	Universitas Negeri Surabaya Faculty of Mathematics and Natural Sciences Natural Sciences Education Undergraduate Study Program	Document Code

SEMESTER LEARNING PLAN

Courses	CODE	Course Family	Credit Weight			SEMESTER	Compilation Date
Science Mathematics	8420103087	Compulsory Study Program Subjects	T=3	P=0	ECTS=4.77	2	February 1, 2024

AUTHORIZATION	SP Developer	Course Cluster Coordinator	Study Program Coordinator
	Ahmad Fauzi Hendratmoko, M.Pd.; Muhamad Arif Mahdiannur, S.Pd., M.Pd.	Dr. Mohammad Budiyanto, M.Pd.	Prof. Dr. Erman, M.Pd.

Learning model	**Case Studies**

Program Learning Outcomes (PLO)

PLO study program that is charged to the course

Program Objectives (PO)

PO - 1	Apply substantive and procedural concepts of linear algebra and vectors calculus to solve real-world problems related to science phenomena
PO - 2	Apply substantive and procedural concepts of differential and integral to solve the real-world problem related to scientific phenomena
PO - 3	Apply substantive and procedural concepts of ordinary differential equations (ODEs) to solve the real-world problem related to scientific phenomena

PLO-PO Matrix

P.O
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 discusses the application of basic mathematical concepts to solve the real-world problems related to science phenomena and provide the solution using substantive and procedural concepts of linear algebra, vector calculus, differential, integral, and ordinary differential equations across science (physics, chemistry , and biology) fields.
References	**Main :**

1. Boas, M. L. (2006). Mathematical methods in the physical science (3rd Ed.). John Wiley & Sons.
2. Roswati Mudjiarto, dkk. 2004. Matematika Fisika I. Universitas Pendidikan Indonesia. Bandung.
3. Kreyszig, E. (2006). Advanced engineering mathematics (9th Ed.). John Wiley & Sons.
4. Strauss. W.A. 1992.Partial Differential Equations.John Wiley & Sons.
5. Allonso, M. and Finn, D.J. 1993. Fundamental University Fisic, Vol I, Edisons Wesley Pub.Co..
6. Arfken, G. B., Weber, H. J., & Harris, F. E. (2013). Mathematical methods for physicists: A comprehensive guide (7th Ed.). Academic Press.
7. Sahara Muslim. 2004. Gelombang dan Optik. Jakarta : Depdikbud Dikti
8. Wospakrik,H.J.(1993).Dasar-Dasar Matematika untuk Fisika,DirjenDikti, Depdiknas, Jakarta.
9. Goodson, D. Z. (2011). Mathematical methods for physical and analytical chemistry. Wiley.
10. Logan, J. D., & Wolensensky, W. (2009). Mathematical methods in biology (Vol. 96). John Wiley & Sons.

Supporters:

1. Buku Ajar Matematika Sains. (2004).
2. Open Source Software for Mathematics (like Octave, Mathlab, GeoGebra, etc).

Supporting lecturer	Dr. Mohammad Budiyanto, S.Pd., M.Pd. Tutut Nurita, S.Pd., M.Pd. An Nuril Maulida Fauziah, S.Pd., M.Pd. Muhamad Arif Mahdiannur, S.Pd., M.Pd. Ahmad Fauzi Hendratmoko, M.Pd.

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	1. Explain the substantive concepts of matrices, determinants, and linear systems 2. Apply the procedural concept of matrices, determinants, and linear systems to solve and understand the real-world problem related to scientific phenomena	1. Explain the substantive concepts of matrices, determinants, and linear systems 2. Apply the procedural concept of matrices, determinants, and linear systems to solve and understand the real-world problem related to scientific phenomena	**Criteria:** Accuracy in explaining and applying the substantive and procedural concepts of matrices, determinants, and linear systems to solve the real-world problem related to science phenomena **Form of Assessment** : Participatory Activities	Case studies 3 x 50‘	Case Study through Unesa‘s Learning Management System (LMS) 3 x 60‘	**Material:** Matrices, Determinants, and Linear Systems **References:** *Boas, ML (2006). Mathematical methods in the physical sciences (3rd Ed.). John Wiley & Sons.* **Material:** Matrices, Determinants, and Linear Systems **References:** *Roswati Mudjiarto, et al. 2004. Mathematics Physics I. Indonesian Education University. Bandung.* **Material:** Matrices, Determinants, and Linear Systems **References:** *Kreyszig, E. (2006). Advanced engineering mathematics (9th Ed.). John Wiley & Sons.* **Material:** Matrices, Determinants, and Linear Systems **References:** *Wospakrik, HJ (1993). Basics of Mathematics for Physics, Directorate*	5%

