	Universitas Negeri Surabaya Faculty of Engineering, Mechanical Engineering Undergraduate Study Program	Document Code

SEMESTER LEARNING PLAN

Courses	CODE	Course Family	Credit Weight	SEMESTER	Compilation Date
Mathematics 4	2120104118	Compulsory Curriculum Subjects - National	T=4 P=0 ECTS=6.36	4	May 28, 2023

AUTHORIZATION	SP Developer	Course Cluster Coordinator	Study Program Coordinator
	Tri Hartutuk Ningsih, S.T., M.T. ; Indra Herlamba Siregar, S.T., M.T.	Tri Hartutuk Ningsih, S.T., M.T.	Ir. Priyo Heru Adiwibowo, S.T., M.T.

Learning model	**Case Studies**

Program Learning Outcomes (PLO)

PLO study program that is charged to the course	
PLO-5	Work independently and in groups
PLO-11	Design and development of solutions that take into account the environment and sustainability
PLO-14	Science and engineering knowledge

Program Objectives (PO)	
PO - 1	Able to study, understand and solve systems of linear equations, determinants, vectors in R2 and R3, Euclidean vector space

PLO-PO Matrix

P.O	PLO-5	PLO-11	PLO-14
PO-1			

PO Matrix at the end of each learning stage (Sub-PO)

P.O	Week															
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
PO-1																

Short Course Description	Students are able to conceptually understand ordinary differential equations, multi-variable functions (partial derivatives, gradient vectors, extreme values), double integrals, Laplace transforms and Fourier series and Fourier transforms.

References

Main :

1. [1] Erwin Kresyzig. 2011. Advance Engineering Mathematics 10th.New York: John Willey & Sons Inc.
2. [2] Huw Fox,W. Bolton. 2010.Mathematics forEngineers andTechnologists.Elsevier Science &Technology Books.ISBN: 0750655445.
3. [3] Glyn James. 2011. Advanced Modern Engineering Mathematics 4th. Prentice Hall
4. [4] Spiegel M.R. 1974.Advanced Calculus.MC Graw-Hil. Inc
5. [5] Anton, H.dkk,. 2012.Calculus, 10thEdition. New York:John Wiley & Sons.

Supporters:

Supporting lecturer	Indra Herlamba Siregar, S.T., M.T. Tri Hartutuk Ningsih, S.T., M.T.

Week-	Final abilities of each learning stage (Sub-PO)	Evaluation		Help Learning, Learning methods, Student Assignments, [Estimated time]		Learning materials [References]	Assessment Weight (%)
		Indicator	Criteria & Form	Offline (*offline*)	Online (*online*)		
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)

1	1. Students are able to communicate their understanding of linear algebra concepts in the field of engineering. 2. Students are able to communicate their understanding of Systems of Linear Equations 3. Students are able to communicate their understanding of Gauss–Jordan elimination, matrices and matrix operations	1. Students can do linear algebra in engineering 2. Students can solve Systems of Linear Equations 3. Students can solve using Gauss – Jordan Elimination, Matrices and Matrix operations	**Criteria:** Completeness of the analysis results report	4x50 discussion lectures and questions and answers		**Material:** linear algebra in engineering, Systems of Linear Equations, Gauss-Jordan Elimination, Matrices and Matrix operations **Library:** *[1] Erwin Kresyzig. 2011. Advanced Engineering Mathematics 10th. New York: John Willey & Sons Inc.* **Material:** Linear algebra in engineering, Systems of Linear Equations, Gauss-Jordan Elimination, Matrices and Matrix operations **Library:** *[4] Spiegel MR 1974.Advanced Calculus.MC Graw-Hil. Inc*	5%
2	1. Students are able to communicate their understanding of linear algebra concepts in the field of engineering. 2. Students are able to communicate their understanding of Systems of Linear Equations 3. Students are able to communicate their understanding of Gauss–Jordan elimination, matrices and matrix operations	1. Students can do linear algebra in engineering 2. Students can solve Systems of Linear Equations 3. Students can solve using Gauss – Jordan Elimination, Matrices and Matrix operations	**Criteria:** Completeness of the analysis results report **Form of Assessment** : Participatory Activities	4x50 discussion lectures and questions and answers		**Material:** linear algebra in engineering, Systems of Linear Equations, Gauss-Jordan Elimination, Matrices and Matrix operations **Library:** *[1] Erwin Kresyzig. 2011. Advanced Engineering Mathematics 10th. New York: John Willey & Sons Inc.* **Material:** Linear algebra in engineering, Systems of Linear Equations, Gauss-Jordan Elimination, Matrices and Matrix operations **Library:** *[4] Spiegel MR 1974.Advanced Calculus.MC Graw-Hil. Inc*	5%
3	1. Students are able to create matrix algebra and inverse matrices 2. Students are able to create Elementary Matrices and how to find inverse matrices 3. Students understand other types of matrices	1. Students can work on Matrix Algebra and Inverse Matrices 2. Students can complete the Elementary Matrix and how to find the inverse matrix 3. Students can solve matrix problems with other types of matrices	**Criteria:** Completeness of the analysis results report **Form of Assessment** : Participatory Activities	4x50 discussion lectures and questions and answers		**Material:** linear algebra in engineering, Systems of Linear Equations, Gauss-Jordan Elimination, Matrices and Matrix operations **Library:** *[1] Erwin Kresyzig. 2011. Advanced Engineering Mathematics 10th. New York: John Willey & Sons Inc.* **Material:** Linear algebra in engineering, Systems of Linear Equations, Gauss-Jordan Elimination, Matrices and Matrix operations **Library:** *[4] Spiegel MR 1974.Advanced Calculus.MC Graw-Hil. Inc*	5%

