	Universitas Negeri Surabaya Faculty of Engineering, Electrical Engineering Undergraduate Study Program	Document Code

SEMESTER LEARNING PLAN

Courses	CODE	Course Family	Credit Weight			SEMESTER	Compilation Date
Engineering Mathematics II	2020103078		T=3	P=0	ECTS=4.77	3	July 17, 2024

AUTHORIZATION	SP Developer	Course Cluster Coordinator	Study Program Coordinator
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Learning model	**Case Studies**	
Program Learning Outcomes (PLO)	**PLO study program that is charged to the course**	
	Program Objectives (PO)	
	PO - 1	Able to apply basic knowledge of engineering mathematics II to gain a thorough understanding of engineering principles
	PO - 2	Able to communicate effectively both orally and in writing regarding basic topics in engineering mathematics II
	PO - 3	Able to apply basic engineering mathematics II methods and skills needed to solve problems in the engineering field
	PO - 4	Able to work in cross-disciplinary and cultural arts teams
	PO - 5	Able to understand the need for lifelong learning in the field of engineering mathematics II which is related to relevant current issues
	PO - 6	Students can understand the relationship between natural logarithms and exponentials Students can understand and be able to solve the use of exponentials in everyday problems (estimating population growth and decay) and also make diagrams
	PO - 7	Students can understand complex number systems in general. Students can analyze and solve algebraic problems of complex numbers and their equation functions and properties.
	PO - 8	Able to solve midterm exam questions according to the material from meetings 1 to 7
	PO - 9	Students can understand the conjugation of complex number equation functions and their algebraic properties Students can analyze and solve problems of the conjugation of complex number equation functions and their algebraic properties
	PO - 10	Students can understand the Argand diagram. Students can analyze and solve complex number functions on the Argand diagram
	PO - 11	Students can understand polar coordinates of complex numbers and their application to Euler's formula. Students can analyze and solve problems with polar coordinates of complex numbers and their application to Euler's formula
	PO - 12	Students can understand the modulus of complex numbers and their properties Students can analyze and solve problems with the modulus of complex numbers and the properties of the modulus of complex numbers
	PO - 13	Students can understand the de Moivre formula and the roots of complex numbers
	PO - 14	Students can understand Legendre's differential equations and their algebraic operations. Students can analyze and solve Legendre differential equation problems and algebraic operations
	PO - 15	Students can understand one-sided limits. Students can analyze and solve one-sided limit problems
	PO - 16	Able to complete final semester exam questions according to the material from meetings 1 to 15
	PLO-PO Matrix	

P.O
PO-1
PO-2
PO-3
PO-4
PO-5
PO-6
PO-7
PO-8
PO-9
PO-10
PO-11
PO-12
PO-13
PO-14
PO-15
PO-16

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																
PO-8																
PO-9																
PO-10																
PO-11																
PO-12																
PO-13																
PO-14																
PO-15																
PO-16																

Short Course Description	Through this lecture, students can explain and differentiate Multivariable Functions (Partial Derivatives, solving double and triple Integrals and their applications), Ordinary Differential Equations, z transformations, and furrier transformations using the case method learning model in lectures.
References	**Main :**

1. Mursita, Danang. 2011. Matematika untuk Perguruan Tinggi. Bandung: Rekayasa Sains
2. K A Stroud. 2015. Matematika untuk Teknik. Bandung: Erlangga
3. Xin-She Yang. 2017. Engineering Mathematics with Examples and Applications. Middlesex University. School of Science and Technology. London, United Kingdom
4. Alan Jeffrey. 2002. Advanced Engineering Mathematics. University of Newcastle-upon-Ttyne. Harcourt/Academic Press

Supporters:

1. Kreyszig. Erwin. 1993. Matematika Teknik Lanjutan. Edisi-6, buku 1. Jakarta: Gramedia Pustaka Utama
2. Pepes Louis A & Harvill Lawrence R. 1985. Applied Mathematics for Engineering and physics. McGraw Hill.