						General of Higher Education, Ministry of National Education, Jakarta. **Material:** Matrices, Determinants, and Linear Systems **References:** *Goodson, DZ (2011). Mathematical methods for physical and analytical chemistry. Wiley.* **Material:** Matrices, Determinants, and Linear Systems **References:** *Logan, JD, & Wolensensky, W. (2009). Mathematical methods in biology (Vol. 96). John Wiley & Sons.* **Material:** Matrices, Determinants, and Linear Systems **References:** *Arfken, GB, Weber, HJ, & Harris, FE (2013). Mathematical methods for physicists: A comprehensive guide (7th Ed.). Academic Press.*	
2	1. Explain the substantive concepts of matrices, determinants, and linear systems 2. Apply the procedural concept of matrices, determinants, and linear systems to solve and understand the real-world problem related to scientific phenomena	1. Explain the substantive concepts of matrices, determinants, and linear systems 2. Apply the procedural concept of matrices, determinants, and linear systems to solve and understand the real-world problem related to scientific phenomena	**Criteria:** Accuracy in explaining and applying the substantive and procedural concepts of matrices, determinants, and linear systems to solve the real-world problem related to science phenomena **Form of Assessment** : Participatory Activities	Case studies 3 x 50‘	Case Study through Unesa‘s Learning Management System (LMS) 3 x 60‘	**Material:** Matrices, Determinants, and Linear Systems **References:** *Boas, ML (2006). Mathematical methods in the physical sciences (3rd Ed.). John Wiley & Sons.* **Material:** Matrices, Determinants, and Linear Systems **References:** *Roswati Mudjiarto, et al. 2004. Mathematics Physics I. Indonesian Education University. Bandung.* **Material:** Matrices, Determinants,	5%

						and Linear Systems **References:** *Kreyszig, E. (2006). Advanced engineering mathematics (9th Ed.). John Wiley & Sons.* **Material:** Matrices, Determinants, and Linear Systems **References:** *Wospakrik, HJ (1993). Basics of Mathematics for Physics, Directorate General of Higher Education, Ministry of National Education, Jakarta.* **Material:** Matrices, Determinants, and Linear Systems **References:** *Goodson, DZ (2011). Mathematical methods for physical and analytical chemistry. Wiley.* **Material:** Matrices, Determinants, and Linear Systems **References:** *Logan, JD, & Wolensensky, W. (2009). Mathematical methods in biology (Vol. 96). John Wiley & Sons.* **Material:** Matrices, Determinants, and Linear Systems **References:** *Arfken, GB, Weber, HJ, & Harris, FE (2013). Mathematical methods for physicists: A comprehensive guide (7th Ed.). Academic Press.*	
3	1. Explain the substantive concepts of matrices, determinants, and linear systems 2. Apply the procedural concept of matrices, determinants,	1. Explain the substantive concepts of matrices, determinants, and linear systems 2. Apply the procedural concept of matrices, determinants,	**Criteria:** Accuracy in explaining and applying the substantive and procedural concepts of matrices, determinants, and linear systems to solve the real-world problem related to science phenomena	Case studies 3 x 50'	Case Study through Unesa's Learning Management System (LMS) 3 x 60'	**Material:** Matrices, Determinants, and Linear Systems **References:** *Boas, ML (2006). Mathematical methods in the physical sciences (3rd Ed.). John*	5%

