	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 3	2120104108	Compulsory Curriculum Subjects - National	T=0	P=0	ECTS=0	3	April 28, 2023

AUTHORIZATION	SP Developer	Course Cluster Coordinator	Study Program Coordinator
	Tri Hartutuk Ningsih, S.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-14	Science and engineering knowledge

Program Objectives (PO)

PO - 1	a Ability to Identify specific facts about mathematics, science, and engineering required for sequences and infinite series, Conic Sections and Polar coordinates, Derivatives in functions of two or more variables, Limits and continuity, Differentiability, Directional derivatives and gradients, Chain rule, Fields tangency and surface approximation.
PO - 2	a. Able to formulate problems (identify "needs") and analyze constraints
PO - 3	a. Able to formulate problems and identify main problems / variables

PLO-PO Matrix

P.O	PLO-14
PO-1	
PO-2	
PO-3	

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																
PO-2																
PO-3																

Short Course Description	Mathematics 3 equips and helps in solving problems related to the field of Mechanical Engineering. Students learn about the basic concepts of sequences and infinite series, conic sections and polar coordinates, derivatives in functions of two or more variables, limits and continuity, differentiability, directed derivatives and gradients, chain rule, tangent planes and surface approximations.

References

Main :

1. Erwin Kresyzig . 2011. Advance Engineering Mathematics 10th. New York: John Willey & Sons Inc.
2. Glyn James . 2011. Advanced Modern Engineering Mathematics 4th. Prentice Hall
3. Huw Fox, W. Bolton. 2010. Mathematics for Engineers and Technologists. Elsevier Science & Technology Books. ISBN: 0750655445.
4. Spiegel M.R. 1974. Advanced Calculus. MC Graw-Hil. Inc
5. Anton, H. dkk,. 2012. Calculus, 10th Edition. 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 Sequences and Infinite Series 2. Students are able to communicate their understanding of positive term series and their convergence test, sign changing series and their convergence test	1. Students are able to explain about Sequences and Infinite Series 2. Students are able to solve problems regarding rows and infinite series 3. Students are able to explain positive term series and their convergence test, sign changing series and their convergence test	**Criteria:** Completeness of the analysis results report **Form of Assessment** : Participatory Activities	Discussion Lecture, questions and answers 4 X 50		**Material:** Infinite Sequences and Series **Reference:** *Erwin Kresyzig . 2011. Advanced Engineering Mathematics 10th. New York: John Willey & Sons Inc.* **Material:** Positive term series and sign changing series and their convergence tests. **Reference:** *Huw Fox, W. Bolton. 2010. Mathematics for Engineers and Technologists. Elsevier Science & Technology Books. ISBN: 0750655445.*	3%
2	1. Students are able to communicate their understanding of Sequences and Infinite Series 2. Students are able to communicate their understanding of positive term series and their convergence test, sign changing series and their convergence test	1. Students are able to explain about Sequences and Infinite Series 2. Students are able to solve problems regarding rows and infinite series 3. Students are able to explain positive term series and their convergence test, sign changing series and their convergence test	**Criteria:** Completeness of the analysis results report **Form of Assessment** : Participatory Activities	Discussion Lecture, questions and answers 4 X 50		**Material:** Infinite Sequences and Series **Reference:** *Erwin Kresyzig . 2011. Advanced Engineering Mathematics 10th. New York: John Willey & Sons Inc.* **Material:** Positive term series and sign changing series and their convergence tests. **Reference:** *Huw Fox, W. Bolton. 2010. Mathematics for Engineers and Technologists. Elsevier Science & Technology Books. ISBN: 0750655445.*	39%
3	1. Students are able to communicate their understanding of power series and their operations, Taylor and Mc Laurin series 2. Students are able to communicate their understanding of the Taylor Approximation Series for functions	1. Students are able to explain power series and their operations, Taylor and Mc Laurin series 2. Students are able to solve power series problems and their operations, Taylor and Mc Laurin series 3. Students are able to explain the Taylor Approximation Series for functions 4. Students are able to complete the Taylor Approximation Series for functions	**Criteria:** Completeness of the report, analysis results	Discussion Lecture, questions and answers 4 X 50		**Material:** Power series and their operations, Taylor and Mc Laurin Series **Reader:** *Glyn James. 2011. Advanced Modern Engineering Mathematics 4th. Prentice Hall* **Material:** Taylor Approximation Series for functions **References:** *Spiegel MR 1974. Advanced Calculus. MC Graw-Hil. Inc*	3%