Supporting lecturer	Dr. Ir. Achmad Imam Agung, M.Pd. Ibrohim, S.T., M.T. Dr. Nurhayati, 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	Students can understand differential equations of order 1 and order 2. Students can analyze and be able to solve problems with differential equations of order 1 and order 2.	Students can understand, analyze, and be able to solve problems of first order and second order differential equations	**Criteria:** 1.Value Criteria: 2.Excellent: 90 to 100; Very Good: 76 to 89; Average: 56 to 75; Below average: 0 to 55 **Form of Assessment** : Participatory Activities	Approach: ScientificMethod: Questions and answers and assignmentsModel: CooperativeLearning Strategy: Assignments and Activeness during PBM 3 X 50		**Material:** Meeting material 1 **Reader:** *Mursita, Danang. 2011. Mathematics for Higher Education. Bandung: Science Engineering*	3%
2	Students can understand and be able to solve differential equations through direct integration. Students can understand and be able to solve differential equations through separation of variables	Students can understand and be able to solve differential equations through direct integration and separation of variables	**Criteria:** 1.Value Criteria: 2.Excellent: 90 to 100; Very Good: 76 to 89; Average: 56 to 75; Below average: 0 to 55 **Form of Assessment** : Participatory Activities	Approach: Scientific Method: Questions and answers and assignments Model: Cooperative Learning Strategy: Assignments, group assignments, Active during PBM 3 X 50		**Material:** Meeting material 2 **Literature:** *Mursita, Danang. 2011. Mathematics for Higher Education. Bandung: Science Engineering*	3%
3	Students can understand and be able to solve differential equations through substitution Students can understand and be able to solve differential equations through linear equations (Integral Factors)	Students can understand and be able to solve differential equations through substitution and linear equations (Integral Factors)	**Criteria:** 1.Value Criteria: 2.Excellent: 90 to 100; Very Good: 76 to 89; Average: 56 to 75; Below average: 0 to 55 **Form of Assessment** : Participatory Activities	Approach: Scientific Method: Questions and answers and assignments Model: Cooperative Learning Strategy: Assignments, group assignments, Active during PBM 3 X 50		**Material:** Meeting material 3 **Reader:** *KA Stroud. 2015. Mathematics for Engineering. Bandung: Erlangga*	3%
4	Students can understand Ordinary Differential Equations of Order n Constant Coefficient Students can analyze and solve problems of Ordinary Differential Equations of Order n Constant Coefficient	Students can understand, analyze and solve problems with Ordinary Differential Equations of Constant Order and Coefficient	**Criteria:** 1.Value Criteria: 2.Excellent: 90 to 100; Very Good: 76 to 89; Average: 56 to 75; Below average: 0 to 55 **Form of Assessment** : Participatory Activities	Approach: ScientificMethod: Questions and answers and assignmentsModel: CooperativeLearning Strategy: Assignments and Activeness during PBM 3 X 50		**Material:** Meeting material 4 **Reader:** *KA Stroud. 2015. Mathematics for Engineering. Bandung: Erlangga*	3%
5	Students can understand, analyze and complete the Homogeneous Constant Coefficient Second Order Linear SKPD Students can understand, analyze and complete the Constant Coefficient Homogeneous Second Order Linear SKPD	Students can understand, analyze and complete SUPD and SKPD Linear Second Order Homogeneous Constant Coefficients	**Criteria:** 1.Value Criteria: 2.Excellent: 90 to 100; Very Good: 76 to 89; Average: 56 to 75; Below average: 0 to 55 **Form of Assessment** : Participatory Activities	Approach: ScientificMethod: Questions and answers and assignmentsModel: CooperativeLearning Strategy: Assignments and Activeness during PBM 3 X 50		**Material:** Meeting material 5 **Reader:** *Mursita, Danang. 2011. Mathematics for Higher Education. Bandung: Science Engineering*	3%

