MINISTRY OF HIGHER EDUCATION, SCIENCE, AND TECHNOLOGY
UNIVERSITAS NEGERI SURABAYA
FACULTY OF MATHEMATICS AND NATURAL SCIENCES
UNDERGRADUATE PROGRAM OF MATHEMATICS EDUCATION
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Module Name:	Mathematical Modelling Pemodelan Matematika
Module Level:	Sarjana (S-1) / Undergraduate
Abbreviation, if applicable:	8420202004
Sub-heading, if applicable:	-
Course included in the module, if applicable:	-
Semester/term:	5 / Third year
Module Coordinator(s):	Dr. Dian Savitri, M.Si.
Lecturer(s):	Novita Vindri Harini, M.Pd.
Language:	Indonesian
Classification within the curriculum:	~~Compulsory course~~/elective studies
Teaching format/class hours per week during the semester	Teaching format: lectures, self-directed work, questions and answers, interactive discussion, and project-based learning with student presentations Class hours per week: 2 x 170 minutes = 340 minutes (5.67 hours), of which 2 x 50 minutes are lectures
Workload:	16 weeks per semester consisting of: • 2 hours lectures (2 x 50 minutes) per week, • 2 hours structured assignments (2 x 60 minutes) per week, • 2 hours independent study (2 x 60 minutes) per week, Total workload: 16 x 2 x 170 minutes = 5,440 minutes = 90.67 hours = 3.18 ECTS*
Credit Point:	2 CU (3.18 ECTS)
Requirements:	Ordinary Differential Equations and Operation Research
Learning Goals :	**Programme Learning Outcomes (PLO) addressed:** PLO 5: Apply the basic principles of mathematics to solve simple mathematical problems PLO 6: Design, implement and evaluate mathematics learning

	using IT **Course Learning Outcomes (CLO): after completing this module, students are able to:** CLO-1: Explain the paradigm of mathematical modelling and the modelling cycle, based on scientific methods and on quantitative and qualitative analysis of a problem (PLO 5) CLO-2: Construct and analyse simple mathematical models, including linear programming models and models of motion in mechanics, and determine feasible solutions by analysing and simulating the behaviour of the solutions (PLO 5) CLO-3: Construct and analyse models based on differential equations for population dynamics, such as growth, predator-prey interaction, and harvesting, and find their solutions numerically using technology (PLO 5, PLO 6) CLO-4: Construct, analyse, and simulate models of health phenomena, such as tuberculosis, tumour growth, and the spread of infectious diseases, and interpret the feasible and applicable solutions (PLO 5, PLO 6) CLO-5: Design alternative mathematics learning based on modelling tasks with technology, and compile the modelling projects into a well-structured written report (PLO 6)
Content:	This course studies the basic concepts of mathematical modelling and trains students to build models from real problems, analyse them, and interpret the results with scientific arguments instead of unfounded assumptions. Topics are the modelling paradigm and cycle; simple models, including linear programming and models of motion in mechanics; models based on differential equations for population dynamics, including growth, predator-prey interaction, and harvesting; and models of health phenomena, including tuberculosis, tumour growth, and the spread of infectious diseases. Each model is analysed qualitatively and simulated numerically with technology, and each project ends with an alternative way of

	teaching the idea in school mathematics. Learning combines lectures, self-directed work, discussion, and a series of modelling projects that students present and compile into a report.
Study/exam achievements	• Students are considered competent and pass if the final score, calculated from weekly tasks, modelling projects, and participation (70%), the midterm formative examination (15%), and the final formative examination (15%), is at least 55 or C. • Final score is calculated as follows:

Week	Course Learning Outcomes (CLO)	Programme Learning Outcomes (PLO)	Evaluation
1	CLO-1	PLO-5	5%
2	CLO-2	PLO-5	5%
3	CLO-2	PLO-5	5%
4	CLO-2	PLO-5	5%
5	CLO-3	PLO-5, PLO-6	5%
6	CLO-3	PLO-5, PLO-6	5%
7	CLO-3	PLO-5, PLO-6	5%
8	CLO-3	PLO-5, PLO-6	15%
9	CLO-4	PLO-5, PLO-6	5%
10	CLO-4	PLO-5, PLO-6	5%
11	CLO-4	PLO-5, PLO-6	5%
12	CLO-4	PLO-5, PLO-6	5%
13	CLO-4	PLO-5, PLO-6	5%
14	CLO-5	PLO-6	5%
15	CLO-5	PLO-6	5%
16	CLO-5	PLO-6	15%

• Final index is defined as follow:

Index	Converted Score	Score Range
A	4.00	$85 \leq A \leq 100$

	A-	3.75	$80 \leq A- < 85$
	B+	3.50	$75 \leq B+ < 80$
	B	3.00	$70 \leq B < 75$
	B-	2.75	$65 \leq B- < 70$
	C+	2.50	$60 \leq C+ < 65$
	C	2.00	$55 \leq C < 60$
	D	1.00	$40 \leq D < 55$
	E	0.00	$0 \leq E < 40$

Forms of Media	Slides, LCD projector, whiteboard, UNESA Learning Management System (LMS), Python (Google Colab), Microsoft Excel or Google Sheets, GeoGebra
Literature	1. Aris, R. (1994). Mathematical modelling techniques. Dover Publications. 2. Barnes, B., & Fulford, G. R. (2009). Mathematical modelling with case studies: A differential equation approach using Maple and MATLAB (2nd ed.). CRC Press. 3. Edwards, D., & Hamson, M. (2016). Guide to mathematical modelling (3rd ed.). Macmillan International Higher Education. 4. Giordano, F. R., Fox, W. P., & Horton, S. B. (2014). A first course in mathematical modeling (5th ed.). Cengage Learning. 5. Murray, J. D. (2002). Mathematical biology I: An introduction (3rd ed.). Springer. 6. Brauer, F., Castillo-Chavez, C., & Feng, Z. (2019). Mathematical models in epidemiology. Springer. 7. Kapur, J. N. (1988). Mathematical modelling. New Age International. 8. Kelly, F. (2001). Mathematical modelling of the Internet. In B. Engquist & W. Schmid (Eds.), Mathematics unlimited: 2001 and beyond (pp. 685-702). Springer. 9. Blum, W., Galbraith, P. L., Henn, H.-W., & Niss, M. (Eds.). (2007). Modelling and applications in mathematics education: The 14th ICMI study. Springer. 10. Blum, W., & Borromeo Ferri, R. (2009). Mathematical modelling: Can it be taught and learned? Journal of Mathematical Modelling and Application, 1(1), 45-58.
Note	*Based on the Regulation of the Minister of Education, Culture,

	Research, and Technology of the Republic of Indonesia Number 53 of 2023 on Quality Assurance in Higher Education, 1 credit unit (CU) corresponds to 45 hours of learning per semester. UNESA implements this as 170 minutes per week over 16 weeks, including the midterm and final examinations: 1 CU = 170 x 16 = 2,720 minutes or 45.3 hours. The total workload of 144 CU is therefore 144 x 45.3 = 6,523.2 hours. UNESA sets this workload as equivalent to 229 ECTS, so that 1 ECTS = 6,523.2 / 229 = 28.48 hours and 1 CU = 1.59 ECTS.