4	1. Students are able to communicate their understanding of power series and their operations, Taylor and Mc Laurin series 2. Students are able to communicate their understanding of the Taylor Approximation Series for functions	1. Students are able to explain power series and their operations, Taylor and Mc Laurin series 2. Students are able to solve power series problems and their operations, Taylor and Mc Laurin series 3. Students are able to explain the Taylor Approximation Series for functions 4. Students are able to complete the Taylor Approximation Series for functions	**Criteria:** Completeness of the report, analysis results **Form of Assessment** : Participatory Activities, Tests	Discussion Lecture, questions and answers 4 X 50		**Material:** Power series and their operations, Taylor and Mc Laurin Series **Reader:** *Glyn James. 2011. Advanced Modern Engineering Mathematics 4th. Prentice Hall* **Material:** Taylor Approximation Series for functions **References:** *Spiegel MR 1974. Advanced Calculus. MC Graw-Hil. Inc*	3%
5	1. Students are able to communicate their understanding of Parabola, Ellipse and Hyperbola 2. Students are able to communicate their understanding of translation and rotation of coordinate axes	1. Students are able to explain Parabola, Ellipse and Hyperbola 2. Students are able to solve translation and rotation problems on coordinate axes	**Criteria:** Completeness of the report, analysis results **Form of Assessment** : Participatory Activities, Tests	Discussion Lecture, questions and answers 4 X 50		**Material:** Parabola, Ellipse and Hyperbola, Translation and Rotation of coordinate axes **Reference:** *Spiegel MR 1974. Advanced Calculus. MC Graw-Hil. Inc* **Material:** Parabola, Ellipse and Hyperbola, Translation and Rotation of coordinate axes **References:** *Anton, H. et al. 2012. Calculus, 10th Edition. New York: John Wiley & Sons.*	3%
6	1. Students are able to communicate their understanding of Parabola, Ellipse and Hyperbola 2. Students are able to communicate their understanding of translation and rotation of coordinate axes	1. Students are able to explain Parabola, Ellipse and Hyperbola 2. Students are able to solve translation and rotation problems on coordinate axes	**Criteria:** Completeness of the report, analysis results **Form of Assessment** : Participatory Activities, Tests	Discussion Lecture, questions and answers 4 X 50		**Material:** Parabola, Ellipse and Hyperbola, Translation and Rotation of coordinate axes **Reference:** *Spiegel MR 1974. Advanced Calculus. MC Graw-Hil. Inc* **Material:** Parabola, Ellipse and Hyperbola, Translation and Rotation of coordinate axes **References:** *Anton, H. et al. 2012. Calculus, 10th Edition. New York: John Wiley & Sons.*	3%

7	1. Students are able to communicate their understanding of parametric representation of curves in the plane 2. Students are able to communicate their understanding of the polar coordinate system	1. Students are able to explain parametric representation of curves in the plane 2. Students are able to solve problems on parametric representation of curves in the plane 3. Students are able to explain the polar coordinate system 4. Students are able to solve problems regarding the polar coordinate system	**Criteria:** Completeness of the report, analysis results **Form of Assessment** : Participatory Activities	Discussion Lecture, questions and answers 4 X 50		**Material:** Parametric representation of curves in the field **Reference:** *Erwin Kresyzig . 2011. Advanced Engineering Mathematics 10th. New York: John Willey & Sons Inc.* **Material:** Polar coordinate system **Reference:** *Spiegel MR 1974. Advanced Calculus. MC Graw-Hil. Inc*	3%
8	Able to do all the questions correctly	USS-Sub Summative Exam/UTS Midterm Exam	**Criteria:** USS-Sub Summative Exam/UTS Midterm Exam **Form of Assessment** : Portfolio Assessment	USS-Sub Summative Exam/UTS Midterm Exam 4 X 50		**Material:** All material at meetings 1-7 **Reader:** *Erwin Kresyzig . 2011. Advanced Engineering Mathematics 10th. New York: John Willey & Sons Inc.*	20%
9	1. Students are able to communicate their understanding of graphs of polar equations 2. Students are able to communicate their understanding of calculus in polar coordinates	1. Students are able to analyze and complete graphs of polar equations 2. Students are able to analyze and solve calculus in polar coordinates	**Criteria:** Completeness of the analysis results task report **Form of Assessment** : Participatory Activities	LectureDiscussionAssignment 4 X 50		**Material:** graphs of polar equations **References:** *Huw Fox, W. Bolton. 2010. Mathematics for Engineers and Technologists. Elsevier Science & Technology Books. ISBN: 0750655445.* **Material:** calculus in polar coordinates **Reference:** *Spiegel MR 1974. Advanced Calculus. MC Graw-Hil. Inc*	3%
10	1. Students are able to communicate their understanding of graphs of polar equations 2. Students are able to communicate their understanding of calculus in polar coordinates	1. Students are able to analyze and complete graphs of polar equations 2. Students are able to analyze and solve calculus in polar coordinates	**Criteria:** Completeness of the analysis results task report **Form of Assessment** : Participatory Activities	LectureDiscussionAssignment 4 X 50		**Material:** graphs of polar equations **References:** *Huw Fox, W. Bolton. 2010. Mathematics for Engineers and Technologists. Elsevier Science & Technology Books. ISBN: 0750655445.* **Material:** calculus in polar coordinates **Reference:** *Spiegel MR 1974. Advanced Calculus. MC Graw-Hil. Inc*	3%

