MINISTRY OF HIGHER EDUCATION, SCIENCE, AND TECHNOLOGY
UNIVERSITAS NEGERI SURABAYA
FACULTY OF MATHEMATICS AND NATURAL SCIENCES
UNDERGRADUATE PROGRAM OF MATHEMATICS EDUCATION
Ketintang Campus, Jalan Ketintang, C8 C9 Building, Surabaya 60231
Phone: +62 895335466373, email: s1-pmat@unesa.ac.id
Website: https://pendidikan-matematika.fmipa.unesa.ac.id/

Module Name:	Numerical Methods Metode Numerik
Module Level:	Sarjana (S-1) / Undergraduate
Abbreviation, if applicable:	8420202004
Sub-heading, if applicable:	-
Course included in the module, if applicable:	-
Semester/term:	3 / Second year
Module Coordinator(s):	Dr. Dian Savitri, M.Si.
Lecturer(s):	Dr. Dian Savitri, M.Si.
Language:	Indonesian
Classification within the curriculum:	~~Compulsory course~~/elective studies
Teaching format/class hours per week during the semester	Teaching format: lectures, collaborative learning with student presentations, problem-based learning with case studies, computer practice, interactive discussion, and project-based learning 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:	Differential Calculus and Integral Calculus
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 numerical paradigm and analyse the sources, types, and propagation of errors, including floating-point representation, rounding, and truncation (PLO 5) CLO-2: Find approximate solutions of nonlinear equations (bisection, regula falsi, secant, Newton, and fixed-point iteration) and of linear systems (Gaussian elimination, LU decomposition, and iterative methods), and estimate the errors (PLO 5) CLO-3: Construct interpolating polynomials (Lagrange and Newton) and fit curves to data using least squares and splines (PLO 5) CLO-4: Approximate derivatives and definite integrals numerically using various methods, and estimate the errors (PLO 5) CLO-5: Implement numerical algorithms with Excel and Python, evaluate their accuracy and convergence, and apply them to contextual modelling problems and to mathematics learning at the secondary level (PLO 6)
Content:	This course equips students with the numerical paradigm and the basic principles of numerical solution, without leaving the analytical reasoning behind each method. Topics are the concept of error, including its sources and how to reduce it; approximate roots of nonlinear equations and solutions of linear systems; interpolation and curve fitting; and numerical differentiation and integration. Understanding of the concepts is followed by the skill to implement the methods with Excel and Python and to apply them to contextual mathematics problems and to mathematics learning at the secondary level. Learning combines collaborative and problem-based learning with case studies based on contextual and realistic data, and a project that students must present.
Study/exam	• Students are considered competent and pass if the final score,

achievements

calculated from weekly tasks, presentations, and participation (60%), the midterm formative examination (15%), and the project-based final formative examination (25%), 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	4%
2	CLO-1	PLO-5	4%
3	CLO-2	PLO-5	4%
4	CLO-2	PLO-5	4%
5	CLO-2	PLO-5	4%
6	CLO-2	PLO-5	4%
7	CLO-3	PLO-5	4%
8	CLO-3	PLO-5	15%
9	CLO-3	PLO-5	4%
10	CLO-4	PLO-5	4%
11	CLO-4	PLO-5	4%
12	CLO-4	PLO-5	4%
13	CLO-5	PLO-6	4%
14	CLO-5	PLO-6	4%
15	CLO-5	PLO-6	8%
16	CLO-5	PLO-6	25%

- 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), Microsoft Excel or Google Sheets, Python (Google Colab), GeoGebra
Literature	1. Fuad, Y. (2010). Metode numerik. Unipress IKIP Surabaya. 2. Gerald, C. F., & Wheatley, P. O. (2004). Applied numerical analysis (7th ed.). Pearson Education. 3. Kharab, A., & Guenther, R. B. (2019). An introduction to numerical methods: A MATLAB approach (4th ed.). CRC Press. 4. Gezerlis, A. (2023). Numerical methods in physics with Python (2nd ed.). Cambridge University Press. 5. LeMesurier, B. (2024). Introduction to numerical methods and analysis with Python. http://lemesurierb.people.cofc.edu/introduction-to-numerical-methods-and-analysis-python/ 6. Miles, W. (2023). Numerical methods with Python for scientists. De Gruyter. 7. Atkinson, K. (2003). Elementary numerical analysis (3rd ed.). John Wiley & Sons. 8. Fuad, Y. (2012). Lembar kerja praktikum metode numerik. FMIPA Unesa. 9. Kong, Q., Siauw, T., & Bayen, A. M. (2021). Python programming and numerical methods: A guide for engineers and scientists. Academic Press.
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.