		and linear systems to solve and understand the real-world problem related to scientific phenomena	and linear systems to solve and understand the real-world problem related to scientific phenomena	**Form of Assessment** : Participatory Activities, Tests			*Wiley & Sons.* **Material:** Matrices, Determinants, and Linear Systems **References:** *Roswati Mudjiarto, et al. 2004. Mathematics Physics I. Indonesian Education University. Bandung.* **Material:** Matrices, Determinants, and Linear Systems **References:** *Kreyszig, E. (2006). Advanced engineering mathematics (9th Ed.). John Wiley & Sons.* **Material:** Matrices, Determinants, and Linear Systems **References:** *Wospakrik, HJ (1993). Basics of Mathematics for Physics, Directorate General of Higher Education, Ministry of National Education, Jakarta.* **Material:** Matrices, Determinants, and Linear Systems **References:** *Goodson, DZ (2011). Mathematical methods for physical and analytical chemistry. Wiley.* **Material:** Matrices, Determinants, and Linear Systems **References:** *Logan, JD, & Wolensensky, W. (2009). Mathematical methods in biology (Vol. 96). John Wiley & Sons.* **Material:** Matrices, Determinants, and Linear Systems **References:** *Arfken, GB, Weber, HJ, & Harris, FE*	

						(2013). Mathematical methods for physicists: A comprehensive guide (7th Ed.). Academic Press.	
4	1. Explain the substantive concept of eigenvalues and eigenvectors 2. Apply the procedural concept of eigenvalues and eigenvectors to solve and understand the real-world problem related to scientific phenomena	1. Explain the substantive concept of eigenvalues and eigenvectors 2. Apply the procedural concept of eigenvalues and eigenvectors to solve and understand the real-world problem related to scientific phenomena	**Criteria:** Accuracy in explaining and applying the substantive and procedural concepts of matrices, determinants, and linear systems to solve the real-world problem related to science phenomena **Form of Assessment** : Participatory Activities, Tests	Case studies 3 x 50‘	Case Study through Unesa‘s Learning Management System (LMS) 3 x 60‘	**Material:** Eigenvalues and Eigenvectors **References:** *Boas, ML (2006). Mathematical methods in the physical sciences (3rd Ed.). John Wiley & Sons.* **Material:** Eigenvalues and Eigenvectors **Reference:** *Roswati Mudjiarto, et al. 2004. Mathematics Physics I. Indonesian Education University. Bandung.* **Material:** Eigenvalues and Eigenvectors **References:** *Kreyszig, E. (2006). Advanced engineering mathematics (9th Ed.). John Wiley & Sons.* **Material:** Eigenvalues and Eigenvectors **References:** *Arfken, GB, Weber, HJ, & Harris, FE (2013). Mathematical methods for physicists: A comprehensive guide (7th Ed.). Academic Press.* **Material:** Eigenvalues and Eigenvectors **Library:** *Wospakrik, HJ (1993). Basics of Mathematics for Physics, Director General of Higher Education, Ministry of National Education, Jakarta.* **Material:** Eigenvalues and Eigenvectors **References:**	5%

						Goodson, DZ (2011). Mathematical methods for physical and analytical chemistry. Wiley. **Material:** Eigenvalues and Eigenvectors **References:** *Logan, JD, & Wolensensky, W. (2009). Mathematical methods in biology (Vol. 96). John Wiley & Sons.*	
5	Applying open-source software for problem-solving matrix problems in the science field	Applying open-source software for problem-solving matrix problems in the science field	**Criteria:** Accuracy in applying open-source software for problem-solving matrix problems in the science field **Form of Assessment** : Practical Assessment	Case studies 3 x 50‘	Case Study through Unesa‘s Learning Management System (LMS) 3 x 60‘	**Material:** Matrices, Determinants, Linear Systems, Eigenvalues, and Eigenvectors **References:** *Boas, ML (2006). Mathematical methods in the physical sciences (3rd Ed.). John Wiley & Sons.* **Material:** Matrices, Determinants, Linear Systems, Eigenvalues, and Eigenvectors **References:** *Kreyszig, E. (2006). Advanced engineering mathematics (9th Ed.). John Wiley & Sons.* **Material:** Matrices, Determinants, Linear Systems, Eigenvalues, and Eigenvectors **References:** *Allonso, M. and Finn, DJ 1993. Fundamental University Physics, Vol I, Edisons Wesley Pub.Co..* **Material:** Matrices, Determinants, Linear Systems, Eigenvalues, and Eigenvectors **References:** *Arfken, GB, Weber, HJ, & Harris, FE (2013). Mathematical*	10%

