	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
NUMERICAL METHODS	2020102297		T=0	P=0	ECTS=0	2	July 17, 2024

AUTHORIZATION	SP Developer	Course Cluster Coordinator	Study Program Coordinator
	.....	.....	Dr. Lusia Rakhmawati, S.T., M.T.

Learning model	**Case Studies**	
Program Learning Outcomes (PLO)	**PLO study program that is charged to the course**	
	PLO-5	Able to apply knowledge of mathematics, natural sciences, information technology, and engineering to gain a thorough understanding of the principles of electrical engineering
	PLO-8	Able to apply engineering principles, identify, formulate and analyze data/information to solve problems in the electrical field
	PLO-11	Able to plan, complete and evaluate tasks within the constraints that exist in the field of electrical engineering
	Program Objectives (PO)	
	PO - 1	CLO1-CPL-S2 Able to be responsible for solving electrical engineering problems using Numerical Methods
	PLO-PO Matrix	

P.O	PLO-5	PLO-8	PLO-11
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	This course describes modeling engineering problems in the form of mathematical models so that they can be solved using arithmetic operations. Apart from that, we also study the position of numerical methods in solving mathematical models of physical conditions and the types of problems that can be solved using numerical methods. This course also teaches the use and application of numerical methods in a computer program.	
References	**Main :**	
	1. Chapra, S.C., Canale, R.P. 2006. Numerical Methods for Engineers 5th ed. McGraw-Hill. 2. Soeharjo.1985. Analisa Numerik. 3. Munif, A., Prastyoko, A.1995. Penguasaan dan Penggunaan Metode Numerik. Guna Widya.	
	Supporters:	
Supporting lecturer	Prof. Dr. I Gusti Putu Asto Buditjahjanto, S.T., M.T. Dr. Nurhayati, S.T., M.T. Dr. Lilik Anifah, 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 are able to calculate the error of a numerical approximation	Students can solve error problems of a numerical approximation	**Criteria:** final result= 30% assignment 20% activeness 20% USS 20% UAS **Form of Assessment** : Participatory Activities	face to face, discussion, solving related questions, 3 X 50 assignments		**Material:** Error of a numerical approximation **References:** *Chapra, SC, Canale, RP 2006. Numerical Methods for Engineers 5th ed. McGraw-Hill.*	1%
2	Students understand about absolute error and relative error	Students can solve absolute and relative error problems	**Criteria:** Assessment score 0-100 **Form of Assessment** : Participatory Activities	face to face, discussion, problem solving, 3 X 50 assignments		**Material:** Absolute error and relative error **References:** *Chapra, SC, Canale, RP 2006. Numerical Methods for Engineers 5th ed. McGraw-Hill.*	2%
3	students understand the bisection method	Students can use numerical methods to solve nonlinear equations using the bisection method	**Criteria:** final result= 30% assignment 20% activeness 20% USS 20% UAS **Form of Assessment** : Participatory Activities	face to face, discussion, solving related questions, 3 X 50 assignments		**Material:** Method for two **References:** *Munif, A., Prastyoko, A.1995. Mastery and Use of Numerical Methods. Guna Widya.*	2%
4	students understand the false position method	Students can use numerical methods to solve nonlinear equations using the false position method	**Criteria:** final result= 30% assignment 20% activeness 20% USS 20% UAS **Form of Assessment** : Participatory Activities	face to face, discussions, solving related questions, program assignments and 3 X 50 simulations		**Material:** Regula Falsi **References:** *Chapra, SC, Canale, RP 2006. Numerical Methods for Engineers 5th ed. McGraw-Hill.*	2%
5	students understand the fixed point method	Students can use numerical methods to solve nonlinear equations using the fixed point method	**Criteria:** Scale assessment score 0-100 **Form of Assessment** : Test	face to face, discussions, solving related questions, program assignments and 3 X 50 simulations		**Material:** Roots of equations using Numerical Methods **References:** *Chapra, SC, Canale, RP 2006. Numerical Methods for Engineers 5th ed. McGraw-Hill.*	0%

6	Students understand Newton Raphson's method	· Students can explain the Gaussian elimination method to find the value of a variable · Students can use the Gaussian elimination method to find the value of a variable	**Criteria:** final result= 30% assignment 20% activeness 20% USS 20% UAS **Form of Assessment** : Practice / Performance	face to face, discussions, solving related questions, program assignments and 3 X 50 simulations		**Material:** Finding the roots of a quadratic equation using Numerical Methods **References:** *Chapra, SC, Canale, RP 2006. Numerical Methods for Engineers 5th ed. McGraw-Hill.*	10%
7	Students understand Newton Raphson's method	7.1. Inversion Matrix · Students can use the inversion matrix method to find roots · Students can explain the inversion matrix method to find roots 7.2. Iteration method · Students can use the Iteration method to find roots · Students can explain the Iteration method to find roots	**Criteria:** Scale assessment score 0-100 **Form of Assessment** : Participatory Activities	face to face, discussions, solving related questions, program assignments and 3 X 50 simulations		**Material:** Finding the roots of a quadratic equation using Numerical Methods **References:** *Chapra, SC, Canale, RP 2006. Numerical Methods for Engineers 5th ed. McGraw-Hill.* **Material:** Finding the roots of a quadratic equation using Numerical Methods **References:** *Chapra, SC, Canale, RP 2006. Numerical Methods for Engineers 5th ed. McGraw-Hill.*	10%

