



**Universitas Negeri Surabaya**  
**Faculty of Mathematics and Natural Sciences**  
**Data Science Undergraduate Study Program**

Document Code

## SEMESTER LEARNING PLAN

Courses	CODE	Course Family	Credit Weight			SEMESTER	Compilation Date
Advanced Calculus	4920203007	Compulsory Study Program Subjects	T=3	P=0	ECTS=4.77	2	January 24, 2024
AUTHORIZATION	SP Developer		Course Cluster Coordinator			Study Program Coordinator	
	Hasanuddin Al-Habib, M.Si		Dr. Atik Wintarti, M.Kom			Yuliani Puji Astuti, S.Si., M.Si.	

Learning model	Case Studies																																
Program Learning Outcomes (PLO)	PLO study program which is charged to the course																																
	PLO-9     Able to apply data science principles to solve problems																																
	PLO-17    Mastering mathematical and statistical theories related to data science																																
	Program Objectives (PO)																																
	PLO-PO Matrix																																
	<table border="1" style="margin: auto;"> <tr> <td style="width: 30%;">P.O</td> <td style="width: 30%;">PLO-9</td> <td style="width: 30%;">PLO-17</td> </tr> </table>	P.O	PLO-9	PLO-17																													
P.O	PLO-9	PLO-17																															
PO Matrix at the end of each learning stage (Sub-PO)																																	
<table border="1" style="margin: auto;"> <tr> <td rowspan="2" style="width: 5%;">P.O</td> <td colspan="16" style="text-align: center;">Week</td> </tr> <tr> <td style="width: 2%;">1</td><td style="width: 2%;">2</td><td style="width: 2%;">3</td><td style="width: 2%;">4</td><td style="width: 2%;">5</td><td style="width: 2%;">6</td><td style="width: 2%;">7</td><td style="width: 2%;">8</td><td style="width: 2%;">9</td><td style="width: 2%;">10</td><td style="width: 2%;">11</td><td style="width: 2%;">12</td><td style="width: 2%;">13</td><td style="width: 2%;">14</td><td style="width: 2%;">15</td><td style="width: 2%;">16</td> </tr> </table>	P.O	Week																1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
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	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16																	

**Short Course Description**     This course studies the basics of ordinary differential equations and several solving techniques, as well as studying functions of two independent variables, partial derivatives, determining maximum and minimum values, vector calculus, and studying fold integrals in several specific case studies.

<b>References</b>	<p><b>Main :</b></p> <ol style="list-style-type: none"> <li>George B. Thomas. 2018 . Thomas Calculus 14th Edition. Pearson</li> </ol> <p><b>Supporters:</b></p> <ol style="list-style-type: none"> <li>Purcell, E.J., Varberg, D., and Rigdon, S.E. 2007. Calculus 9th Edition. Ontario: Pearson, Prentice Hall</li> <li>Stroud, K.A. and Booth, D. 2020. Engineering Mathematics 8th Edition. Red Globe Press.</li> </ol>
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**Supporting lecturer**     Dr. Abadi, M.Sc.  
Yuliani Puji Astuti, S.Si., M.Si.  
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Riskhana Dewi Intan Puspitasari, M.Kom.