4	1.Students are able to create matrix algebra and inverse matrices 2.Students are able to create Elementary Matrices and how to find inverse matrices 3.Students understand other types of matrices	1.Students can work on Matrix Algebra and Inverse Matrices 2.Students can complete the Elementary Matrix and how to find the inverse matrix 3.Students can solve matrix problems with other types of matrices	**Criteria:** Completeness of the analysis results report **Form of Assessment** : Participatory Activities	4x50 discussion lectures and questions and answers		**Material:** linear algebra in engineering, Systems of Linear Equations, Gauss-Jordan Elimination, Matrices and Matrix operations **Library:** *[1] Erwin Kresyzig. 2011. Advanced Engineering Mathematics 10th. New York: John Willey & Sons Inc.* **Material:** Linear algebra in engineering, Systems of Linear Equations, Gauss-Jordan Elimination, Matrices and Matrix operations **Library:** *[4] Spiegel MR 1974.Advanced Calculus.MC Graw-Hil. Inc*	5%
5	1.Students are able to communicate their understanding of Determinant Functions, Definitions 2.Students are able to communicate their understanding of calculating determinants using line operations	1.Students understand Determinant Functions, Definitions 2.Students can calculate determinants using line operations	**Criteria:** Completeness of the analysis results report **Form of Assessment** : Participatory Activities	4x50 discussion lectures and questions and answers		**Material:** Determinants **References:** *[5] Anton, H. et al. 2012. Calculus, 10thEdition. New York: John Wiley & Sons.*	5%
6	1.Students are able to communicate the characteristics of determinants 2.Students are able to communicate Cofactor Expansion	1.Students can understand the characteristics of determinants 2.Students can complete Cofactor Expansion	**Criteria:** Completeness of the analysis results report **Form of Assessment** : Participatory Activities	4x50 discussion lectures and questions and answers		**Material:** Determinants **References:** *[4] Spiegel MR 1974.Advanced Calculus.MC Graw-Hil. Inc*	5%
7	Students are able to communicate their understanding of Cramer‘s rule	Students can solve determinant problems using Cramer‘s rules	**Criteria:** Completeness of the analysis results report **Form of Assessment** : Participatory Activities	4x50 discussion lectures and questions and answers		**Material:** linear algebra in engineering, Systems of Linear Equations, Gauss-Jordan Elimination, Matrices and Matrix operations **Library:** *[1] Erwin Kresyzig. 2011. Advanced Engineering Mathematics 10th. New York: John Willey & Sons Inc.* **Material:** Linear algebra in engineering, Systems of Linear Equations, Gauss-Jordan Elimination, Matrices and Matrix operations **Library:** *[4] Spiegel MR 1974.Advanced Calculus.MC Graw-Hil. Inc*	5%
8	Able to do all the questions correctly	Able to do all questions correctly and on time	**Criteria:** Full marks are obtained if you do all the questions correctly and on time	independently 4 X 50		**Material:** All material at meetings 1-7 **References:** *[4] Spiegel MR 1974.Advanced Calculus.MC Graw-Hil. Inc* **Material:** All material at meetings 1-7 **References:** *[5] Anton, H. et al. 2012. Calculus, 10thEdition. New York: John Wiley & Sons.*	15%