8	1.CLO1-CPL-S2 Able to be responsible for solving electrical engineering problems using Numerical Methods 2.CLO2-CPL-KU1 Able to analyze and interpret data to strengthen technical assessments using Numerical Methods 3.CLO3-CPL-KK2 Able to apply using Numerical Methods to solve problems in the engineering field 4.CLO4-CPL-P1 Able to apply knowledge of mathematics, natural sciences, information technology, and electrical engineering to gain a thorough understanding of engineering principles	Able to complete the case study given well and according to procedures	**Criteria:** final result= 30% assignment 20% activeness 20% USS 20% UAS **Form of Assessment** : Participatory Activities	Case Study 3 X 50		**Material:** Solving Electrical Engineering problems using Numerical Methods **References:** *Chapra, SC, Canale, RP 2006. Numerical Methods for Engineers 5th ed. McGraw-Hill.*	15%
9	students understand the Jacobi iteration method	Students can use numerical methods to solve linear equations using the Jacobi iteration method	**Criteria:** Scale assessment score 0-100 **Form of Assessment** : Participatory Activities	3 X 50		**Material:** Integration using Numerical Methods **References:** *Chapra, SC, Canale, RP 2006. Numerical Methods for Engineers 5th ed. McGraw-Hill.*	2%
10	students understand the Gaussian elimination method	Students can use numerical methods to solve linear equations using the Gaussian method	**Criteria:** Assessment score 0-100 **Form of Assessment** : Participatory Activities	3 X 50		**Material:** Gaussian Elimination **References:** *Chapra, SC, Canale, RP 2006. Numerical Methods for Engineers 5th ed. McGraw-Hill.*	11%
11	students understand the Gaussian elimination method	Able to solve problems using polynomial interpolation and Lagrange polynomial interpolation	**Criteria:** Scale assessment score 0-100 **Form of Assessment** : Test	3 X 50		**Material:** Polynomial interpolation **References:** *Chapra, SC, Canale, RP 2006. Numerical Methods for Engineers 5th ed. McGraw-Hill.*	5%

12	Students understand the Gauss-Seidel method	Students can use numerical methods to solve linear equations using the Gauss-Seidel method	**Criteria:** final result= 30% assignment 20% activeness 20% USS 20% UAS **Form of Assessment** : Test	face to face, discussions, solving related questions, program assignments and 3 X 50 simulations		**Material:** Gauss-seidel method **References:** *Chapra, SC, Canale, RP 2006. Numerical Methods for Engineers 5th ed. McGraw-Hill.*	5%
13	Students understand the Gauss-Seidel method	Students can use numerical methods to solve linear equations using the Gauss-Seidel method	**Criteria:** final result= 30% assignment 20% activeness 20% USS 20% UAS **Form of Assessment** : Test	face to face, discussions, solving related questions, program assignments and 3 X 50 simulations		**Material:** Gauss Seidel **Bibliography:** *Chapra, SC, Canale, RP 2006. Numerical Methods for Engineers 5th ed. McGraw-Hill.*	0%
14	Students understand and explain the principles of the Euler method and the Runge Kutta method	Students can use numerical methods to solve linear equations using the SOR method	**Criteria:** Scale assessment score 0-100 **Form of Assessment** : Test	face to face, discussions, solving related questions, program assignments and 3 X 50 simulations		**Material:** Euler method and Runge Kutta method **References:** *Chapra, SC, Canale, RP 2006. Numerical Methods for Engineers 5th ed. McGraw-Hill.*	5%
15	Students understand the SOR method	Students understand and explain the principles of differential estimation methods with finite differences	**Criteria:** Scale assessment score 0-100 **Form of Assessment** : Participatory Activities	face to face, discussions, solving related questions, program assignments and 3 X 50 simulations		**Material:** SOR Method **References:** *Chapra, SC, Canale, RP 2006. Numerical Methods for Engineers 5th ed. McGraw-Hill.*	10%

16	1. CLO1-CPL-S2 Able to be responsible for solving electrical engineering problems using Numerical Methods 2. CLO2-CPL-KU1 Able to analyze and interpret data to strengthen technical assessments using Numerical Methods 3. CLO3-CPL-KK2 Able to apply using Numerical Methods to solve problems in the engineering field 4. CLO4-CPL-P1 Able to apply knowledge of mathematics, natural sciences, information technology, and electrical engineering to gain a thorough understanding of engineering principles	Students are able to complete the case study given correctly and according to procedures	**Criteria:** final result= 30% assignment 20% activeness 20% USS 20% UAS **Form of Assessment** : Participatory Activities	case study 3 X 50		**Material:** Problem solving using Numerical Methods **References:** *Chapra, SC, Canale, RP 2006. Numerical Methods for Engineers 5th ed. McGraw-Hill.*	10%

Evaluation Percentage Recap: Case Study

No	Evaluation	Percentage
1.	Participatory Activities	65%
2.	Practice / Performance	10%
3.	Test	15%
		90%

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.