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	Students understand ordinary differential equations and their solutions.	<ol style="list-style-type: none"> <li>1.Able to explain ordinary differential equations.</li> <li>2.Able to find solutions to ordinary differential equations using the variable separation method.</li> <li>3.Able to find solutions to ordinary differential equations using the substitution method.</li> </ol>	<b>Criteria:</b> Exercises.  <b>Form of Assessment :</b> Participatory Activities	Presentation and question and answer. 3x50		<b>Material:</b> Chapter 9. First-Order Differential Equation <b>Bibliography:</b> George B. Thomas. 2018 . Thomas Calculus 14th Edition. Pearson <hr/> <b>Material:</b> Part II, Program 25: First-order differential equation <b>Reference:</b> Stroud, KA and Booth, D. 2020. Engineering Mathematics 8th Edition. Red Globe Press.	5%
2	Students understand ordinary differential equations and their solutions.	<ol style="list-style-type: none"> <li>1.Able to understand exact differential equations.</li> <li>2.Able to find solutions to exact differential equations.</li> </ol>	<b>Criteria:</b> Exercises.  <b>Form of Assessment :</b> Participatory Activities	Presentation and question and answer. 3x50		<b>Material:</b> Chapter 9. First-Order Differential Equation <b>Bibliography:</b> George B. Thomas. 2018 . Thomas Calculus 14th Edition. Pearson <hr/> <b>Material:</b> Part II, Program 25: First-order differential equation <b>Reference:</b> Stroud, KA and Booth, D. 2020. Engineering Mathematics 8th Edition. Red Globe Press.	5%
3	Able to understand 1st order linear differential equations and their solutions.	<ol style="list-style-type: none"> <li>1.Able to understand 1st order linear differential equations.</li> <li>2.Able to find solutions to 1st order linear differential equations.</li> </ol>	<b>Criteria:</b> Exercises.  <b>Form of Assessment :</b> Participatory Activities	Presentation and question and answer. 3x50		<b>Material:</b> Chapter 9. First-Order Differential Equation <b>Bibliography:</b> George B. Thomas. 2018 . Thomas Calculus 14th Edition. Pearson <hr/> <b>Material:</b> Part II, Program 25: First-order differential equation <b>Reference:</b> Stroud, KA and Booth, D. 2020. Engineering Mathematics 8th Edition. Red Globe Press.	5%

4	Students understand the concepts in the function of two independent variables.	<ol style="list-style-type: none"> <li>1.Able to understand functions and function graphs of two independent variables.</li> <li>2.Able to understand height curve graphs.</li> </ol>	<b>Criteria:</b> Exercises.  <b>Form of Assessment :</b> Participatory Activities	Presentation and questions and answers 3x50		<b>Material:</b> Chapter 14, Subchapter 14.1. Function of Several Variables. <b>Bibliography:</b> George B. Thomas. 2018 . Thomas Calculus 14th Edition. Pearson	5%
5	Students understand the concept of limits and continuity of functions.	<ol style="list-style-type: none"> <li>1.Able to understand the concept of function limits and continuity.</li> <li>2.Able to understand the continuity of the function of two independent variables.</li> </ol>	<b>Criteria:</b> Exercises.  <b>Form of Assessment :</b> Participatory Activities	Presentation and question and answer. 3x50		<b>Material:</b> Chapter 14, Subchapter 14.2. Limits and Continuity in Higher Dimensions <b>Bibliography:</b> George B. Thomas. 2018 . Thomas Calculus 14th Edition. Pearson	5%
6	Students understand the concept of partial differential equations.	<ol style="list-style-type: none"> <li>1.Able to understand the difference between partial differential equations and ordinary differential equations</li> <li>2.Able to find solutions to partial differential equations.</li> </ol>	<b>Criteria:</b> Exercises.	Presentation and question and answer. 3x50		<b>Material:</b> Chapter 14. Partial Derivatives <b>Bibliography:</b> George B. Thomas. 2018 . Thomas Calculus 14th Edition. Pearson	5%
7	Students understand high-level partial differential equations.	<ol style="list-style-type: none"> <li>1.Able to understand high level partial differentials.</li> <li>2.Able to find solutions to high level partial differential equations.</li> </ol>	<b>Criteria:</b> Exercises.  <b>Form of Assessment :</b> Participatory Activities	Presentation and question and answer. 3x50		<b>Material:</b> Chapter 14. Partial Derivatives <b>Bibliography:</b> George B. Thomas. 2018 . Thomas Calculus 14th Edition. Pearson	5%
8	Midterm exam	<ol style="list-style-type: none"> <li>1.Answer questions related to ordinary differential equations.</li> <li>2.Answer questions related to the function of two independent variables.</li> <li>3.Answer questions related to partial differential equations.</li> </ol>	<b>Criteria:</b> Written exam.  <b>Form of Assessment :</b> Test	Written exam. 2x50		<b>Material:</b> Chapter 9 and Chapter 14 <b>Reference:</b> George B. Thomas. 2018 . Thomas Calculus 14th Edition. Pearson	15%
9	Students understand the concept of total differential.	Be able to understand the difference between total, ordinary and partial differentials.	<b>Criteria:</b> Exercises.  <b>Form of Assessment :</b> Participatory Activities	Presentation and question and answer. 3x50		<b>Material:</b> Chapter 14. Partial Derivatives <b>Bibliography:</b> George B. Thomas. 2018 . Thomas Calculus 14th Edition. Pearson	5%