9	1.Students are able to communicate their understanding of Vectors in R2 and R3 2.Students are able to communicate their understanding of general vectors and Euclid	1.Students are able to analyze, discuss and complete vectors in R2 and R3 2.Students are able to analyze, discuss and solve general and Euclidean vectors	**Criteria:** Completeness of the task report resulting from the analysis **Form of Assessment** : Participatory Activities	Lectures, discussions and questions and answers 4 X 50		**Material:** Vectors in R2 and R3 **References:** *[1] Erwin Kresyzig. 2011. Advanced Engineering Mathematics 10th. New York: John Willey & Sons Inc.* **Material:** Vectors in R2 and R3 General vectors and Euclid **Reference:** *[3] Glyn James. 2011. Advanced Modern Engineering Mathematics 4th. Prentice Hall*	5%
10	1.Students are able to communicate their understanding of Vectors in R2 and R3 2.Students are able to communicate their understanding of general vectors and Euclid	1.Students are able to analyze, discuss and complete vectors in R2 and R3 2.Students are able to analyze, discuss and solve general and Euclidean vectors	**Criteria:** Completeness of the task report resulting from the analysis **Form of Assessment** : Participatory Activities	Lectures, discussions and questions and answers 4 X 50		**Material:** Vectors in R2 and R3 **References:** *[1] Erwin Kresyzig. 2011. Advanced Engineering Mathematics 10th. New York: John Willey & Sons Inc.* **Material:** Vectors in R2 and R3 General vectors and Euclid **Reference:** *[3] Glyn James. 2011. Advanced Modern Engineering Mathematics 4th. Prentice Hall*	5%
11	1.Students are able to communicate their understanding of Vectors in R2 and R3 2.Students are able to communicate their understanding of general vectors and Euclid	1.Students are able to analyze, discuss and complete vectors in R2 and R3 2.Students are able to analyze, discuss and solve general and Euclidean vectors	**Criteria:** Completeness of the task report resulting from the analysis **Form of Assessment** : Participatory Activities	Lectures, discussions and questions and answers 4 X 50		**Material:** Vectors in R2 and R3 **References:** *[1] Erwin Kresyzig. 2011. Advanced Engineering Mathematics 10th. New York: John Willey & Sons Inc.* **Material:** Vectors in R2 and R3 General vectors and Euclid **Reference:** *[3] Glyn James. 2011. Advanced Modern Engineering Mathematics 4th. Prentice Hall*	5%
12	1.Students are able to communicate their understanding of Vectors in R2 and R3 2.Students are able to communicate their understanding of general vectors and Euclid	1.Students are able to analyze, discuss and complete vectors in R2 and R3 2.Students are able to analyze, discuss and solve general and Euclidean vectors	**Criteria:** Completeness of the task report resulting from the analysis **Form of Assessment** : Participatory Activities	Lectures, discussions and questions and answers 4 X 50		**Material:** Vectors in R2 and R3 **References:** *[1] Erwin Kresyzig. 2011. Advanced Engineering Mathematics 10th. New York: John Willey & Sons Inc.* **Material:** Vectors in R2 and R3 General vectors and Euclid **Reference:** *[3] Glyn James. 2011. Advanced Modern Engineering Mathematics 4th. Prentice Hall*	5%
13	1.Students are able to communicate their understanding of Vectors in R2 and R3 2.Students are able to communicate their understanding of general vectors and Euclid	1.Students are able to analyze, discuss and complete vectors in R2 and R3 2.Students are able to analyze, discuss and solve general and Euclidean vectors	**Criteria:** Completeness of the task report resulting from the analysis **Form of Assessment** : Participatory Activities	Lectures, discussions and questions and answers 4 X 50		**Material:** Vectors in R2 and R3 **References:** *[1] Erwin Kresyzig. 2011. Advanced Engineering Mathematics 10th. New York: John Willey & Sons Inc.* **Material:** Vectors in R2 and R3 General vectors and Euclid **Reference:** *[3] Glyn James. 2011. Advanced Modern Engineering Mathematics 4th. Prentice Hall*	5%

