	Universitas Negeri Surabaya Faculty of Mathematics and Natural Sciences Undergraduate Mathematics Study Program	Document Code

SEMESTER LEARNING PLAN

Courses	CODE	Course Family	Credit Weight			SEMESTER	Compilation Date
Differential Calculus	4420104051	Compulsory Study Program Subjects	T=4	P=0	ECTS=6.36	1	July 17, 2024

AUTHORIZATION	SP Developer	Course Cluster Coordinator	Study Program Coordinator
	.....	.....	Prof. Dr. Raden Sulaiman, M.Si.

Learning model	**Project Based Learning**	
Program Learning Outcomes (PLO)	**PLO study program that is charged to the course**	
	Program Objectives (PO)	
	PO - 1	Able to generalize concepts related to the real number system, real functions, limits and continuity, derivatives of a real function, transcendent functions and their derivatives, limits of indefinite forms, Taylor series and Maclaurin series
	PO - 2	Able to identify and explain simple problems related to the real number system, real functions, limits and continuity, derivatives of a real function, transcendent functions and their derivatives, limits of indefinite forms, Taylor series and Maclaurin series
	PO - 3	Generalize the ideas used to complete tasks related to the concepts of the real number system, real functions, limits and continuity, derivatives of a real function, transcendent functions and their derivatives, limits of indefinite forms, Taylor series and Maclaurin series and be able to communicate orally or in writing
	PO - 4	Able to formulate and solve fundamental mathematical problems related to the real number system, real functions, limits and continuity, derivatives of real functions, transcendent functions and their derivatives, limits of indefinite forms, Taylor series and Maclaurin series
	PO - 5	Able to use solution search methods in solving mathematical problems related to the real number system, real functions, limits and continuity, derivatives of a real function, transcendent functions and their derivatives, limits of indefinite forms, Taylor series and Maclaurin series
	PO - 6	Able to implement solution search methods related to real number systems, real functions, limits and continuity, derivatives of real functions, transcendent functions and their derivatives, limits of indefinite forms, Taylor series and Maclaurin series using the help of Geogebra, Maple or mathematica.
	PO - 7	Able to complete tasks within the specified time
	PLO-PO Matrix	

P.O
PO-1
PO-2
PO-3
PO-4
PO-5
PO-6
PO-7

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																
PO-4																
PO-5																
PO-6																
PO-7																

Short Course Description	Studying the real number system, real functions, limits and continuity, derivatives of real functions and their uses, transcendent functions and their derivatives, limits of irregular forms, Taylor and Maclaurin series, applying these concepts to the problem of determining asymptotes function graphs, optimization problems and determining the approach to a function at a point through hybrid learning that activates students (independent study, discussion and question and answer), both offline and online using the Vinesa LMS.
References	**Main :** 1. Thomas Jr., G. B., Hass, J., Heil C., & Weir, M.D., et.al. 2018. Thomas, Calculus 14th Edition (Revised) . Boston: Pearson 2. Purcell, E.J., Varberg, D., and Rigdon, S.E. 2007 . Calculus 9th Edition . Ontario: Pearson, Prentice Hall **Supporters:** 1. Stewart, J. 2020. Calculus: Early Transcendental 9th Edition. Boston: Cengage Learning 2. Adams, R. A. 2017. Calculus: A Complete Course, 9th Edition. Ontario: Pearson 3. Abadi & Wintarti, A. 2014 (in press). Kalkulus, Buku 1. Surabaya 4. Moesono, D. 1994. Kalkulus I (Edisi Revisi). Surabaya: University Press Surabaya
Supporting lecturer	Dr. Abadi, M.Sc. Dr. Dian Savitri, S.Si., M.Si. Yuliani Puji Astuti, S.Si., M.Si. Rudianto Artiono, S.Pd., M.Si. Dwi Nur Yunianti, S.Si., M.Sc. Budi Priyo Prawoto, S.Pd., M.Si. Dayat Hidayat, S.Pd., M.Pd., M.Si. Riska Wahyu Romadhonia, S.Si., 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	1. Understand the real number system and inequalities 2. Understand the definition of interval 3. Obtaining solutions to inequalities on the set of real numbers	1. Explain the properties of Real Numbers 2. Understand the definition of intervals in the real number system 3. Solve inequalities and get solutions on the set of Real numbers	**Criteria:** Attached **Form of Assessment** : Test	Hybrid learning with a collaborative approach and independent work. 200		**Material:** Real number systems and real functions **References:** *Thomas Jr., GB, Hass, J., Heil C., & Weir, MD, et.al. 2018. Thomas, Calculus 14th Edition (Revised). Boston: Pearson*	2%

