	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 2	2120104117	Compulsory Curriculum Subjects - National	T=3	P=0	ECTS=4.77	2	April 30, 2023

AUTHORIZATION	SP Developer	Course Cluster Coordinator	Study Program Coordinator
	Handini Novita Sari, S.Pd., M.T. ; Ika Nurjannah, S.Pd., M.T. ; Tri Hartutuk Ningsih, 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	Students are able to understand, analyze and solve the use of certain integrals to find area, content, arc length, center of gravity, moment of inertia, double integrals, matrices, systems of linear equations and their applications.
	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	Use of specific integrals to find area, volume, arc length, center of gravity, moment of inertia, double integrals, matrices, systems of linear equations and their applications.	
References	**Main :**	

1. Baisuni , MH , 1986 , Kalkulus , Jakarta : Universitas Indonesia
2. Purcell dan Verberg,1992,Kalkulus dan Geometri Analitis, Jakarta : Erlangga.
3. Stroud, KA, 1989, Matematika untuk Teknik, Alih bahasa: Erwin Sucipto, Jakarta Erlangga.
4. Verberg, Purcell, Rigdon, 2007, Kalkulus, Jakarta : Erlangga.

	Supporters:	
Supporting lecturer	Ika Nurjannah, S.Pd., M.T. Handini Novita Sari, S.Pd., 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	Students are able to communicate their understanding of integral applications: area and volume of rotating objects	Students can: · Explain indefinite integrals · Explain the basis and properties of integrals · Explain integration techniques · Explain substitution integrals · Explain trigonometric substitution integrals Explain partial integrals & integrals of rational split functions.	**Criteria:** Full marks are obtained if you do all the questions correctly. **Form of Assessment** : Participatory Activities	Lectures, discussions, questions and answers 3 X 50		**Material:** Integral applications **References:** *Baisuni, MH, 1986, Calculus, Jakarta: University of Indonesia* **Material:** Integral applications **Reader:** *Purcell and Verberg, 1992, Calculus and Analytical Geometry, Jakarta: Erlangga.*	5%
2	Students are able to communicate their understanding of integral applications: area and volume of rotating objects	Students can: · Explain indefinite integrals · Explain the basis and properties of integrals · Explain integration techniques · Explain substitution integrals · Explain trigonometric substitution integrals Explain partial integrals & integrals of rational split functions.	**Criteria:** Full marks are obtained if you do all the questions correctly. **Form of Assessment** : Participatory Activities	Lectures, discussions, questions and answers 3 X 50		**Material:** Integral applications **References:** *Baisuni, MH, 1986, Calculus, Jakarta: University of Indonesia* **Material:** Integral applications **Reader:** *Purcell and Verberg, 1992, Calculus and Analytical Geometry, Jakarta: Erlangga.*	5%
3	Students are able to communicate their understanding of integral applications: Curve length and surface area of rotating objects	Students can: · Explain and calculate the length of a curve and the surface area of a rotating object	**Criteria:** Completeness of the analysis results report **Form of Assessment** : Participatory Activities, Practice/Performance	Lectures, discussions, questions and answers. 3 X 50		**Material:** Integral applications **References:** *Baisuni, MH, 1986, Calculus, Jakarta: University of Indonesia* **Material:** Integral applications **Bibliography:** *Stroud, KA, 1989, Mathematics for Engineering, Translation: Erwin Sucipto, Jakarta Erlangga.* **Material:** Integral applications **Bibliography:** *Stroud, KA, 1989, Mathematics for Engineering, Translation: Erwin Sucipto, Jakarta Erlangga.*	5%

4	Students are able to communicate their understanding of integral applications: Curve length and surface area of rotating objects	Students can: · Explain and calculate fluid work and forces	**Criteria:** Completeness of the analysis results report **Form of Assessment** : Participatory Activities, Practice/Performance	Lectures, discussions, questions and answers. 3 X 50		**Material:** Integral applications **References:** *Baisuni, MH, 1986, Calculus, Jakarta: University of Indonesia* **Material:** Integral applications **Bibliography:** *Stroud, KA, 1989, Mathematics for Engineering, Translation: Erwin Sucipto, Jakarta Erlangga.* **Material:** Integral applications **Bibliography:** *Stroud, KA, 1989, Mathematics for Engineering, Translation: Erwin Sucipto, Jakarta Erlangga.*	5%
5	Students are able to communicate their understanding of integral applications: Moment and center of mass	Students can: · Explain and calculate moments and center of mass	**Criteria:** Completeness of the analysis results report **Form of Assessment** : Participatory Activities, Practice/Performance	Lectures, discussions, questions and answers. 3 X 50		**Material:** Integral applications **References:** *Baisuni, MH, 1986, Calculus, Jakarta: University of Indonesia* **Material:** Integral applications **Bibliography:** *Stroud, KA, 1989, Mathematics for Engineering, Translation: Erwin Sucipto, Jakarta Erlangga.* **Material:** Integral applications **Reader:** *Purcell and Verberg, 1992, Calculus and Analytical Geometry, Jakarta: Erlangga.*	5%

