamwork skills and display potential leadership qualities		be mindful of contemporary issues.		

#	Intended Student Learning Outcome	Relevant Program Outcome(s)	Applicable
	/Course Learning Objective		Attribute(s)
1.	Use technology to analyze and solve problems during the course. Communicate problem solutions in writing, using correct mathematical terminology and good English. Justify your mathematical statements.	 The ability to identify, formulate and solve mathematical and/or statistical problems. The recognition of the need for self- improvement, and to seek more knowledge and skills in mathematics and/or statistics. 	A1, B2
2.	State the definitions and important theorems concerning matrices and determinants and apply them to the solution of systems of linear equations and to computer graphics	The ability to identify, formulate and solve mathematical and/or statistical problems.	A1
3.	Use the Gaussian elimination procedure to determine whether a given system of simultaneous linear equations is consistent, and if so to describe its general solutions.	The ability to identify, think critically and to engage in innovative applications of mathematics and statistics in diverse area.	A3
4.	Invert a matrix by Gaussian elimination method.	The ability to identify, formulate and solve mathematical and/or statistical problems.	A1
5.	Describe the logical interconnections between different characterizations of invertible matrices and apply them in problems.	The ability to identify, think critically and to engage in innovative applications of mathematics and statistics in diverse area	A3
6.	State the defining axioms of vector spaces and subspaces and determine if a set of objects does or does not fit these definitions.	The ability to identify, formulate and solve mathematical and/or statistical problems.	A3
7.	Describe the concepts of linear independence, span, basis and change of basis and apply these in solving problems.	The ability to identify, formulate and solve mathematical and/or statistical problems.	A1
8.	Describe the various spaces that arise naturally from a matrix (row, column and null spaces) and the numerical relationship between their dimensions and the rank of the matrix and be able to solve problems concerning them.	The ability to identify, formulate and solve mathematical and/or statistical problems.	A3
9.	Characterize a linear transformation including its kernel and range.	The ability to identify, formulate and solve mathematical and/or statistical problems.	A2, B1
10.	Find the eigenvalues and eigenvectors for a square matrix.	The ability to identify, formulate and solve mathematical and/or statistical problems.	B2
11.	Determine whether a matrix is diagonalizable or not.	The ability to identify, formulate and solve mathematical and/or statistical problems.	A1

Students Responsibilities

It is the student's responsibility to know and comply with all University Academic Regulations relevant to participation in this course. These regulations specifically include attendance requirements and students` academic code of conduct.

For attendance, it is the student's responsibility to be punctual and to attend all classes.

Students are expected to perform their work with honesty and avoid any academic misconduct, which is defined as the use of any dishonest or deceitful means to gain some academic advantage or benefit. This can take many forms, including but not limited to, the following: copying, plagiarism, collusion and forging documents. For full details, please refer to the Undergraduate Academic Regulations and to the Student Academic Misconduct Policy.

Additionally, this course requires that you:

- 1) Be responsible for getting help. If you have questions or problems with the work, ask your instructor either during lectures or during tutorials. Otherwise, you could communicate with your instructor by email to get help.
- 2) Attempt the suggested solved examples and do the suggested exercises. Because of time constraints, your instructor may not be able to discuss <u>all suggested</u> solved examples and/or suggested exercises.
- 3) Check Moodle regularly for course updates and announcements. To enroll yourself in the Moodle page of the course do the following steps:
- > On SQU webpage, choose "Online Services", then "E-Learning".
- Choose "E-Learning (Academic)", then login using your SQU username and password.
- ▶ From the available courses under "Science", "Mathematics", choose "Linear Algebra Fall 2022".
- The Enrolment key: m2202-section number (e.g. m2202-10, m2202-20, m2202-30)