2	1. Understanding Real Functions, Domains and Function Ranges 2. Sketching Function graphs manually or with the help of software 3. Understand composition and inverse functions 4. Complete assignments according to the specified time 5. Presenting the results of the assignment	1. Determine various types of functions including transcendent functions 2. Determining the Function Domain and Range 3. Drawing Function Graphs 4. Find the condition that two functions are mutually inverse 5. Transforming functions through function composition	**Criteria:** Attached **Form of Assessment** : Participatory Activities, Tests	Hybrid learning with a collaborative approach and independent work. 200		**Material:** Domain and Range of Functions, Graphs of Functions, Composition of functions, Inverse of a Function, Transformation of functions **References:** *Thomas Jr., GB, Hass, J., Heil C., & Weir, MD, et.al. 2018. Thomas, Calculus 14th Edition (Revised). Boston: Pearson*	2%
3	1. Understanding Real Functions, Domains and Function Ranges 2. Sketching Function graphs manually or with the help of software 3. Understand composition and inverse functions 4. Complete assignments according to the specified time 5. Presenting the results of the assignment	1. Determine various types of functions including transcendent functions 2. Determining the Function Domain and Range 3. Drawing Function Graphs 4. Find the condition that two functions are mutually inverse 5. Transforming functions through function composition	**Criteria:** Attached **Form of Assessment** : Participatory Activities, Tests	Hybrid learning with a collaborative approach and independent work. 200		**Material:** Domain and Range of Functions, Graphs of Functions, Composition of functions, Inverse of a Function, Transformation of functions **References:** *Thomas Jr., GB, Hass, J., Heil C., & Weir, MD, et.al. 2018. Thomas, Calculus 14th Edition (Revised). Boston: Pearson*	2%
4	1. Determining the limit of the function at a point 2. Determining whether a function is continuous or discontinuous at a point c. 3. Defines a new function for a discontinuous function that can be eliminated	1. Determining the limit of the function at a point 2. Determining whether a function is continuous or discontinuous at a point c 3. Defines a new function for a discontinuous function that can be eliminated	**Criteria:** Attached	Hybrid learning with a collaborative approach and independent work. 200		**Material:** Function Limits around point c. Continuity of function at point c. **References:** *Thomas Jr., GB, Hass, J., Heil C., & Weir, MD, et.al. 2018. Thomas, Calculus 14th Edition (Revised). Boston: Pearson*	2%
5	1. Determining the limit of the function at a point 2. Determining whether a function is continuous or discontinuous at a point c. 3. Defines a new function for a discontinuous function that can be eliminated	1. Determining the limit of the function at a point 2. Determining whether a function is continuous or discontinuous at a point c 3. Defines a new function for a discontinuous function that can be eliminated	**Criteria:** Attached **Form of Assessment** : Participatory Activities, Tests	Hybrid learning with a collaborative approach and independent work. 200		**Material:** Function Limits around point c. Continuity of function at point c. **References:** *Thomas Jr., GB, Hass, J., Heil C., & Weir, MD, et.al. 2018. Thomas, Calculus 14th Edition (Revised). Boston: Pearson*	2%

