	Universitas Negeri Surabaya Vocational Faculty, D4 Mechanical Engineering Study Program	Document Code

SEMESTER LEARNING PLAN

Courses	CODE	Course Family	Credit Weight			SEMESTER	Compilation Date
Applied mathematics	99992140103022		T=3	P=0	ECTS=4.77	1	July 17, 2024

AUTHORIZATION	SP Developer	Course Cluster Coordinator	Study Program Coordinator
	Diah Wulandari, S.T., M.T	Diah Wulandari, S.T., M.T	Arya Mahendra Sakti, S.T., M.T.

Learning model	**Case Studies**
Program Learning Outcomes (PLO)	**PLO study program that is charged to the course**
	Program Objectives (PO)
	PLO-PO Matrix

	P.O

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

Short Course Description	Study of the basics of mathematics through understanding the concepts of theorems and their application to various problems including real number systems, complexes, vectors, functions, function limits and continuity, graphs of functions, polar coordinates, derivatives of functions along with their application to straight line equations, minimum maximum values and rate changes related fields so that students can apply them in the field of mechanical engineering
References	**Main :**

1. [1]. Spiegel, Murray R, Advanced Calculus, Schaum's Series, Mc. Graw Hill, Singapore, 1981
2. [2]. Kreyzig Erwin, Advance Engineering Mathematic, Edisi ke-7, John Wiley, 1993
3. [3]. Paul A. Calter, MSME & Michael A. Calter, PH.D, Technical Mathematics with Calculus, 2011, John Willey & Sons Inc. Wesleyan University, United Stated of America
4. [4]. Huw Fox & W. Bolton, Mathematics for Engineers and Technologists, 2002, Elsevier Science & Technology Books, ISBN: 0750655445

	Supporters:
Supporting lecturer	Diah Wulandari, S.T., M.T. Ferly Isnomo Abdi, S.T., S.Pd., M.T. Dewi Puspitasari, S.Pd., M.Sc.

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	Able to explain number systems starting from the simplest numbers to the most complex numbers, power numbers, radicals and mathematical operations, equations and inequalities	1. Explain the types of numbers starting from the simplest numbers to the most complex numbers 2. Explains radical power numbers and their mathematical operations. 3. Explain and be able to solve equations and inequalities	**Criteria:** Full marks are obtained if you do all the questions correctly	Brainstorming discussions and problem-based learning 3 X 50		**Material:** from the simplest numbers to the most complex numbers, power numbers, radicals and mathematical operations, equations and inequalities **Library:** *[1]. Spiegel, Murray R, Advanced Calculus, Schaum's Series, Mc. Graw Hill, Singapore, 1981*	0%
2	Understand the definition of vectors and relations and vector algebra operations, and be able to calculate the angle formed by 2 vectors, calculate the area of a parallelogram and be able to calculate the volume of a parallelepipedum	1. Explains the definition of vectors and relations and vector algebra operations 2. Calculating the angle formed by 2 vectors calculates the area of a parallelogram and calculates the volume of a parallelepipedum	**Criteria:** Full marks are obtained if you do all the questions correctly	Problem-based learning and discussion 3 X 50		**Material:** vectors, relations and vector algebra operations, angles formed by 2 vectors, area of a parallelogram, calculating the volume of a parallelepipedum. **Reference:** *[2]. Kreyzig Erwin, Advanced Engineering Mathematics, 7th Edition, John Wiley, 1993*	0%
3	Understand the definition of vectors and relations and vector algebra operations, and be able to calculate the angle formed by 2 vectors, calculate the area of a parallelogram and be able to calculate the volume of a parallelepipedum	1. Explains the definition of vectors and relations and vector algebra operations 2. Calculating the angle formed by 2 vectors calculates the area of a parallelogram and calculates the volume of a parallelepipedum	**Criteria:** Full marks are obtained if you do all the questions correctly **Form of Assessment** : Participatory Activities	Problem-based learning and discussion 3 X 50		**Material:** vectors, relations and vector algebra operations, angles formed by 2 vectors, area of a parallelogram, calculating the volume of a parallelepipedum. **Reference:** *[2]. Kreyzig Erwin, Advanced Engineering Mathematics, 7th Edition, John Wiley, 1993*	25%
4	Able to define functions, understand various functions, be able to draw function graphs, determine the origin area (domain) and result area (function), understand graph shifts, calculate function operations and function composition and be able to draw function graphs in polar coordinates	1. Explain the definition of function · Explain the various functions 2. Drawing function graphs, determining domain areas and function areas · Drawing function graphs using the law of translation/shift 3. Explains the occurrence of new functions based on the operation of functions and function composition 4. Explain the depiction of function graphs in polar coordinates	**Criteria:** Full marks are obtained if you do all the questions correctly	Problem-based learning and discussion 3 X 50		**Material:** functions, various functions, drawing function graphs, determining the origin area (domain) and result area (function), graph shifts, function operations and function composition and being able to draw function graphs in polar coordinates. **Reference:** *[3]. Paul A. Calter, MSME & Michael A. Calter, PH.D, Technical Mathematics with Calculus, 2011, John Willey & Sons Inc. Wesleyan University, United States of America*	0%

