		Document Code
	Universitas Negeri Surabaya **Faculty of Mathematics and Natural Sciences,** **Mathematics Education Masters Study Program**	

SEMESTER LEARNING PLAN

Courses		CODE	Course Family	Credit Weight				SEMESTER	Compilation Date
Mathematical Modeling (Mathematical Modeling)		8410202162		T=2	P=0	ECTS=4.48		2	April 28, 2023

AUTHORIZATION	SP Developer	Course Cluster Coordinator	Study Program Coordinator
	Dr. Abadi	....	Dr. Agung Lukito, M.S.

Learning model	**Project Based Learning**

Program Learning Outcomes (PLO)	**PLO study program which is charged to the course**	
	PLO-11	Collaborate and be responsible professionally and ethically in completing mathematics and mathematics education tasks
	PLO-12	Able to work on and present problems in mathematics and mathematics education
	Program Objectives (PO)	
	PO - 1	understand the principles of modeling
	PO - 2	understand a mathematical model and its application.
	PO - 3	Able to explain the application of mathematical modeling in education
	PLO-PO Matrix	

P.O	PLO-11	PLO-12
PO-1		
PO-2		
PO-3		

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																

Short Course Description	This course provides students with insight, knowledge and skills in mathematical modeling of a phenomenon and its solution. The material coverage includes understanding mathematical models and models, stages of mathematical modeling, and mathematical modeling in mathematics learning. The lecture begins with an explanation of the concepts and principles of modeling, the use of modeling in solving problems, mathematical modeling in learning mathematics, and mathematical modeling as an approach to learning mathematics. Lectures are held in a hybrid manner, student assignments and discussions are based on existing examples. through individual and group assignment-based learning as well as presentation of study results.

References	**Main :**	
	1. Giordano F.R, Fox W.P, and Horton. S.B, 2014, A First Course in Mathematical Modeling, Fifth Edition, Brooks/Cole, Cengage Learning, Boston, MA 02210 USA 2. Mass, J., et.al. 2018. Mathematical Modelling for Teachers: A Practical Guide to Applicable Mathematics Education. Cham: Switzerland.	
	Supporters:	

	1. Meyer W.J, 1984, Consepts of Mathematical Modeling, Dover Publications, inc. Mineola, New York. 2. PISA Mathematics Framework 2022 3. Blum & Ferri (2009) Mathematical Modelling: Can it be Taught and Learnt. 4. Design research in statistics education On symbolizing and computer tools 5. STEM Education						
Supporting lecturer	Dr. Abadi, 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	understand modeling principles	1.explains the modeling stages 2.Give examples of problems that can be created mathematical models 3.transform the problem in the form of a mathematical model	**Form of Assessment** : Participatory Activities	Expository, Discussion and question and answer 2 x 50		**Material:** Principles of mathematical modeling **References:** *Giordano FR, Fox WP, and Horton. SB, 2014, A First Course in Mathematical Modeling, Fifth Edition, Brooks/Cole, Cengage Learning, Boston, MA 02210 USA*	2%
2	understand a mathematical model and its application.	1.explains an example of the process of modeling a phenomenon into a mathematical model. 2.Determine the solution of the mathematical model discussed and its interpretation.	**Form of Assessment** : Participatory Activities	Assignments (giving modeling cases) Individual work studying pre-existing materials related to their respective assignments. 2 x 50	Asynchronous discussion and collection of work results at Vinesa	**Material:** Cases in mathematical modeling **References:** *Giordano FR, Fox WP, and Horton. SB, 2014, A First Course in Mathematical Modeling, Fifth Edition, Brooks/Cole, Cengage Learning, Boston, MA 02210 USA*	7%
3	understand a mathematical model and its application.	1.explains an example of the process of modeling a phenomenon into a mathematical model. 2.Determine the solution of the mathematical model discussed and its interpretation.	**Form of Assessment** : Participatory Activities	Assignment (assignment of modeling cases) Modeling case analysis and consultation 2 x 50	Asynchronous discussion and collection of work results at Vinesa	**Material:** Cases in mathematical modeling **References:** *Giordano FR, Fox WP, and Horton. SB, 2014, A First Course in Mathematical Modeling, Fifth Edition, Brooks/Cole, Cengage Learning, Boston, MA 02210 USA*	7%