							methods for physicists: A comprehensive guide (7th Ed.). Academic Press. **Material:** Matrices, Determinants, Linear Systems, Eigenvalues, and Eigenvectors **Library:** *Sahara Muslim. 2004. Waves and Optics. Jakarta: Department of Education and Culture, Higher Education* **Material:** Matrices, Determinants, Linear Systems, Eigenvalues, and Eigenvectors **Library:** *Wospakrik, HJ (1993). Basics of Mathematics for Physics, Director General of Higher Education, Ministry of National Education, Jakarta.* **Material:** Matrices, Determinants, Linear Systems, Eigenvalues, and Eigenvectors **References:** *Goodson, DZ (2011). Mathematical methods for physical and analytical chemistry. Wiley.* **Material:** Matrices, Determinants, Linear Systems, Eigenvalues, and Eigenvectors **References:** *Logan, JD, & Wolensensky, W. (2009). Mathematical methods in biology (Vol. 96). John Wiley & Sons.* **Material:** Matrices, Determinants, Linear Systems, Eigenvalues,		

						and Eigenvectors **Library:** *Open Source Software for Mathematics (like Octave, Mathlab, GeoGebra, etc).*	
6	1.Explain the substantive concept of vectors and vector analysis 2.Apply the procedural concept of vectors and vector analysis to solve and understand the real-world problems related to scientific phenomena	1.Explain the substantive concept of vectors and vector analysis 2.Apply the procedural concept of vectors and vector analysis to solve and understand the real-world problems related to scientific phenomena	**Criteria:** Accuracy in explaining and applying the substantive and procedural concepts of vectors and vector analysis to solve the real-world problem related to scientific phenomena **Form of Assessment** : Participatory Activities	Case Study 3 x 50‘	Case Study through Unesa‘s Learning Management System (LMS) 3 x 60‘	**Material:** Vectors and Vector Analysis **References:** *Boas, ML (2006). Mathematical methods in the physical sciences (3rd Ed.). John Wiley & Sons.* **Material:** Vectors and Vector Analysis **Literature:** *Roswati Mudjiarto, et al. 2004. Mathematics Physics I. Indonesian Education University. Bandung.* **Material:** Vectors and Vector Analysis **References:** *Kreyszig, E. (2006). Advanced engineering mathematics (9th Ed.). John Wiley & Sons.* **Material:** Vectors and Vector Analysis **Bibliography:** *Allonso, M. and Finn, DJ 1993. Fundamental University Physics, Vol I, Edisons Wesley Pub.Co..* **Material:** Vectors and Vector Analysis **References:** *Arfken, GB, Weber, HJ, & Harris, FE (2013). Mathematical methods for physicists: A comprehensive guide (7th Ed.). Academic Press.* **Material:** Vectors and Vector Analysis **Library:** *Wospakrik, HJ*	5%

						(1993). Basics of Mathematics for Physics, Director General of Higher Education, Ministry of National Education, Jakarta. **Material:** Vectors and Vector Analysis **References:** *Goodson, DZ (2011). Mathematical methods for physical and analytical chemistry. Wiley.* **Material:** Vectors and Vector Analysis **References:** *Logan, JD, & Wolensensky, W. (2009). Mathematical methods in biology (Vol. 96). John Wiley & Sons.*	
7	1. Explain the substantive concept of vectors and vector analysis 2. Apply the procedural concept of vectors and vector analysis to solve and understand the real-world problems related to scientific phenomena	1. Explain the substantive concept of vectors and vector analysis 2. Apply the procedural concept of vectors and vector analysis to solve and understand the real-world problems related to scientific phenomena	**Criteria:** Accuracy in explaining and applying the substantive and procedural concepts of vectors and vector analysis to solve the real-world problem related to scientific phenomena **Form of Assessment** : Participatory Activities, Tests	Case Study 3 x 50‘	Case Study through Unesa's Learning Management System (LMS) 3 x 60‘	**Material:** Vectors and Vector Analysis **References:** *Boas, ML (2006). Mathematical methods in the physical sciences (3rd Ed.). John Wiley & Sons.* **Material:** Vectors and Vector Analysis **Literature:** *Roswati Mudjiarto, et al. 2004. Mathematics Physics I. Indonesian Education University. Bandung.* **Material:** Vectors and Vector Analysis **References:** *Kreyszig, E. (2006). Advanced engineering mathematics (9th Ed.). John Wiley & Sons.* **Material:** Vectors and Vector Analysis **Bibliography:** *Allonso, M. and Finn, DJ 1993. Fundamental University*	5%