11	1. Students are able to communicate their understanding of the function of many variables 2. Students are able to communicate their understanding of Partial Derivatives 3. Students are able to communicate their understanding of limits and continuity	1. Students are able to analyze and solve functions of many variables 2. Students are able to analyze and solve Partial Derivatives 3. Students are able to analyze and solve limits and continuity	**Criteria:** Completeness of the analysis results task report **Form of Assessment** : Participatory Activities	LectureDiscussionAssignment 4 X 50		**Material:** functions of many variables, partial derivatives, limits and continuity. **Reader:** *Glyn James. 2011. Advanced Modern Engineering Mathematics 4th. Prentice Hall* **Material:** functions of many variables, partial derivatives, limits and continuity. **References:** *Huw Fox, W. Bolton. 2010. Mathematics for Engineers and Technologists. Elsevier Science & Technology Books. ISBN: 0750655445.*	3%
12	1. Students are able to communicate their understanding of the function of many variables 2. Students are able to communicate their understanding of Partial Derivatives 3. Students are able to communicate their understanding of limits and continuity	1. Students are able to analyze and solve functions of many variables 2. Students are able to analyze and solve Partial Derivatives 3. Students are able to analyze and solve limits and continuity	**Criteria:** Completeness of the analysis results task report **Form of Assessment** : Participatory Activities	LectureDiscussionAssignment 4 X 50		**Material:** functions of many variables, partial derivatives, limits and continuity. **Reader:** *Glyn James. 2011. Advanced Modern Engineering Mathematics 4th. Prentice Hall* **Material:** functions of many variables, partial derivatives, limits and continuity. **References:** *Huw Fox, W. Bolton. 2010. Mathematics for Engineers and Technologists. Elsevier Science & Technology Books. ISBN: 0750655445.*	5%

13	1. Students are able to communicate their understanding of differentiation 2. Students are able to communicate their understanding of directed derivatives and gradients 3. Students are able to communicate their understanding of the chain rule	1. Students are able to analyze and resolve differentiation 2. Students are able to analyze and solve directed derivatives and gradients 3. Students are able to analyze and solve limits and continuity	**Criteria:** Completeness of the analysis results task report **Form of Assessment** : Participatory Activities	LectureDiscussionAssignment 4 X 50		**Material:** differentiability, directional derivatives and gradients, limits and continuity. **References:** *Huw Fox, W. Bolton. 2010. Mathematics for Engineers and Technologists. Elsevier Science & Technology Books. ISBN: 0750655445.* **Material:** Differentiability, Directional derivatives and gradients, Limits and continuity **References:** *Spiegel MR 1974. Advanced Calculus. MC Graw-Hil. Inc*	5%
14	1. Students are able to communicate their understanding of derivatives in functions of two or more variables using the chain rule 2. Students are able to communicate their understanding of tangent planes and surface approximations 3. Students are able to communicate their understanding of the Lagrange multiplier method	1. Students are able to analyze and solve derivatives in functions of two or more variables using the chain rule 2. Students are able to analyze and solve tangent planes and surface approximations 3. Students are able to analyze and solve the Lagrange multiplier method	**Criteria:** Completeness of the analysis results task report **Form of Assessment** : Participatory Activities	Discussion Lecture on Giving Assignments 4 X 50	Discussion Lecture on Assignment 4 x 50	**Material:** derivatives in Functions of two or more variables chain rule **Reader:** *Glyn James . 2011. Advanced Modern Engineering Mathematics 4th. Prentice Hall* **Material:** Tangent plane and surface approximation & Lagrange multiplier method **References:** *Anton, H. et al. 2012. Calculus, 10th Edition. New York: John Wiley & Sons.*	5%
15	1. Students are able to communicate their understanding of derivatives in functions of two or more variables using the chain rule 2. Students are able to communicate their understanding of tangent planes and surface approximations 3. Students are able to communicate their understanding of the Lagrange multiplier method	1. Students are able to analyze and solve derivatives in functions of two or more variables using the chain rule 2. Students are able to analyze and solve tangent planes and surface approximations 3. Students are able to analyze and solve the Lagrange multiplier method	**Criteria:** Completeness of the analysis results task report **Form of Assessment** : Participatory Activities	Discussion Lecture on Giving Assignments 4 X 50	Discussion Lecture on Assignment 4 x 50	**Material:** derivatives in Functions of two or more variables chain rule **Reader:** *Glyn James . 2011. Advanced Modern Engineering Mathematics 4th. Prentice Hall* **Material:** Tangent plane and surface approximation & Lagrange multiplier method **References:** *Anton, H. et al. 2012. Calculus, 10th Edition. New York: John Wiley & Sons.*	5%

16	UAS	Able to answer all questions correctly	**Criteria:** Full marks are obtained if you are able to answer all questions correctly	UAS (Final Semester Examination) 4 X 50		**Material:** Meeting material 9-15 **Reader:** *Huw Fox, W. Bolton. 2010. Mathematics for Engineers and Technologists. Elsevier Science & Technology Books. ISBN: 0750655445.* **Material:** Meeting material 9-15 **References:** *Spiegel MR 1974. Advanced Calculus. MC Graw-Hil. Inc*	30%

Evaluation Percentage Recap: Case Study

No	Evaluation	Percentage
1.	Participatory Activities	78.5%
2.	Portfolio Assessment	20%
3.	Test	4.5%
		100%

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.