4	understand a mathematical model and its application.	1.explains an example of the process of modeling a phenomenon into a mathematical model. 2.Determine the solution of the mathematical model discussed and its interpretation.	**Form of Assessment** : Participatory Activities	Assignment (assignment of modeling cases) Modeling case analysis and consultation 2 x 50	Asynchronous discussion and collection of work results at Vinesa	**Material:** Cases in mathematical modeling **References:** *Giordano FR, Fox WP, and Horton. SB, 2014, A First Course in Mathematical Modeling, Fifth Edition, Brooks/Cole, Cengage Learning, Boston, MA 02210 USA*	7%
5	understand a mathematical model and its application.	1.explains an example of the process of modeling a phenomenon into a mathematical model. 2.Determine the solution of the mathematical model discussed and its interpretation.	**Form of Assessment** : Participatory Activities	Assignment (assignment of modeling cases) Modeling case analysis and consultation 2 x 50	Asynchronous discussion and collection of work results at Vinesa	**Material:** Cases in mathematical modeling **References:** *Giordano FR, Fox WP, and Horton. SB, 2014, A First Course in Mathematical Modeling, Fifth Edition, Brooks/Cole, Cengage Learning, Boston, MA 02210 USA*	7%
6	understand a mathematical model and its application.	1.explains an example of the process of modeling a phenomenon into a mathematical model. 2.Determine the solution of the mathematical model discussed and its interpretation.	**Forms of Assessment** : Participatory Activities, Project Results Assessment / Product Assessment	Assignment (giving a modeling case) Presentation of the results of a 2 x 50 mathematical modeling case study	Asynchronous discussion and collection of work results at Vinesa	**Material:** Cases in mathematical modeling **References:** *Giordano FR, Fox WP, and Horton. SB, 2014, A First Course in Mathematical Modeling, Fifth Edition, Brooks/Cole, Cengage Learning, Boston, MA 02210 USA*	2%
7	understand a mathematical model and its application.	1.explains an example of the process of modeling a phenomenon into a mathematical model. 2.Determine the solution of the mathematical model discussed and its interpretation.	**Forms of Assessment** : Participatory Activities, Project Results Assessment / Product Assessment, Practices / Performance	Assignment (giving a modeling case) Presentation of the results of a 2 x 50 mathematical modeling case study	Asynchronous discussion and collection of work results at Vinesa	**Material:** Cases in mathematical modeling **References:** *Giordano FR, Fox WP, and Horton. SB, 2014, A First Course in Mathematical Modeling, Fifth Edition, Brooks/Cole, Cengage Learning, Boston, MA 02210 USA*	18%

8	Able to explain the application of mathematical modeling in education	Application of modeling aspects in mathematics education	**Form of Assessment** : Participatory Activities, Practice/Performance	Expository, discussion and question and answer. 2 x 50	asynchronous discussion on Vinesa	**Material:** Application of mathematical modeling in PISA **Library:** *PISA Mathematics Framework 2022*	2%
						Material: Application of mathematical modeling in teaching **References:** *Blum & Ferri (2009) Mathematical Modeling: Can it be Taught and Learnt.*	
						Material: Application of mathematical modeling in RME **Library:** *Design research in statistics education On symbolizing and computer tools*	
						Material: Application of mathematical modeling in mathematics olympiads **References:** *Mass, J., et.al. 2018. Mathematical Modeling for Teachers: A Practical Guide to Applicable Mathematics Education. Cham: Switzerland.*	

| 9 | Able to explain the application of mathematical modeling in education | Application of modeling aspects in mathematics education | **Form of Assessment** : Participatory Activities | Case assignments on the application of modeling in mathematics education. Individual assignments to study pre-existing materials and 2 x 50 consultations | asynchronous discussions and consultations at Vinesa | **Material:** Application of mathematical modeling in PISA
Library: *PISA Mathematics Framework 2022*

Material: Application of mathematical modeling in teaching
References: *Blum & Ferri (2009) Mathematical Modeling: Can it be Taught and Learnt.*

Material: Application of mathematical modeling in RME
Library: *Design research in statistics education On symbolizing and computer tools*

Material: Application of mathematical modeling in mathematics olympiads
References: *Mass, J., et.al. 2018. Mathematical Modeling for Teachers: A Practical Guide to Applicable Mathematics Education. Cham: Switzerland.* | 7% |

| 10 | Able to explain the application of mathematical modeling in education | Application of modeling aspects in mathematics education | **Form of Assessment** : Participatory Activities | Case assignments on the application of modeling in mathematics education. Individual assignments to study pre-existing materials and 2 x 50 consultations | asynchronous discussions and consultations at Vinesa | **Material:** Application of mathematical modeling in PISA **Library:** *PISA Mathematics Framework 2022*