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8	Mid-Semester Test	Sub-CPMK 1 - Sub-CPMK 7	**Criteria:** Accuracy in explaining and applying the substantive and procedural concepts of matrices, determinants, linear systems, eigenvalues, eigenvectors, vectors and vector analysis to solve the real-world problems related to science phenomena **Form of Assessment** : Test	Mid-Semester Test 100‘	Mid-Semester Test 100‘		10%
9	1.Explain the substantive	1.Explain the substantive	**Criteria:** Accuracy in explaining and	Case Study 3 x 50‘	Case Study through Unesa‘s Learning Management System	**Material:** Differential and Integral	5%

		concept of differential and integral 2. Apply the procedural concept of differential and integral to solve and understand the real-world problems related to scientific phenomena	concept of differential and integral 2. Apply the procedural concept of differential and integral to solve and understand the real-world problems related to scientific phenomena	applying the substantive and procedural concepts of differential and integral to solve the real-world problem related to science phenomena **Form of Assessment** : Participatory Activities		(LMS) 3 x 60‘	**References:** *Boas, ML (2006). Mathematical methods in the physical sciences (3rd Ed.). John Wiley & Sons.* **Material:** Differential and Integral **Literature:** *Roswati Mudjiarto, et al. 2004. Mathematics Physics I. Indonesian Education University. Bandung.* **Material:** Differential and Integral **Bibliography:** *Kreyszig, E. (2006). Advanced engineering mathematics (9th Ed.). John Wiley & Sons.* **Material:** Differential and Integral **Bibliography:** *Allonso, M. and Finn, DJ 1993. Fundamental University Physics, Vol I, Edisons Wesley Pub.Co..* **Material:** Differential and Integral **Bibliography:** *Arfken, GB, Weber, HJ, & Harris, FE (2013). Mathematical methods for physicists: A comprehensive guide (7th Ed.). Academic Press.* **Material:** Differential and Integral **Library:** *Wospakrik, HJ (1993). Basics of Mathematics for Physics, Director General of Higher Education, Ministry of National Education, Jakarta.* **Material:** Differential and Integral **Bibliography:** *Goodson, DZ (2011). Mathematical*		

						methods for physical and analytical chemistry. Wiley. **Material:** Differential and Integral **Bibliography:** *Logan, JD, & Wolensensky, W. (2009). Mathematical methods in biology (Vol. 96). John Wiley & Sons.*	
10	1.Explain the substantive concept of differential and integral 2.Apply the procedural concept of differential and integral to solve and understand the real-world problems related to scientific phenomena	1.Explain the substantive concept of differential and integral 2.Apply the procedural concept of differential and integral to solve and understand the real-world problems related to scientific phenomena	**Criteria:** Accuracy in explaining and applying the substantive and procedural concepts of differential and integral to solve the real-world problem related to science phenomena **Form of Assessment** : Participatory Activities, Tests	Case Study 3 x 50‘	Case Study through Unesa‘s Learning Management System (LMS) 3 x 60‘	**Material:** Differential and Integral **References:** *Boas, ML (2006). Mathematical methods in the physical sciences (3rd Ed.). John Wiley & Sons.* **Material:** Differential and Integral **Literature:** *Roswati Mudjiarto, et al. 2004. Mathematics Physics I. Indonesian Education University. Bandung.* **Material:** Differential and Integral **Bibliography:** *Kreyszig, E. (2006). Advanced engineering mathematics (9th Ed.). John Wiley & Sons.* **Material:** Differential and Integral **Bibliography:** *Allonso, M. and Finn, DJ 1993. Fundamental University Physics, Vol I, Edisons Wesley Pub.Co..* **Material:** Differential and Integral **Bibliography:** *Arfken, GB, Weber, HJ, & Harris, FE (2013). Mathematical methods for physicists: A comprehensive guide (7th Ed.). Academic Press.* **Material:** Differential and Integral	5%