10	Students understand the concept of implicit function derivatives and the chain rule.	<ol style="list-style-type: none"> <li>1.Able to understand implicit function derivatives</li> <li>2.Able to understand and apply the chain rule.</li> </ol>	<b>Criteria:</b> Exercises.  <b>Form of Assessment :</b> Participatory Activities	Presentation and question and answer. 3x50		<b>Material:</b> Chapter 14. Partial Derivatives <b>Bibliography:</b> George B. Thomas. 2018 . Thomas Calculus 14th Edition. Pearson	5%
11	Students understand the concept of maximum and minimum scores.	<ol style="list-style-type: none"> <li>1.Able to understand extreme values unconditionally.</li> <li>2.Able to understand conditional extreme values.</li> </ol>	<b>Criteria:</b> Exercises.  <b>Form of Assessment :</b> Participatory Activities	Presentation and question and answer. 3x50		<b>Material:</b> Chapter 14. Partial Derivatives <b>Bibliography:</b> George B. Thomas. 2018 . Thomas Calculus 14th Edition. Pearson	5%
12	Students are able to understand the concepts in vector calculus.	<ol style="list-style-type: none"> <li>1.Able to understand vector functions.</li> <li>2.Able to understand vector-valued function graphs.</li> </ol>	<b>Criteria:</b> Exercises.  <b>Form of Assessment :</b> Participatory Activities	Presentation and question and answer. 3x50		<b>Material:</b> Chapter 12. Vectors and The Geometry of Space <b>Reference:</b> George B. Thomas. 2018 . Thomas Calculus 14th Edition. Pearson	5%
13	Students are able to understand the concepts in vector calculus.	<ol style="list-style-type: none"> <li>1.Able to understand the concept of limits and continuity in vectors.</li> <li>2.Able to understand the concept of derivative and integral of vector functions.</li> </ol>	<b>Criteria:</b> Exercises.  <b>Form of Assessment :</b> Participatory Activities	Presentation and question and answer. 3x50		<b>Material:</b> Chapter 12. Vectors and The Geometry of Space <b>Reference:</b> George B. Thomas. 2018 . Thomas Calculus 14th Edition. Pearson	5%
14	Students are able to understand the concepts in fold integrals.	<ol style="list-style-type: none"> <li>1.Able to understand the concept of double integrals.</li> <li>2.Able to understand the concept of folding integrals over rectangular areas.</li> </ol>	<b>Criteria:</b> Exercises.  <b>Form of Assessment :</b> Participatory Activities	Presentation and question and answer. 3x50		<b>Material:</b> Chapter 15. Multiple Integrals <b>Bibliography:</b> George B. Thomas. 2018 . Thomas Calculus 14th Edition. Pearson	5%
15	Students are able to understand the concepts in fold integrals.	<ol style="list-style-type: none"> <li>1.Able to understand the concept of folding integrals over general areas.</li> <li>2.Able to understand the concept of double integrals in polar coordinates.</li> </ol>	<b>Criteria:</b> Exercises.  <b>Form of Assessment :</b> Participatory Activities	Presentation and question and answer. 3x50		<b>Material:</b> Chapter 15. Multiple Integrals <b>Bibliography:</b> George B. Thomas. 2018 . Thomas Calculus 14th Edition. Pearson	5%

16	Final exams	<ol style="list-style-type: none"> <li>1. Answers questions related to total differentials, derivatives of functions, and chain rules.</li> <li>2. Answer questions related to maximum and minimum values or extreme values.</li> <li>3. Answering questions related to vector calculus.</li> <li>4. Answering questions related to fold integrals.</li> </ol>	<b>Criteria:</b> Written exam.  <b>Form of Assessment :</b> Test	Written exam. 2x50		<b>Material:</b> Chapters 12, 14, and 15 <b>Reference:</b> George B. Thomas. 2018 . Thomas Calculus 14th Edition. Pearson	15%
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#### Evaluation Percentage Recap: Case Study

No	Evaluation	Percentage
1.	Participatory Activities	65%
2.	Test	30%
		95%

#### 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.