5	Able to define functions, understand various functions, be able to draw function graphs, determine the origin area (domain) and result area (function), understand graph shifts, calculate function operations and function composition and be able to draw function graphs in polar coordinates	1. Explain the definition of function · Explain the various functions 2. Drawing function graphs, determining domain areas and function areas · Drawing function graphs using the law of translation/shift 3. Explains the occurrence of new functions based on the operation of functions and function composition 4. Explain the depiction of function graphs in polar coordinates	**Criteria:** Full marks are obtained if you do all the questions correctly	Problem-based learning and discussion 3 X 50		**Material:** functions, various functions, drawing function graphs, determining the origin area (domain) and result area (function), graph shifts, function operations and function composition and being able to draw function graphs in polar coordinates. **Reference:** *[3]. Paul A. Calter, MSME & Michael A. Calter, PH.D, Technical Mathematics with Calculus, 2011, John Willey & Sons Inc. Wesleyan University, United States of America*	0%
6	Able to solve function limitsAble to solve function limits	1. Explain the definition of limit 2. Explain limit theorems 3. Explain the limits of trigonometric functions · 4. Explain the limits of rational numbers · 5. Explain the limit of indefinite numbers 6. Explain the limits of exponential numbers	**Criteria:** Full marks are obtained if you do all the questions correctly	Problem-based learning and discussion 3 X 50		**Material:** Function limits **Library:** *[1]. Spiegel, Murray R, Advanced Calculus, Schaum's Series, Mc. Graw Hill, Singapore, 1981*	0%
7	Able to understand the continuity of function at one point	Proving the condition that the function is continuous at one point	**Criteria:** Full marks are obtained if you do all the questions correctly	Problem-based learning and discussion 3 X 50		**Material:** Continuity of function at one point **References:** *[1]. Spiegel, Murray R, Advanced Calculus, Schaum's Series, Mc. Graw Hill, Singapore, 1981*	0%
8	Midterm exam	Midterm exam	**Criteria:** Full marks are obtained if you do all the questions correctly **Form of Assessment** : Test	Midterm Exam 3 X 50			15%
9	Understand the definition and properties of derivatives and be able to find derivatives of various functions	1. Explain the definition of a derivative and the properties of a derivative 2. Explain derivatives with chain rules, higher order derivatives, implicit function derivatives and parameter function derivatives	**Criteria:** Full marks are obtained if you do all the questions correctly	Problem-based learning and discussion 3 X 50		**Material:** Derivation of various functions. **Library:** *[2]. Kreyzig Erwin, Advanced Engineering Mathematics, 7th Edition, John Wiley, 1993*	0%

10	Understand the definition and properties of derivatives and be able to find derivatives of various functions	1. Explain the definition of a derivative and the properties of a derivative 2. Explain derivatives with chain rules, higher order derivatives, implicit function derivatives and parameter function derivatives	**Criteria:** Full marks are obtained if you do all the questions correctly	Problem-based learning and discussion 3 X 50		**Material:** Derivation of various functions. **Library:** *[2]. Kreyzig Erwin, Advanced Engineering Mathematics, 7th Edition, John Wiley, 1993*	0%
11	Able to understand the application of the derivative of a function	Explain the application of the derivative of a function to the velocity of solid particles, liquid velocity, extreme values (maximum and minimum) and the associated rate of change.	**Criteria:** Full marks are obtained if you do all the questions correctly	Problem-based learning and discussion 3 X 50		**Material:** Application of the Derivative of a function **References:** *[3]. Paul A. Calter, MSME & Michael A. Calter, PH.D, Technical Mathematics with Calculus, 2011, John Willey & Sons Inc. Wesleyan University, United States of America*	25%
12	Able to understand the application of the derivative of a function	Explain the application of the derivative of a function to the velocity of solid particles, liquid velocity, extreme values (maximum and minimum) and the associated rate of change.	**Criteria:** Full marks are obtained if you do all the questions correctly **Form of Assessment** : Participatory Activities	Problem-based learning and discussion 3 X 50		**Material:** Application of the Derivative of a function **References:** *[3]. Paul A. Calter, MSME & Michael A. Calter, PH.D, Technical Mathematics with Calculus, 2011, John Willey & Sons Inc. Wesleyan University, United States of America*	25%
13	Solve integrals of various functions and techniques in integration. Able to solve integrals with boundary conditions	Integral analysis of various functions and techniques in integration	**Criteria:** Full marks are obtained if you do all the questions correctly	Problem-based learning and discussion 3 X 50		**Material:** Integrals of various functions and techniques in integration. **Reference:** *[4]. Huw Fox & W. Bolton, Mathematics for Engineers and Technologists, 2002, Elsevier Science & Technology Books, ISBN: 0750655445*	0%
14	Solve integrals of various functions and techniques in integration. Able to solve integrals with boundary conditions	Integral analysis of various functions and techniques in integration	**Criteria:** Full marks are obtained if you do all the questions correctly	Problem-based learning and discussion 3 X 50		**Material:** Integrals of various functions and techniques in integration. **Reference:** *[4]. Huw Fox & W. Bolton, Mathematics for Engineers and Technologists, 2002, Elsevier Science & Technology Books, ISBN: 0750655445*	0%

15	Able to apply Certain Integrals to calculate Area of Land, Volume of Rotating Objects, arc length, skin area of rotating objects, center of gravity and moment of inertia	Calculating the Area of a Rotating Object, Volume of a Rotating Object, arc length, skin area of a rotating object, center of gravity and moment of inertia	**Criteria:** Full marks are obtained if you do all the questions correctly **Form of Assessment** : Portfolio Assessment	Problem-based learning and discussion 3 X 50		**Material:** Applying Certain Integrals to calculate Area of Land, Volume of Rotating Objects, arc length, skin area of rotating objects, center of gravity and moment of inertia **References:** *[1]. Spiegel, Murray R, Advanced Calculus, Schaum's Series, Mc. Graw Hill, Singapore, 1981*	15%
16			**Form of Assessment** : Test				20%

Evaluation Percentage Recap: Case Study

No	Evaluation	Percentage
1.	Participatory Activities	50%
2.	Portfolio Assessment	15%
3.	Test	35%
		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.