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11	1. Explain the substantive concept of partial differentiation and multiple integrals 2. Apply the procedural concept of partial differentiation and multiple integrals to solve and understand the real-world problems related to scientific phenomena	1. Explain the substantive concept of partial differentiation and multiple integrals 2. Apply the procedural concept of partial differentiation and multiple integrals to solve and understand the real-world problems related to scientific phenomena	**Criteria:** Accuracy in explaining and applying the substantive and procedural concepts of partial differentiation and multiple integrals to solve the real-world problem related to scientific phenomena **Form of Assessment** : Participatory Activities	Case Study 3 x 50‘	Case Study through Unesa‘s Learning Management System (LMS) 3 x 60‘	**Material:** Partial Differentiation and Multiple Integral **Reference:** *Strauss. WA 1992. Partial Differential Equations. John Wiley & Sons.* **Material:** Partial Differentiation and Multiple Integrals **References:** *Boas, ML (2006). Mathematical methods in the physical sciences (3rd Ed.). John Wiley & Sons.* **Material:** Partial Differentiation and Multiple Integral **References:** *Kreyszig, E. (2006). Advanced engineering mathematics (9th Ed.). John Wiley & Sons.* **Material:** Partial Differentiation and Multiple Integral **Reference:** *Roswati Mudjiarto, et al.*	5%

						2004. Mathematics Physics I. Indonesian Education University. Bandung. **Material:** Partial Differentiation and Multiple Integrals **References:** *Arfken, GB, Weber, HJ, & Harris, FE (2013). Mathematical methods for physicists: A comprehensive guide (7th Ed.). Academic Press.* **Material:** Partial Differentiation and Multiple Integral **Library:** *Wospakrik, HJ (1993). Basics of Mathematics for Physics, Director General of Higher Education, Ministry of National Education, Jakarta.* **Material:** Partial Differentiation and Multiple Integral **References:** *Goodson, DZ (2011). Mathematical methods for physical and analytical chemistry. Wiley.* **Material:** Partial Differentiation and Multiple Integral **References:** *Logan, JD, & Wolensensky, W. (2009). Mathematical methods in biology (Vol. 96). John Wiley & Sons.* **Material:** Partial Differentiation and Multiple Integral **Library:** *Mathematics and Science Textbook. (2004).*	
12	1.Explain the substantive concept of partial	1.Explain the substantive concept of partial	**Criteria:** Accuracy in explaining and applying the substantive and	Case Study 3 x 50‘	Case Study through Unesa‘s Learning Management System (LMS) 3 x 60‘	**Material:** Partial Differentiation and Multiple Integral	5%

		differentiation and multiple integrals 2. Apply the procedural concept of partial differentiation and multiple integrals to solve and understand the real-world problems related to scientific phenomena	differentiation and multiple integrals 2. Apply the procedural concept of partial differentiation and multiple integrals to solve and understand the real-world problems related to scientific phenomena	procedural concepts of partial differentiation and multiple integrals to solve the real-world problem related to scientific phenomena **Form of Assessment** : Participatory Activities, Tests			**Reference:** *Strauss. WA 1992. Partial Differential Equations. John Wiley & Sons.* **Material:** Partial Differentiation and Multiple Integrals **References:** *Boas, ML (2006). Mathematical methods in the physical sciences (3rd Ed.). John Wiley & Sons.* **Material:** Partial Differentiation and Multiple Integral **References:** *Kreyszig, E. (2006). Advanced engineering mathematics (9th Ed.). John Wiley & Sons.* **Material:** Partial Differentiation and Multiple Integral **Reference:** *Roswati Mudjiarto, et al. 2004. Mathematics Physics I. Indonesian Education University. Bandung.* **Material:** Partial Differentiation and Multiple Integrals **References:** *Arfken, GB, Weber, HJ, & Harris, FE (2013). Mathematical methods for physicists: A comprehensive guide (7th Ed.). Academic Press.* **Material:** Partial Differentiation and Multiple Integral **Library:** *Wospakrik, HJ (1993). Basics of Mathematics for Physics, Director General of Higher Education, Ministry of National Education, Jakarta.*		

