Universitas Brawijaya	
Faculty of Mathematics and Natural Sciences	
Department of Statistics / Bachelor Statistics Study Programme	

Module Handbook

Module Name:	Matrix and Vector Spaces (MAS62113)
Module Level:	Bachelor
Abbreviation, if applicable:	-
Sub-heading, if applicable:	-
Courses included in the module, if applicable:	-
Semester/term:	2nd / First Year
Module Coordinator(s):	Luthfatul Amaliana, S.Si., M.Si
Lecturer(s):	1. Dr. Ir. Bernadetha Theresia Mitakda
	2. Luthfatul Amaliana, S.Si., M.Si.
	3. Dr. Suci Astutik, M.Si.
	4. Nur Silviyah Rahmi, S.Si., M.Stat
Language:	Indonesian
Classification within the curriculum:	Compulsory course
Teaching format / class per week during semester:	3×50 minutes
Workload:	2.5 hours lectures, 3 hours structural activities, 3 hours individual studies, 16 weeks per semester, and total 136 hours per semester 4.5 ECTS
Credit Points:	3
Requirements:	Mathematics (MAS61111)
Learning goals / competencies:	**General Competence (Knowledge):**

ILO1	The students are able to master basic scientific concepts and statistical analysis methods applied on computing, social science, humanities, economics, industry and life science.
ILO5	The students are able to apply logical, critical, systematic, and innovative thinking independently when applied to science and technology that contain humanities values, based on scientific principles, procedures and ethics with excellent and measurable results.
ILO6	The students are able to take appropriate decisions to solve the problems expertly, based on the information and data analysis.

	ILO8	The students are able to apply and internalize the spirit of independence, struggle, entrepreneurship, based on values, norms, and academic ethics of Pancasila in all aspects of life.
	Specific Competence:	
	M1	Students are able to explain the concept of Linear Equation System (LES) and can find the solutions. (ILO1, ILO5, ILO6, ILO8)
	M2	Students are able to explain the concept of matrix. (ILO1, ILO5, ILO6, ILO8)
	M3	Students are able to explain the determinant and inverse matrix. (ILO1, ILO5, ILO6, ILO8)
	M4	Students are able to explain vectors in Space-2 and Space-3. (ILO1, ILO5, ILO6, ILO8)
	M5	Students are able to explain the concept of Vector Spaces. (ILO1, ILO5, ILO6, ILO8)
	M6	Students are able to explain Linear Transformation. (ILO1, ILO5, ILO6, ILO8)
	M7	Students are able to explain Eigen Values, Eigen Vectors, and applications in matrix diagonalization. (ILO1, ILO5, ILO6, ILO8)
	M8	Students are able to do Singular Value Decomposition (SVD) and Quadratic Form. (ILO1, ILO5, ILO6, ILO8)
Contents:	1	LES, Gauss elimination, Gauss-Jordan elimination, homogeneous LES.
	2	Matrix and matrix operations, elementary matrix, transpose matrix, inverse matrix, diagonal matrix, triangular matrix, matrix partition, general inverse matrix, Kronecker matrix.
	3	Determinant Functions, Determine Determinants using Row Reduction, Determinant Function Properties, Co-factor Expansion, Minor Co-factors, Cramer Rules.
	4	Vectors in Space-2 and Space-3: norms, vector arithmetic, dot product, projection, cross product, line and plane in Space-3.
	5	Euclidis n-space, general vector space, linear independence, basis and dimensions, rank, inner product space, orthonormal basis, Gram-Schmidt process.

	6	Linear transformations, properties of linear transformations, linear transformations from Space-n to Space-m, linear transformation matrix.
	7	Eigenvalue, eigenvector, diagonalization, orthogonal and orthonormal diagonalization, symmetric matrix.
	8	Singular Value Decomposition (SVD), Quadratic form.
Soft skill attribute:	Responsible, independently, and discipline	
Study/exam achievement:	Final score (NA) is calculated as follow: 15% Assignments, 20% Quizzes, 10% Tutorial Class, 25% Midterm Test, 25% Final Exam, 5% Attitude Final index is defined as follow: A : > 80 - 100 B+ : > 75 - 80 B : > 69 - 75 C+ : > 60 - 69 C : > 55 - 60 D+ : > 50 - 55 D : > 44 - 50 E : 0 - 44	
Forms of media:	Laptop, LCD projector, whiteboard	
Learning methods:	Lecture, assessments, and discussion	
Literature:	Main:	
	1. Anton, H dan Rorres, C. 2013. Elementary Linear Algebra with Applications. Ninth Edition. John Wiley and Sons, Inc.	
	2. Anton, H. 1995. Aljabar Linear Elementer. Edisi Kelima. Alih Bahasa: Silaban, P. dan Susila, I. N. Penerbit Erlangga, Jakarta.	
	Support:	
	1. Nasoetion, A. H. 1980. Aljabar Matriks. Penerbit Bhratara Karya Aksara Jakarta.	
	2. Lipschutz, S. dan Lipson, M.L. 2009. Linear Algebra, Schaum's Outlines. Fourth Edition. The McGraw-Hill Companies, Inc.	
	3. Schott, J. R. 2017. Matrix Analysis for Statistics. Third Edition. John Wiley and Sons, Inc.	
	4. Searle, S. R. dan Khuri, A. I. 2017. Matrix Algebra Useful for Statistics. Second Edition. John Wiley and Sons, Inc.	
Notes:		