6	Students can understand the relationship between natural logarithms and exponentials Students can understand and be able to solve the use of exponentials in everyday problems (estimating population growth and decay) and also make diagrams	Students can understand the relationship between natural logarithms and exponentials and are able to analyze and solve everyday exponential function problems (estimating population growth and decay) and also make diagrams.	**Criteria:** 1.Value Criteria: 2.Excellent: 90 to 100; Very Good: 76 to 89; Average: 56 to 75; Below average: 0 to 55 **Form of Assessment** : Participatory Activities	Approach: Scientific Method: Questions and answers and assignments Model: Cooperative Learning Strategy: Assignments, group assignments, Active during PBM 3 X 50		**Material:** Meeting material 6 **Reader:** *KA Stroud. 2015. Mathematics for Engineering. Bandung: Erlangga*	5%
7	Students can understand complex number systems in general Students can analyze and solve algebraic problems of complex numbers and their equation functions and properties	Students can understand complex number systems in general and can analyze and solve algebraic problems of complex numbers and their equation functions and properties.	**Criteria:** 1.Value Criteria: 2.Excellent: 90 to 100; Very Good: 76 to 89; Average: 56 to 75; Below average: 0 to 55 **Form of Assessment** : Participatory Activities	Approach: ScientificMethod: Questions and answers and assignmentsModel: CooperativeLearning Strategy: Assignments and Activeness during PBM 3 X 50		**Material:** Meeting material 7 **Reader:** *Kreyszig. Erwin. 1993. Advanced Engineering Mathematics. 6th edition, book 1. Jakarta: Gramedia Pustaka Utama*	5%
8	Able to solve midterm exam questions according to the material from meetings 1 to 7	Able to solve midterm exam questions according to the material from meetings 1 to 7	**Criteria:** 1.Value Criteria: 2.Excellent: 90 to 100; Very Good: 76 to 89; Average: 56 to 75; Below average: 0 to 55 **Form of Assessment** : Test	Approach: Scientific Method: Questions and answers and assignments Model: Cooperative Learning Strategy: Assignments, group assignments, Active during PBM 3 X 50		**Material:** Meeting material 1-7 **Reader:** *Kreyszig. Erwin. 1993. Advanced Engineering Mathematics. 6th edition, book 1. Jakarta: Gramedia Pustaka Utama*	20%
9	Students can understand the conjugation of complex number equation functions and their algebraic properties Students can analyze and solve problems of the conjugation of complex number equation functions and their algebraic properties	Students can understand the conjugation of complex number equation functions and their algebraic properties and can analyze and solve problems of the conjugation of complex number equation functions and their algebraic properties	**Criteria:** 1.Value Criteria: 2.Excellent: 90 to 100; Very Good: 76 to 89; Average: 56 to 75; Below average: 0 to 55 **Form of Assessment** : Participatory Activities	Approach: ScientificMethod: Questions and answers and assignmentsModel: CooperativeLearning Strategy: Assignments and Activeness during PBM 3 X 50		**Material:** Meeting material 9 **Reader:** *Kreyszig. Erwin. 1993. Advanced Engineering Mathematics. 6th edition, book 1. Jakarta: Gramedia Pustaka Utama*	3%
10	Students can understand the Argand diagram. Students can analyze and solve complex number functions on the Argand diagram	Students can understand Argand diagrams and can analyze and solve complex number functions on Argand diagrams	**Criteria:** 1.Value Criteria: 2.Excellent: 90 to 100; Very Good: 76 to 89; Average: 56 to 75; Below average: 0 to 55 **Form of Assessment** : Participatory Activities	Approach: ScientificMethod: Questions and answers and assignmentsModel: CooperativeLearning Strategy: Assignments and Activeness during PBM 3 X 50		**Material:** 10th meeting material **Bibliography:** *Pepes Louis A & Harvill Lawrence R. 1985. Applied Mathematics for Engineering and physics. McGraw Hill.*	3%