6	Students are able to communicate their understanding of integration techniques: Partial integrals, Integral trigonometric functions, Rational substitution, Integral rational functions	Students can: · Explain partial integrals, integrals of trigonometric functions, rationalizing substitutions, integrals of rational functions, calculating examples of partial integrals, integrals of trigonometric functions, rationalizing substitutions, integrals of rational functions	**Criteria:** indefinite integral **Form of Assessment** : Participatory Activities	Lectures, discussions, questions and answers. 3 X 50		**Material:** Integration techniques **References:** *Verberg, Purcell, Rigdon, 2007, Calculus, Jakarta : Erlangga.* **Material:** Integration techniques **Bibliography:** *Baisuni, MH, 1986, Calculus, Jakarta: University of Indonesia*	5%
7	Students are able to communicate their understanding of integration techniques: Partial integrals, Integral trigonometric functions, Rational substitution, Integral rational functions	Students can: · Explain partial integrals, integrals of trigonometric functions, rationalizing substitutions, integrals of rational functions, calculating examples of partial integrals, integrals of trigonometric functions, rationalizing substitutions, integrals of rational functions	**Criteria:** indefinite integral **Form of Assessment** : Participatory Activities	Lectures, discussions, questions and answers. 3 X 50		**Material:** Integration techniques **References:** *Verberg, Purcell, Rigdon, 2007, Calculus, Jakarta : Erlangga.* **Material:** Integration techniques **Bibliography:** *Baisuni, MH, 1986, Calculus, Jakarta: University of Indonesia*	5%
8	USS (attached)	USS (attached)	**Criteria:** USS (attached) **Form of Assessment** : Practice / Performance	USS (attached) 3 X 50		**Material:** Material at meetings 1-7 **References:** *Purcell and Verberg, 1992, Calculus and Analytical Geometry, Jakarta : Erlangga.* **Material:** Material at meetings 1-7 **References:** *Stroud, KA, 1989, Mathematics for Engineering, Translation: Erwin Sucipto, Jakarta Erlangga.*	15%

9	Students are able to communicate their understanding of TRANSCENDENT FUNCTIONS: Natural logarithm function, Inverse function and its derivatives, Natural exponential function	Full marks are obtained if you do all the questions correctly	**Criteria:** Students are able to analyze and work on TRANSCENDENT FUNCTION problems: Natural logarithm function, Inverse function and its derivatives, Natural exponential function **Form of Assessment** : Participatory Activities	Lectures, discussions and questions and answers 3x50		**Material:** Natural logarithm function, inverse function and its derivatives, natural exponential function **Reference:** *Stroud, KA, 1989, Mathematics for Engineering, Translation: Erwin Sucipto, Jakarta Erlangga.* **Material:** Natural logarithm function, inverse function and its derivatives, natural exponential function **Reference:** *Verberg, Purcell, Rigdon, 2007, Calculus, Jakarta : Erlangga.*	5%

10	Students are able to communicate their understanding of general exponential and logarithmic functions, inverse trigonometric functions and their derivatives, hyperbolic functions and their inverse	Full marks are obtained if you do all the questions correctly	**Criteria:** able to analyze and work on function problems, general exponential and logarithmic functions, inverse trigonometric functions and their derivatives, hyperbolic functions and their inverse **Form of Assessment** : Participatory Activities	Lectures, discussions and questions and answers 3x50		**Material:** Integral Applications **Library:** *Verberg, Purcell, Rigdon, 2007, Calculus, Jakarta : Erlangga.* **Material:** General exponential and logarithmic functions, inverse trigonometric functions and their derivatives, hyperbolic functions and their inverses **References:** *Stroud, KA, 1989, Mathematics for Engineering, Translation: Erwin Sucipto, Jakarta Erlangga.* **Material:** General exponential and logarithmic functions, inverse trigonometric functions and their derivatives, hyperbolic functions and their inverses **References:** *Verberg, Purcell, Rigdon, 2007, Calculus, Jakarta : Erlangga.*	5%

