QF01/0408-4.0E	Course Plan for Bachelor program - Study Plan Development and Updating Procedures/ Mathematics Department

Study plan No.	**2021/2022**		**University Specialization**		**Bachelor of Mathematics**	
Course No.	**0101221**		**Course name**		**Linear Algebra (1)**	
Credit Hours	**3**		**Prerequisite/ Co-requisite**		……..	
Course type	☐ MANDATORY UNIVERSITY REQUIREMENT	☐ UNIVERSITY ELECTIVE REQUIREMENTS	✓ **FACULTY MANDATORY REQUIREMENT**	☐ Support course family requirements	☐ Mandatory requirements	☐ Elective requirements
Teaching style	☐ Full online learning		☐ Blended learning		✓ **Traditional learning**	
Teaching model	☐ 1 Synchronous: 1 asynchronous		☐ 1 face to face : 1 asynchronous		✓ **2 Traditional**	

Faculty member and study divisions' information (to be filled in each semester by the subject instructor)

Name	Academic rank	Office No.	Phone No.	E-mail	
Division number	**Time**	**Place**	**Number of students**	**Teaching style**	**Approved model**

Brief description

Matrices and operations on matrices, Determinants, Inverse of matrix using adjoint, matrices form of linear systems and solving linear systems, Eigenvalues and eigenvectors, Characteristic polynomial, Vectors in 2-space or 3-space, Dot product, Cross product, Vector space, Subspaces, Linearly independence, Basis and dimension, Linear transformations from $\Re^n$ to $\Re^m$.

Learning resources

Course book information (Title, author, date of issue, publisher ... etc)	Elementary Linear Algebra by Howard Anton, 8th Edition. Publisher: John Wiley and Sons			
Supportive learning resources (Books, databases, periodicals, software, applications, others)	1- Linear Algebra and its Applications; David C. Lay; Addison-Wesley; 2006 2- Elementary Linear Algebra; B. Kolman & D. Hill; Prentice-Hall; 2004 3- Linear Algebra with Applications; Steven J. Leon; Prentice-Hall; 2006 4- Linear Algebra; An introduction. Larson; 2006.			
Supporting websites	1- https://en.wikipedia.org/wiki/Linear_algebra 2- http://ocw.mit.edu/courses/mathematics/18-06-linear-algebra-spring-2010/ 3- http://ocw.mit.edu/courses/mathematics/18-06-linear-algebra-spring-2010/video-lectures/			
The physical environment for teaching	✓ **Class room**	☐ labs	☐ Virtual educational platform	☐ Others
Necessary equipment and software				
Supporting people with special needs				

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For technical support	

Course learning outcomes (S= *Skills, C= Competences K= Knowledge,)*

No.	Course learning outcomes	The associated program learning output code
	Knowledge	
K1	Recognize methods to solve a system of linear equations.	MK1
K2	Describe the adjoint of a matrix to find its inverse.	MK2
K3	Memorize the properties of determinants.	MK2
K4	Define the notion of vector spaces and subspaces.	MK1
K5	Define the notion of bases and dimension of vector spaces	MK2
	Skills	
S1	Evaluate the determinant of a matrix.	MS1
S2	Use Cramer's Rule to solve a system of linear equations.	MS2
S3	Analyze whether a set S of vectors in a vector space V is a spanning set of V.	MS4
S4	Analyze whether a finite set of vectors in a vector space V is linearly independent.	MS4
	Competences	
C1	Work independently to solve assignments in the course.	MC1
C2	Develop the individual's ability to communicate and interact with other mathematical courses	MC2

Mechanisms for direct evaluation of learning outcomes

Type of assessment / learning style	Fully electronic learning	Blended learning	Traditional Learning (Theory Learning)	Traditional Learning (Practical Learning)
First/Second exam	30%	30%	**30%**	30%
Participation / practical applications	0	0	**20%**	30%
Asynchronous interactive activities	30%	30%	**0**	0
Final exam	40%	40%	**50%**	40%

Schedule of simultaneous / face-to-face encounters and their topics

Week	Subject	learning style	Reference
1	Introduction to systems of linear equations Gaussian elimination Homogeneous systems	Lecture	2 – 5 8 – 16 16 – 19
2	Matrices Matrix operations Rules of matrix arithmetic	Lecture	23 – 25 25 – 33 37 – 41
3	Inverses Elementary matrices Method for finding A^{-1}	Lecture	41 – 47 50 – 53 54 – 56

4	Further results on systems of equations and invertibility Diagonal and triangular matrices Symmetric matrices	Lecture	59 – 61 66 – 69 69 – 71
5	The determinant function Evaluating determinants by row reduction Evaluating determinants by column reduction	Lecture	82 – 87 89 – 93 93 – 94
6	Properties of the determinant function Determinant of a matrix product Determinant test for invertibility	Lecture	95 – 96 97 – 101
7	Minors and cofactors Cofactor Expansion Adjoint of a matrix	Lecture	104 – 105 105 – 107 107 – 109
8	Inverse of a matrix using its adjoint Cramer's rule Applications of determinants **Midterm Exam**	Lecture	109 -110 111 – 112 112 – 114
9	Vectors in 2-Space, 3-Space, and n-Space Norm, Dot Product, and Distance in R^n Cross Product	Lecture	131-142 142-155 163-170
10	Real Vector Spaces Euclidean n-space Some properties of vectors. Subspaces Solution spaces of homogeneous systems	Lecture	172-182 211 – 214 214 – 215 215 – 217
11	Linear combination Spanning sets. Linear independence Linear independence of functions	Lecture	217 – 219 221 – 222 227 – 228
12	Basis and dimension Coordinates relative to a basis Some fundamental theorems	Lecture	231 – 233 233 – 237 237 – 242
13	Eigenvalues Eigenvectors	Lecture	338 – 340 340 – 341
14	General linear transformations	Lecture	173 – 185
15	Properties of linear transformations. Review	Lecture	189 – 194
16	**Final Exam**		