14	1.Students are able to communicate their understanding of Vectors in R2 and R3 2.Students are able to communicate their understanding of general vectors and Euclid	1.Students are able to analyze, discuss and complete vectors in R2 and R3 2.Students are able to analyze, discuss and solve general and Euclidean vectors	**Criteria:** Completeness of the task report resulting from the analysis **Form of Assessment** : Participatory Activities	Lectures, discussions and questions and answers 4 X 50		**Material:** Vectors in R2 and R3 **References:** *[1] Erwin Kresyzig. 2011. Advanced Engineering Mathematics 10th. New York: John Willey & Sons Inc.* **Material:** Vectors in R2 and R3 General vectors and Euclid **Reference:** *[3] Glyn James. 2011. Advanced Modern Engineering Mathematics 4th. Prentice Hall*	5%
15	1.Students are able to communicate their understanding of Vectors in R2 and R3 2.Students are able to communicate their understanding of general vectors and Euclid	1.Students are able to analyze, discuss and complete vectors in R2 and R3 2.Students are able to analyze, discuss and solve general and Euclidean vectors	**Criteria:** Completeness of the task report resulting from the analysis **Form of Assessment** : Participatory Activities	Lectures, discussions and questions and answers 4 X 50		**Material:** Vectors in R2 and R3 **References:** *[1] Erwin Kresyzig. 2011. Advanced Engineering Mathematics 10th. New York: John Willey & Sons Inc.* **Material:** Vectors in R2 and R3 General vectors and Euclid **Reference:** *[3] Glyn James. 2011. Advanced Modern Engineering Mathematics 4th. Prentice Hall*	5%
16	Final Semester Examination (UAS)		**Criteria:** Able to answer all questions correctly and on time	working independently 4x50		**Material:** Material at meeting 9-15 **References:** *[5] Anton, H. et al. 2012. Calculus, 10thEdition. New York: John Wiley & Sons.* **Material:** Material at meeting 9-15 **Reader:** *[3] Glyn James. 2011. Advanced Modern Engineering Mathematics 4th. Prentice Hall* **Material:** Material at meeting 9-15 **References:** *[2] Huw Fox,W. Bolton. 2010.Mathematics forEngineers andTechnologists.Elsevier Science & Technology Books.ISBN: 0750655445.*	15%

Evaluation Percentage Recap: Case Study

No	Evaluation	Percentage
1.	Participatory Activities	65%
		65%

Notes

1. **Learning Outcomes of Study Program Graduates (PLO - Study Program)** are the abilities possessed by each Study Program graduate which are the internalization of attitudes, mastery of knowledge and skills according to the level of their study program obtained through the learning process.
2. **The PLO imposed on courses** are several learning outcomes of study program graduates (CPL-Study Program) which are used for the formation/development of a course consisting of aspects of attitude, general skills, special skills and knowledge.
3. **Program Objectives (PO)** are abilities that are specifically described from the PLO assigned to a course, and are specific to the study material or learning materials for that course.
4. **Subject Sub-PO (Sub-PO)** is a capability that is specifically described from the PO that can be measured or observed and is the final ability that is planned at each learning stage, and is specific to the learning material of the course.
5. **Indicators for assessing** ability in the process and student learning outcomes are specific and measurable statements that identify the ability or performance of student learning outcomes accompanied by evidence.
6. **Assessment Criteria** are benchmarks used as a measure or measure of learning achievement in assessments based on predetermined indicators. Assessment criteria are guidelines for assessors so that assessments are consistent and unbiased. Criteria can be quantitative or qualitative.
7. **Forms of assessment:** test and non-test.
8. **Forms of learning:** Lecture, Response, Tutorial, Seminar or equivalent, Practicum, Studio Practice, Workshop Practice, Field Practice, Research, Community Service and/or other equivalent forms of learning.
9. **Learning Methods:** Small Group Discussion, Role-Play & Simulation, Discovery Learning, Self-Directed Learning, Cooperative Learning, Collaborative Learning, Contextual Learning, Project Based Learning, and other equivalent methods.
10. **Learning materials** are details or descriptions of study materials which can be presented in the form of several main points and sub-topics.
11. **The assessment weight** is the percentage of assessment of each sub-PO achievement whose size is proportional to the level of difficulty of achieving that sub-PO, and the total is 100%.
12. TM=Face to face, PT=Structured assignments, BM=Independent study.