Material: Application of mathematical modeling in teaching **References:** *Blum & Ferri (2009) Mathematical Modeling: Can it be Taught and Learnt.*

Material: Application of mathematical modeling in RME **Library:** *Design research in statistics education On symbolizing and computer tools*

Material: Application of mathematical modeling in mathematics olympiads **References:** *Mass, J., et.al. 2018. Mathematical Modeling for Teachers: A Practical Guide to Applicable Mathematics Education. Cham: Switzerland.* | 7% |

| 11 | Able to explain the application of mathematical modeling in education | Application of modeling aspects in mathematics education | **Form of Assessment** : Participatory Activities, Practice/Performance | Case assignments on the application of modeling in mathematics education. Individual assignments to study pre-existing materials and consult progress report presentations 2 x 50 | asynchronous discussions and consultations at Vinesa | **Material:** Application of mathematical modeling in PISA **Library:** *PISA Mathematics Framework 2022*

 Material: Application of mathematical modeling in teaching **References:** *Blum & Ferri (2009) Mathematical Modeling: Can it be Taught and Learnt.*

 Material: Application of mathematical modeling in RME **Library:** *Design research in statistics education On symbolizing and computer tools*

 Material: Application of mathematical modeling in mathematics olympiads **References:** *Mass, J., et.al. 2018. Mathematical Modeling for Teachers: A Practical Guide to Applicable Mathematics Education. Cham: Switzerland.* | 7% |

| 12 | Able to explain the application of mathematical modeling in education | Application of modeling aspects in mathematics education | **Form of Assessment** : Participatory Activities | Case assignments on the application of modeling in mathematics education. Individual assignments to study pre-existing materials and 2 x 50 consultations | asynchronous discussions and consultations at Vinesa | **Material:** Application of mathematical modeling in PISA **Library:** *PISA Mathematics Framework 2022*

Material: Application of mathematical modeling in teaching **References:** *Blum & Ferri (2009) Mathematical Modeling: Can it be Taught and Learnt.*

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 Material: Application of mathematical modeling in mathematics olympiads **References:** *Mass, J., et.al. 2018. Mathematical Modeling for Teachers: A Practical Guide to Applicable Mathematics Education. Cham: Switzerland.* | 7% |

| 15 | Able to explain the application of mathematical modeling in education | Application of modeling aspects in mathematics education | **Forms of Assessment** : Participatory Activities, Project Results Assessment / Product Assessment, Practices / Performance | Assignment of cases of the application of modeling in mathematics education. Presentation of the results of modeling case studies in mathematics education 2 x 50 | | **Material:** Application of mathematical modeling in PISA **Library:** *PISA Mathematics Framework 2022*

 Material: Application of mathematical modeling in teaching **References:** *Blum & Ferri (2009) Mathematical Modeling: Can it be Taught and Learnt.*

 Material: Application of mathematical modeling in RME **Library:** *Design research in statistics education On symbolizing and computer tools*

 Material: Application of mathematical modeling in mathematics olympiads **References:** *Mass, J., et.al. 2018. Mathematical Modeling for Teachers: A Practical Guide to Applicable Mathematics Education. Cham: Switzerland.* | 10% |

| 16 | Able to explain the application of mathematical modeling in education | Application of modeling aspects in mathematics education | **Forms of Assessment**: Participatory Activities, Project Results Assessment / Product Assessment, Practices / Performance | Assignment of cases of the application of modeling in mathematics education. Presentation of the results of modeling case studies in mathematics education 2 x 50 | | **Material:** Application of mathematical modeling in PISA **Library:** *PISA Mathematics Framework 2022*

Material: Application of mathematical modeling in teaching **References:** *Blum & Ferri (2009) Mathematical Modeling: Can it be Taught and Learnt.*

Material: Application of mathematical modeling in RME **Library:** *Design research in statistics education On symbolizing and computer tools*

Material: Application of mathematical modeling in mathematics olympiads **References:** *Mass, J., et.al. 2018. Mathematical Modeling for Teachers: A Practical Guide to Applicable Mathematics Education. Cham: Switzerland.* | 10% |

Evaluation Percentage Recap: Project Based Learning

No	Evaluation	Percentage
1.	Participatory Activities	83.16%
2.	Project Results Assessment / Product Assessment	13.66%
3.	Practice / Performance	17.16%
		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.