6	1. Understand function derivatives 2. Determine the derivatives of the given functions 3. Use the chain rule to solve derivatives of functions 4. Determine the tangent line equation and the normal equation 5. Obtaining derivatives of functions using software assistance 6. Complete tasks within the specified time	1. Understand function derivatives 2. Solving derivative problems of various functions: including implicit functions and transcendent functions 3. Use the chain rule to solve derivatives of functions 4. Determine the tangent line equation and the normal equation 5. Obtaining derivatives with the help of technology	**Criteria:** Attached **Form of Assessment** : Project Results Assessment / Product Assessment, Test	Hybrid learning with a collaborative approach and independent work. 200		**Material:** Derivatives of real functions, transcendent functions, and implicit functions Chain rule, tangent line equations and normal equations **References:** *Thomas Jr., GB, Hass, J., Heil C., & Weir, MD, et.al. 2018. Thomas, Calculus 14th Edition (Revised). Boston: Pearson*	2%
7	1. Understand function derivatives 2. Determine the derivatives of the given functions 3. Use the chain rule to solve derivatives of functions 4. Determine the tangent line equation and the normal equation 5. Obtaining derivatives of functions using software assistance 6. Complete tasks within the specified time	1. Understand function derivatives 2. Solving derivative problems of various functions: including implicit functions and transcendent functions 3. Use the chain rule to solve derivatives of functions 4. Determine the tangent line equation and the normal equation 5. Obtaining derivatives with the help of technology	**Criteria:** Attached **Form of Assessment** : Project Results Assessment / Product Assessment, Test	Hybrid learning with a collaborative approach and independent work. 200		**Material:** Derivatives of real functions, transcendent functions, and implicit functions Chain rule, tangent line equations and normal equations **References:** *Thomas Jr., GB, Hass, J., Heil C., & Weir, MD, et.al. 2018. Thomas, Calculus 14th Edition (Revised). Boston: Pearson*	2%
8	UTS	All indicators before UTS	**Criteria:** Attached **Form of Assessment** : Test	UTS 100		**Material:** Derivatives of real functions, transcendent functions, and implicit functions Chain rule, tangent line equations and normal equations **References:** *Thomas Jr., GB, Hass, J., Heil C., & Weir, MD, et.al. 2018. Thomas, Calculus 14th Edition (Revised). Boston: Pearson*	20%

9	1. Determining the critical point of the function 2. Determine extreme points and inflection points 3. Determining the concavity of a function through the first derivative test and the second derivative test 4. Sketching graphs of polynomial functions (CLO-3) with the help of software 5. Understand the related rates 6. Applying derivatives to solve simple problems 7. Complete tasks according to the specified time 8. Presenting the results of the assignment	1. Determining the critical point of the function 2. Determine extreme points and turning points 3. Determining the concavity of a function through first and second derivative tests 4. Sketch graphs of polynomial and rational functions 5. Understand the associated rates 6. Modeling and solving max/min problems	**Criteria:** Attached **Form of Assessment** : Practice / Performance	Hybrid learning with a collaborative approach and independent work. 200		**Material:** Critical points, extreme points, inflection points, concavity of functions, graphs of polynomial functions, related rates, simple mathematical modeling **References:** *Thomas Jr., GB, Hass, J., Heil C., & Weir, MD, et .al. 2018. Thomas, Calculus 14th Edition (Revised). Boston: Pearson*	5%
10	1. Determining the critical point of the function 2. Determine extreme points and inflection points 3. Determining the concavity of a function through the first derivative test and the second derivative test 4. Sketching graphs of polynomial functions (CLO-3) with the help of software 5. Understand the related rates 6. Applying derivatives to solve simple problems 7. Complete tasks according to the specified time 8. Presenting the results of the assignment	1. Determining the critical point of the function 2. Determine extreme points and turning points 3. Determining the concavity of a function through first and second derivative tests 4. Sketch graphs of polynomial and rational functions 5. Understand the associated rates 6. Modeling and solving max/min problems	**Criteria:** Attached **Forms of Assessment** : Participatory Activities, Project Results Assessment / Product Assessment	Hybrid learning with a collaborative approach and independent work. 200		**Material:** Critical points, extreme points, inflection points, concavity of functions, graphs of polynomial functions, related rates, simple mathematical modeling **References:** *Thomas Jr., GB, Hass, J., Heil C., & Weir, MD, et .al. 2018. Thomas, Calculus 14th Edition (Revised). Boston: Pearson*	5%