11	Students are able to communicate their understanding of SYSTEMS OF LINEAR EQUATIONS: Introduction to the concept of linear algebra in engineering, Introduction to Linear Press Systems, Gauss-Jordan Elimination	Full marks are obtained if you do all the questions correctly	**Criteria:** able to analyze and work on SYSTEMS OF LINEAR EQUATIONS problems: Introduction to the concept of linear algebra in engineering, Introduction to Linear Press Systems, Gauss-Jordan Elimination **Form of Assessment** : Participatory Activities	Lectures, discussions and questions and answers 3x50		**Material:** Integral Applications **Library:** *Verberg, Purcell, Rigdon, 2007, Calculus, Jakarta : Erlangga.* **Material:** SYSTEMS OF LINEAR EQUATIONS **Reference:** *Stroud, KA, 1989, Mathematics for Engineering, Translation: Erwin Sucipto, Jakarta Erlangga.* **Material:** SYSTEMS OF LINEAR EQUATIONS **Reference:** *Verberg, Purcell, Rigdon, 2007, Calculus, Jakarta : Erlangga.*	5%
12	Students are able to communicate their understanding of matrices and matrix operations, matrix algebra, inverse matrices	Full marks are obtained if you do all the questions correctly.	**Criteria:** able to analyze and work on matrix problems and matrix operations, matrix algebra, inverse matrices **Form of Assessment** : Participatory Activities	Lectures, discussions and questions and answers 3x50		**Material:** Matrix and Matrix operations Matrix Algebra, Inverse Matrix **Reference:** *Stroud, KA, 1989, Mathematics for Engineering, Translation: Erwin Sucipto, Jakarta Erlangga.* **Material:** Matrices and Matrix operations Matrix Algebra, Inverse Matrix **References:** *Verberg, Purcell, Rigdon, 2007, Calculus, Jakarta : Erlangga.*	10%

13	Students are able to communicate their understanding of Elementary Matrices, how to find inverse matrices, Types of matrices	Full marks are obtained if you do all the questions correctly.	**Criteria:** able to analyze and work on Elementary Matrix problems, how to find inverse matrices, Types of matrices **Form of Assessment** : Participatory Activities	Lectures, discussions and questions and answers 3x50		**Material:** Integral Applications **Library:** *Verberg, Purcell, Rigdon, 2007, Calculus, Jakarta : Erlangga.* **Material:** Elementary Matrices, how to find inverse matrices, Types of matrices **Reference:** *Stroud, KA, 1989, Mathematics for Engineering, Translation: Erwin Sucipto, Jakarta Erlangga.* **Material:** Elementary Matrices, how to find inverse matrices, Types of matrices **Library:** *Verberg, Purcell, Rigdon, 2007, Calculus, Jakarta : Erlangga.*	10%
14	Students are able to communicate their understanding of infinite series, infinite series, positive term series and their convergence test, sign changing series and their convergence test.	Full marks are obtained if you do all the questions correctly.	**Criteria:** able to analyze and work on problems of infinite series, infinite series, positive term series and their convergence test, sign changing series and their convergence test. **Form of Assessment** : Participatory Activities	Lectures, discussions and questions and answers. 3x50		**Material:** Sequences and series **Bibliography:** *Stroud, KA, 1989, Mathematics for Engineering, Translation: Erwin Sucipto, Jakarta Erlangga.* **Material:** Sequences and series **References:** *Verberg, Purcell, Rigdon, 2007, Calculus, Jakarta : Erlangga.*	5%

15	Students are able to communicate their understanding of power series and their operations, Taylor and Mc Laurin series, Taylor approximation for functions	Full marks are obtained if you do all the questions correctly	**Criteria:** able to analyze and work on power series problems and their operations, Taylor and Mc Laurin series, Taylor approximation for functions **Form of Assessment** : Participatory Activities	Lectures, discussions and questions and answers 3x50		**Material:** Sequences and series **Bibliography:** *Stroud, KA, 1989, Mathematics for Engineering, Translation: Erwin Sucipto, Jakarta Erlangga.* **Material:** Sequences and series **References:** *Verberg, Purcell, Rigdon, 2007, Calculus, Jakarta : Erlangga.*	10%
16	Able to answer all questions correctly and on time	Able to answer all questions correctly and on time	**Criteria:** Full marks are obtained if you are able to answer all questions correctly	Final Semester Examination (UAS) 3x50		**Material:** All material at meeting 9-15 **References:** *Baisuni, MH, 1986, Calculus, Jakarta: University of Indonesia* **Material:** All material at meeting 9-15 **References:** *Verberg, Purcell, Rigdon, 2007, Calculus, Jakarta : Erlangga.* **Material:** All material at meeting 9-15 **Reader:** *Stroud, KA, 1989, Mathematics for Engineering, Translation: Erwin Sucipto, Jakarta Erlangga.* **Material:** All material at meeting 9-15 **References:** *Purcell and Verberg, 1992, Calculus and Analytical Geometry, Jakarta : Erlangga.*	15%

Evaluation Percentage Recap: Case Study

No	Evaluation	Percentage
1.	Participatory Activities	77.5%
2.	Practice / Performance	22.5%
		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.