11	Students can understand polar coordinates of complex numbers and their application to Euler's formula. Students can analyze and solve problems with polar coordinates of complex numbers and their application to Euler's formula	Students can understand, analyze and solve complex number polar coordinate problems and their application to Euler's formula	**Criteria:** 1.Value Criteria: 2.Excellent: 90 to 100; Very Good: 76 to 89; Average: 56 to 75; Below average: 0 to 55 **Form of Assessment** : Participatory Activities	Approach: ScientificMethod: Questions and answers and assignmentsModel: CooperativeLearning Strategy: Assignments and Activeness during PBM 3 X 50		**Material:** Meeting material 11 **Reader:** *Xin-She Yang. 2017. Engineering Mathematics with Examples and Applications. Middlesex University. School of Science and Technology. London, United Kingdom*	3%
12	Students can understand the modulus of complex numbers and their properties Students can analyze and solve problems with the modulus of complex numbers and the properties of the modulus of complex numbers	Students can understand, analyze and solve complex number modulus problems and the properties of complex number modulus	**Criteria:** 1.Value Criteria: 2.Excellent: 90 to 100; Very Good: 76 to 89; Average: 56 to 75; Below average: 0 to 55 **Form of Assessment** : Participatory Activities	Approach: ScientificMethod: Questions and answers and assignmentsModel: CooperativeLearning Strategy: Assignments and Activeness during PBM 3 X 50		**Material:** Meeting material 12 **Reader:** *Alan Jeffrey. 2002. Advanced Engineering Mathematics. University of Newcastle-upon-Ttyne. Harcourt/Academic Press*	3%
13	Students can understand the de Moivre formula and the roots of complex numbers. Students can analyze and solve problems with the de Moivre equation and the roots of complex numbers	Students can understand, analyze and solve problems with the de Moivre equation and the roots of complex numbers	**Criteria:** 1.Value Criteria: 2.Excellent: 90 to 100; Very Good: 76 to 89; Average: 56 to 75; Below average: 0 to 55 **Form of Assessment** : Participatory Activities	Approach: ScientificMethod: Questions and answers and assignmentsModel: CooperativeLearning Strategy: Assignments and Activeness during PBM 3 X 50		**Material:** Meeting material 13 **Reader:** *Mursita, Danang. 2011. Mathematics for Higher Education. Bandung: Science Engineering*	3%
14	Students can understand Legendre's differential equations and their algebraic operations Students can analyze and solve problems with Legendre's differential equations and their algebraic operations	Students can understand, analyze and solve Legendre differential equation problems and their algebraic operations	**Criteria:** 1.Value Criteria: 2.Excellent: 90 to 100; Very Good: 76 to 89; Average: 56 to 75; Below average: 0 to 55 **Form of Assessment** : Participatory Activities	Approach: ScientificMethod: Questions and answers and assignmentsModel: CooperativeLearning Strategy: Assignments and Activeness during PBM 3 X 50		**Material:** Meeting material 14 **Bibliography:** *Kreyszig. Erwin. 1993. Advanced Engineering Mathematics. 6th edition, book 1. Jakarta: Gramedia Pustaka Utama*	5%
15	Students can understand one-sided limits. Students can analyze and solve one-sided limit problems	Students can understand, analyze and solve one-sided limit problems	**Criteria:** 1.Value Criteria: 2.Excellent: 90 to 100; Very Good: 76 to 89; Average: 56 to 75; Below average: 0 to 55 **Form of Assessment** : Participatory Activities	Approach: ScientificMethod: Questions and answers and assignmentsModel: CooperativeLearning Strategy: Assignments and Activeness during PBM 3 X 50		**Material:** Meeting material 15 **Reader:** *Mursita, Danang. 2011. Mathematics for Higher Education. Bandung: Science Engineering*	5%
16	Able to complete final semester exam questions according to the material from meetings 1 to 15	Able to complete final semester exam questions according to the material from meetings 1 to 15	**Criteria:** 1.Value Criteria: 2.Excellent: 90 to 100; Very Good: 76 to 89; Average: 56 to 75; Below average: 0 to 55 **Form of Assessment** : Test	Approach: Scientific Method: Questions and answers and assignments Model: Cooperative Learning Strategy: Assignments, group assignments, Active during PBM 3 X 50		**Material:** Meeting material 1-15 **Reader:** *Mursita, Danang. 2011. Mathematics for Higher Education. Bandung: Science Engineering*	30%

Evaluation Percentage Recap: Case Study

No	Evaluation	Percentage
1.	Participatory Activities	50%

2.	Test	50%
		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** abilities in the process and student learning outcomes are specific and measurable statements that identify the abilities 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.