11	1. Determining the critical point of the function 2. Determine extreme points and inflection points 3. Determining the concavity of a function through the first derivative test and the second derivative test 4. Sketching graphs of polynomial functions (CLO-3) with the help of software 5. Understand the related rates 6. Applying derivatives to solve simple problems 7. Complete tasks according to the specified time 8. Presenting the results of the assignment	1. Determining the critical point of the function 2. Determine extreme points and turning points 3. Determining the concavity of a function through first and second derivative tests 4. Sketch graphs of polynomial and rational functions 5. Understand the associated rates 6. Modeling and solving max/min problems	**Criteria:** Attached **Form of Assessment** : Participatory Activities	Hybrid learning with a collaborative approach and independent work. 200		**Material:** Critical points, extreme points, inflection points, concavity of functions, graphs of polynomial functions, related rates, simple mathematical modeling **References:** *Thomas Jr., GB, Hass, J., Heil C., & Weir, MD, et .al. 2018. Thomas, Calculus 14th Edition (Revised). Boston: Pearson*	6%
12	1. Determining the limit of indefinite form 2. Solving limit problems of indefinite form 3. Understanding l'Hôpital's theorem 4. Solving limit problems of indefinite form using l'Hôpital's theorem 5. Complete tasks on time	1. Solving limits of the form 0/0 and ∞/∞ 2. Solving limits of the form 0·∞ 3. Solving limits of the form ∞·∞ 4. Solving limits of the form 0·0, 0^∞, and ∞^0 5. Solving limit problems of indefinite form using l'Hôpital's theorem	**Criteria:** Attached **Form of Assessment** : Participatory Activities	Hybrid learning with a collaborative approach and independent work. 200		**Material:** Limits of indefinite forms **References:** *Thomas Jr., GB, Hass, J., Heil C., & Weir, MD, et.al. 2018. Thomas, Calculus 14th Edition (Revised). Boston: Pearson*	6%
13	1. Determining the limit of indefinite form 2. Solving limit problems of indefinite form 3. Understanding l'Hôpital's theorem 4. Solving limit problems of indefinite form using l'Hôpital's theorem 5. Complete tasks on time	1. Solving limits of the form 0/0 and ∞/∞ 2. Solving limits of the form 0·∞ 3. Solving limits of the form ∞·∞ 4. Solving limits of the form 0·0, 0^∞, and ∞^0 5. Solving limit problems of indefinite form using l'Hôpital's theorem	**Criteria:** Attached **Form of Assessment** : Participatory Activities, Practice/Performance	Hybrid learning with a collaborative approach and independent work. 200		**Material:** Limits of indefinite forms **References:** *Thomas Jr., GB, Hass, J., Heil C., & Weir, MD, et.al. 2018. Thomas, Calculus 14th Edition (Revised). Boston: Pearson*	6%

14	1.Understand Taylor series and/or Maclaurin series 2.Changing the function into a Taylor series and/or Maclaurin series form 3.Using the Taylor series and/or Maclaurin series in a value approach problem	1.Converting the function to Taylor and/or Maclaurin series form 2.Using the Taylor and/or Maclaurin series in an approximate value problem	**Criteria:** Attached **Form of Assessment** : Participatory Activities, Practice/Performance	Hybrid learning with a collaborative approach and independent work. 200		**Material:** Taylor Series and Maclaurin Series **References:** *Thomas Jr., GB, Hass, J., Heil C., & Weir, MD, et.al. 2018. Thomas, Calculus 14th Edition (Revised). Boston: Pearson*	6%
15	1.Understand Taylor series and/or Maclaurin series 2.Changing the function into a Taylor series and/or Maclaurin series form 3.Using the Taylor series and/or Maclaurin series in a value approach problem	1.Converting the function to Taylor and/or Maclaurin series form 2.Using the Taylor and/or Maclaurin series in an approximate value problem	**Criteria:** Attached **Form of Assessment** : Participatory Activities, Practice/Performance	Hybrid learning with a collaborative approach and independent work. 200		**Material:** Taylor Series and Maclaurin Series **References:** *Thomas Jr., GB, Hass, J., Heil C., & Weir, MD, et.al. 2018. Thomas, Calculus 14th Edition (Revised). Boston: Pearson*	2%
16	UAS	All indicators before UAS	**Criteria:** Attached **Form of Assessment** : Test	UAS 100		**Material:** All material before UAS **References:** *Thomas Jr., GB, Hass, J., Heil C., & Weir, MD, et.al. 2018. Thomas, Calculus 14th Edition (Revised). Boston: Pearson*	30%

Evaluation Percentage Recap: Project Based Learning

No	Evaluation	Percentage
1.	Participatory Activities	24.5%
2.	Project Results Assessment / Product Assessment	4.5%
3.	Practice / Performance	12%
4.	Test	57%
		98%

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.