COURSE INFORMATION							
Course Code		MATH2202	Course Title	Linear Algebra I			
Semester/ Year Day, Time, and Place		FALL2022	Section	Multi-Section			
Course ('oordinator	Dr. Haniffa Mohame	d Nasir				
Office Location		1069-1F	Office Hours	See Appendix A below			
Office To	el. Ext.	2257	Email	nasirh@squ.edu.om			
			Tentative				
			Schedule				
Week	Lecture/		Material to be co	overed	Assessment		
	Topic						
		Section 1.1: Systems of	f Linear Equation	IS			
	Section	Example: 1, 2, 3 (Norm	nal row reduction a	and back substitution).			
1	1.1	Exercise: 1, 3, 9, 11, 13	8, 15, 17, 18, 19, 2	1, 23-27			
11 Sen		Section 1.2: Row Redu	iction and Echelo	n forms			
11 bep	Section	Example: 2, 3, 4, 5, The	eorems 1 & 2				
	1.2	Exercise: 1, 3, 7, 9, 11	, 13, 15, 16, 17, 19	0, 21-31			
	Section	Section 1.3: Vector Eq	uations				
	1.3	Example: 1, 2, 3, 4, 5, 6	5				
2		Exercise: 1, 5, 7, 9, 11,	13, 15, 17, 19, 20	, 21, 23, 24, 25, 26, TAI*: 32			
18 Sep	Section	Section 1.4: The Matri	ix Equation Ax =	b			
10 bep	1.4	Example: 1, 2, 3, 4, 5, 7	Theorems 3, Theorem	rem 4 & 5 (with proofs)			
		Exercise: 1, 3, 5, 7, 9, 1	1, 13, 15, 17, 18,	19, 21, 22, 23-26, 29-36			
	Section	Section 1.5: Solution S	ets of Linear Sys	tems			
	1.5	Example: 1, 2, 3, Theorem					
3		Exercise: 1, 3, 5, 7, 11,	Exercise: 1, 3, 5, 7, 11, 13, 15, 17, 19, 21, 23-28, 29-38				
25 Sam	Section	Section 1.7: Linear Ind	lependence				
25 Sep	1.7	Example: 1, 2, 3, 4, 5, 6, Theorem 7, Theorems 8 & 9 (with proofs)					
		Exercise: 1, 3, 5, 7, 9, 1	1, 15, 17, 19, 21,	22, 27-30, 31, 32, 33-38, TAI:			
		Section 1.8: Introduction to Linear Transformations					
	a .:	Example: 1, 2, 3, 4, 5		nstor mations			
	Section	Exercise: 1, 3, 5, 7, 8, 9	0, 11, 13, 15, 17, 1	9, 20, 21, 22, 26, 30, 31,			
4	1.8	32-36	, , , , ,		Quiz 1		
02 Oct	Section	Section 1.9: The Matri	ix of a Linear Tra	ansformation	Sec. $1.1-1.4$		
02 000	1 0	Example: 1, 2, 3, 4, 5, 7	Theorem 10 (proof	f self-study), Theorems 11 & 12			
	1.7	(with proofs)					
		Exercise: 1, 3, 5, 7, 8, 1	0, 11, 13, 15, 17,	19, 21, 23, 24, 25, 27, 29-36			
	Section	Section 2.1: Matrix Op	erations				
_	2.1	Example: 1, 2, 3, 4, 7, 8	3, Theorems 1, 2	2 3			
5		Exercise: 2, 4, 5, 7, 9, 1	10, 12, 15, 17-19, 2	21, 23, 25, 27			
09 Oct	Section	Section 2.2: The Inverse of a Matrix					
	2.2	Theorem 7(sketch of p_1	(1)	orems 5 & 0 (with proois),			
		Exercise 1 3 5 7 9 1	0. 11. 13 14 16	19-24 31, 32, 35, 37			
	Section	Section 2.3: Character	rizations of Invert	tible Matrices			
_	2.3	Example: 1, 2, Theorem	ns 8 & 9 (sketch o	f proofs)			
6		Exercise: 1, 3, 5, 7, 11-	15, 17, 19-23, 28,	30-33, 35, 37, 38			
16 Oct	Section	Section 2.4: Partitione	d Matrices (<u>Self-</u>	study)			
	2.4	Example: 1, 3, Theorem	n 10				
		Exercise: 1, 3, 5, 7, 10					

