هيئة تقويم التعليم والتدريب
Education & Training Evaluation Commission

اعتماد NCAAA T4 2020

Course Specifications

Course Title:	LINEAR ALGEBRA II
Course Code:	MATH 3280
Program:	BACHELOR OF SCIENCE IN MATHEMATICS
Department:	MATHEMATICS
College:	COLLEGE OF SCIENCE AND HUMANITIES AL-KHARJ
Institution:	PRINCE SATTAM BIN ABDUALZIZ UNIVERSITY

Table of Contents

A. Course Identification

1. Credit hours:	4(4,0,0)
2. Course type	
a.	University ☐ College ☐ Department ☒ Others ☐
b.	Required ☒ Elective ☐
3. Level/year at which this course is offered:	Level: 7
4. Pre-requisites for this course (if any)**:**	Math 2250
5. Co-requisites for this course (if any)**:**	None

6. Mode of Instruction (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	**Traditional classroom**	Weekly 4 hours	100%
2	**Blended**	None	0%
3	**E-learning**	None	0%
4	**Distance learning**	None	0%
5	**Other**	None	0%

7. Contact Hours (based on academic semester)

No	Activity	Contact Hours
1	**Lecture**	48
2	**Laboratory/Studio**	0
3	**Tutorial**	0
4	**Others** (specify) - Office Hours	60
	Total	108

B. Course Objectives and Learning Outcomes

1. Course Description

Vector Spaces: Vector space axioms – Subspace and Span – Linear Combination – Linear independence – Generators – Basis and Dimension – Coordinate and Change of Basis – Rank of a Matrix – Linear Transformations – Kernel and range – Isomorphism – Matrix of a Linear transformation – Similarity and change of basis – Trace – Determinants– Cofactor expansion – Eigenvalues and Eigenvectors – Diagonalization – Characteristic Polynomial – Cayley Hamilton theorem – Jordan canonical form I& II – Symmetric Matrices – Inner Product – Norm – orthogonal transformations –orthogonal basis – orthogonal Projections – Isometrics – Spectral theorem – Cauchy- Schwarz inequality – Angle between vectors – Gram–Schmidt processes – Applications of Linear Algebra: Graph Theory – Cryptography – Finding The Equation of a Curve Passing through a Point – Computer Graphics

2. Course Main Objective

1. What is the main purpose for this course?

The main purpose of the course is to make the students understand the concept of Vector Spaces, Linear Transformation and associated properties, theorems, proof and their applications

3. Course Learning Outcomes

CLOs		Aligned PLOs
1	**Knowledge and Understanding**	
1.1	Be familiar with concepts and associated theories of Linear Transformation	K1
1.2	Learn and reproduce Cayley Hamilton Theorem	K2
2	**Skills :**	
2.1	Able to apply Sylvester Law to find Rank and Nullity	S1, S2
2.2	Able to find Orthogonal basis using Gram-Schmidt process	S1

C. Course Content

No	List of Topics	Contact Hours
1	Review of basic concepts about Vector Spaces, Subspaces and Span, Linear Combination – Linear Independence	6
2	Basis and Dimension-	4
3	Linear Transformation – Kernel and Range – Isomorphism – Matrix of Linear Transformation- Change of Basis	3
4	Change of Basis-Determinants	3
5	Characteristic Polynomial-Eigen Values and Eigen Vectors	4
6	Diagonalization	3
7	Cayley Hamilton Theorem -Jordon Canonical Form	4
8	Inner Product – Orthogonal Transformation– Cauchy Schwarz Inequality- Angle between vectors	6
9	Orthogonal Basis, Orthogonal Projection, Isometrics	4
10	Gram–Schmidt processes.	4
11	Spectral Theorem	4
12	Applications of Linear Algebra to Graph Theory, Cryptography, Equation of Curve passing through a point, computer graphics	3
Total		48

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 and Understanding**		
1.1	Be familiar with concepts and associated theories of Linear Transformation	1. Class Room Lectures 2. Interactive sessions 3. Exclusive Office Hours for clearing doubts	1. Two Internal Exams 2. At least two Quiz 3. End Semester
1.2	Learn and reproduce Cayley Hamilton		

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
	Theorem	in small groups	Exam
2.0	**Skills**		
2.1	Able to apply Sylvester Law to find Rank and Nullity	1. Class Room Lectures 2. Interactive sessions 3. Exclusive Office Hours for clearing doubts in small groups	1. Two Internal Exams 2. At least two Quiz 3. End Semester Exam
2.2	Able to find Orthogonal basis using Gram-Schmidt process		

2. Assessment Tasks for Students

#	Assessment task*	Week Due	Percentage of Total Assessment Score
1	Mid Term Exam I	6	20%
2	Quiz	4 & 10	5%
3	Mid Term Exam II	13	20%
4	Continuous Assessment – Homework, Assignment, Attendance etc.	--	5%
5	End Semester Exam	15	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 :

1. Exclusive Office Hours – 5 Hours per week
2. Academic Advising for Students – 1 Hour per week

F. Learning Resources and Facilities

1.Learning Resources

Required Textbooks	1. Howard Anton., Chris Rorres, "Elementary Linear Algebra with Applications version", 7th ed. GOHN WILEY & SONS, INC. , (2003). 2. Bretscher O., "Linear Algebra with Applications", 3rd ed. Upper Saddle River, NJ: Prentice Hall, (2004), ISBN: 0131453343 3. Strang Gilbert. "Introduction to Linear Algebra", 3rd ed. Wellesley, MA: Wellesley- Cambridge Press, March (2003), ISBN: 0961408898. 4. Shaum's outline series : Linear Algebra
Essential References Materials	NIL
Electronic Materials	Paul's Online Series.
Other Learning Materials	Lecture Notes Prepared by the Department of Mathematics

2. Facilities Required

Item	Resources

Item	Resources
Accommodation (Classrooms, laboratories, demonstration rooms/labs, etc.)	Classrooms with Smart boards with seating facilities for at least 30 students
Technology Resources (AV, data show, Smart Board, software, etc.)	Smart board, Internet Connection for Blackboard
Other Resources (Specify, e.g. if specific laboratory equipment is required, list requirements or attach a list)	NIL

G. Course Quality Evaluation

Evaluation Areas/Issues	Evaluators	Evaluation Methods
Strategies for Obtaining Student Feedback on Effectiveness of Teaching	1. Course Evaluation done by Quality Assurance Committee of the Department to get the feedback of students 2. Peer Review by Senior Faculty Members / HoD to assess the effectiveness of Classroom teaching strategies from students through interactions 3. End Semester online survey by the University from students	
Processes for Improvement of Teaching:	1. Orientation program organized by the College / University to faculty members at the beginning of academic year 2. Periodic workshops organized by the Quality Wing of College / University 3. Based on review report of Peer Review Committee, advice being given by HoD.	
Processes for Verifying Standards of Student Achievement	1. Moderation of Question papers by a committee of faculty members 2. Moderation of Answer sheets by a three faculty members	
Describe the planning arrangements for periodically reviewing course effectiveness and planning for improvement	1. The course report submitted by the faculty member / course coordinator is reviewed by the quality assurance committee and suggestion for improvement given by the coordinator is considered on need basis by the departmental council	

Evaluation Areas/Issues	Evaluators	Evaluation Methods
	2. Curriculum review committee reviews the content periodically to ensure that the course content matches national and international standards there by ensuring better program delivery	
Strategies for Obtaining Student Feedback on Effectiveness of Teaching	4. Course Evaluation done by Quality Assurance Committee of the Department to get the feedback of students 5. Peer Review by Senior Faculty Members / HoD to assess the effectiveness of Classroom teaching strategies from students through interactions 6. End Semester online survey by the University from students	

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	