*TAI: Think about it

7 23 Oct	Section 2.5 Section 4.1	Section 2.5: Matrix Factorizations Example: 1, 2 Exercise: 1, 3, 5, 9, 11 Section 4.1: Vector Spaces and Subspaces Example: 2, 4, 6, 7, 8, 9, 10, 11, 12, Theorem 1 Exercise: 1-18, 21- 24, 25, 27, 29	Quiz 2 In class Sec. 1.5-1.9
8 30 Oct	Section 4.2 Section 4.3	Section 4.2: Null & Column Spaces, Linear Transformations Example: 1, 2, 3, 4, 5, 6, 7, Theorem 2 (proof), Theorem 3 Exercise: 1, 3, 5, 7, 9, 11, 13, 15, 17, 19, 21, 23, 24, 25, 26, 31, 32, 33 Section 4.3: Linearly Independent Sets; Bases Example: 1, 2, 3, 4, 5, 6, 7, 8, 9 Theorems 4, Theorems 5 & 6 (proofs self-study) Exercise: 1, 3, 5, 7, 9, 11-13, 15, 19, 21, 22, 26, TAI: 29-35	
9 06 Nov	Section 4.4 Section 4.5	Section 4.4: Coordinate Systems Example: 1, 2, 4, 5, 6, 7, Theorem 7(proof), Theorem 8(proof self- study) Exercise: 1, 3, 5, 7, 9, 13, 14, 15, 16, 17, 27, 31,32 Section 4.5: The Dimension of a Vector Space Example: 1, 2, 3, 4, 5, Theorem 9 (proof self-study), Theorems 10, 11 & 12 (sketch of proofs) Exercise: 1, 3, 5, 7, 9, 11, 13, 15, 17, 19, 20, 21-24, 25, TAI: 29, 30	Midterm Exam 07/11/2022 6:15—7:15pm
10 13 Nov	Section 4.6 Section 4.7	Section 4.6: Rank Example: 1, 2, 3, Theorems 13(proof self-study) & Theorems 14, Theorem on page 253 (sketch of proofs) Exercise: 1, 3, 5, 7, 9, 11, 13, 15, 17, 18, 27, TAI: 29, 30 Section 4.7: Change of Basis Example: 1, 2 Exercise: 1, 2	
11 20 Nov	Section 3.1 Section 3.2	Section 3.1: Introduction to Determinants Example: 1, 2, 3, Theorems 1 & 2 Exercise: 1, 3, 5, 7, 9, 11, 13, 19, 21, 23, 25, 27, 31, 33-40 Section 3.2: Properties of Determinants Example: 1, 2, 3, 4, 5, Theorems 3, 4, 6, Theorem 5 (with proof) Exercise: 1, 3, 5, 7, 9, 13, 15, 17, 19, 21, 23, 25, 27, 28- 33, 35-42	
12 27 Nov	Section 3.3 Section 5.1	Section 3.3: Cramer's Rule, Volume, and Linear Transformations Example: 1, 2, 3, 4, Theorem 7 (proof), 8 & 9(sketch of proofs) Exercise: 1, 3, 5, 7, 9, 11, 13, 15, 18, 21, 23, 29, 30 Section 5.1: Eigenvectors and Eigenvalues Example: 1, 2, 3, 4, 5, Theorems 1 & 2 (proof) Exercise: 1, 3, 5, 7, 9, 11, 13, 15, 17, 19, 21, 23, 25, 26, 27	Quiz 3 4.1—4.4
13 04 Dec	Section 5.2 Section 5.5	Section 5.2: The Characteristic Equation Example: 1, 3, 4, Theorem 3, Theorem on page 293, Theorem4(proof) Exercise: 1, 3, 5, 7, 9, 11, 13, 15, 20, 21, 22, 24 Section 5.5: Complex Eigenvalues Example: 1, 2, 4, 5, 6 Exercise: 1, 3, 5, 7, 9, 11, 12	Mini Project Submission Deadline

		Section 5.3: Diagonalization	
	Section	Example: 1, 2, 3, 4, 5, Theorems 5 & 7, Theorem 6 (proof)	
14	5.3	Exercise: 1, 3, 5, 7, 9, 11, 13, 15, 17, 21-24, 27, 28, TAI: 31, 32	
		Section 5.4: Eigenvectors and Linear Transformations (Self-study)	
11 Dec	Section	Example: 1	
	5.4	Exercise: 1, 2	
15			
	-	Revision and Tutorials	Mini Project Presentations
18 Dec			1 resentations
	-		Final Exam
16 25 Dec		_	Date: 28.12.2022 Time: 11:30am
25 Dec			Time: 11.50am
17			
	_	-	
01 Jan			

APPENDIX A: INSTRUCTORS OF MULTIPLE SECTIONS							
Section	Instructor	Day, Time, and Place	Office Location and Extension	Email	Office Hours		
10 11 12	Dr. Asma Al Ghassani	SUN 1000-1150-D06 THU 1000-1150-D06 MON 1615-1805-D08	Office: 121/CETL Ext: 1415/1021	<u>ghassani@squ.edu.om</u>	SUN, THU 1300—1400		
20 21 22	Dr. Haniffa M. Nasir	TUE 1000-1150-D08 THU 0800-0950-D08 MON 1415-1605-D08	Office: 1069-1F Ext: 2257	nasirh@squ.edu.om	MON 1000—1100 TUE 0845—0945		
30 31 32	Dr. Amina Al-Sawaii	SUN 1200-1350-A12 TUE 1200-1350-A12 THU 1000-1150-D05	Office: 0081 Ext: 2240	sawaii@squ.edu.om	SUN 1000—1100 WED 1300—1400		

APPENDIX B: ADDITIONAL INFORMATION

1) Assessments dates are given in the tentative schedule table. You will be informed if there are any changes to this schedule. There will be **no make-up quizzes**. If you miss an assessment component (quiz, test or final exam) for a valid reason, you need to contact your instructor with proper documentation within one week from the assessment date. Those who missed an assessment with a valid documented reason will be assessed accordingly.

2) Final Exam is comprehensive.