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13	1. Explain the substantive concept of the first and second-order of ODEs 2. Apply the procedural concept of the first and second-order of ODEs to solve and understand the real-world problem related to scientific phenomena	1. Explain the substantive concept of the first and second-order of ODEs 2. Apply the procedural concept of the first and second-order of ODEs to solve and understand the real-world problem related to scientific phenomena	**Criteria:** Accuracy in explaining and applying the substantive and procedural concepts of the first and second-order of ODEs to solve the real-world problem related to scientific phenomena **Form of Assessment** : Participatory Activities	Case Study 3 x 50‘	Case Study through Unesa‘s Learning Management System (LMS) 3 x 60‘	**Material:** ODEs **References:** *Boas, ML (2006). Mathematical methods in the physical sciences (3rd Ed.). John Wiley & Sons.* **Material:** ODEs **Bibliography:** *Roswati Mudjiarto, et al. 2004. Mathematics Physics I. Indonesian Education University. Bandung.* **Material:** ODEs **Bibliography:** *Kreyszig, E. (2006). Advanced engineering mathematics (9th Ed.). John Wiley & Sons.* **Material:** ODEs **References:** *Arfken, GB, Weber, HJ, & Harris, FE (2013). Mathematical methods for physicists: A comprehensive guide (7th Ed.). Academic Press.*	5%

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14	1. Explain the substantive concept of the first and second-order of ODEs 2. Apply the procedural concept of the first and second-order of ODEs to solve and understand the real-world problem related to scientific phenomena	1. Explain the substantive concept of the first and second-order of ODEs 2. Apply the procedural concept of the first and second-order of ODEs to solve and understand the real-world problem related to scientific phenomena	**Criteria:** Accuracy in explaining and applying the substantive and procedural concepts of the first and second-order of ODEs to solve the real-world problem related to scientific phenomena **Form of Assessment** : Participatory Activities, Tests	Case Study 3 x 50‘	Case Study through Unesa‘s Learning Management System (LMS) 3 x 60‘	**Material:** ODEs **References:** *Boas, ML (2006). Mathematical methods in the physical sciences (3rd Ed.). John Wiley & Sons.* **Material:** ODEs **Bibliography:** *Roswati Mudjiarto, et al. 2004. Mathematics Physics I. Indonesian Education University. Bandung.* **Material:** ODEs **Bibliography:** *Kreyszig, E. (2006). Advanced engineering mathematics (9th Ed.). John Wiley & Sons.* **Material:** ODEs **References:** *Arfken, GB, Weber, HJ, & Harris, FE (2013). Mathematical methods for physicists: A comprehensive guide (7th Ed.). Academic Press.*	5%

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15	Applying open-source software for problem-solving ODEs problems in the science field	Applying open-source software for problem-solving ODEs problems in the science field	**Criteria:** Accuracy in explaining and applying the substantive and procedural concepts of the first and second-order of ODEs to solve the real-world problem related to scientific phenomena **Form of Assessment** : Practical Assessment	Case Study 3 x 50‘	Case Study through Unesa‘s Learning Management System (LMS) 3 x 60‘	**Material:** ODEs **References:** *Boas, ML (2006). Mathematical methods in the physical sciences (3rd Ed.). John Wiley & Sons.* **Material:** ODEs **Bibliography:** *Roswati Mudjiarto, et al. 2004. Mathematics Physics I. Indonesian Education University. Bandung.* **Material:** ODEs **Bibliography:** *Kreyszig, E. (2006). Advanced engineering mathematics (9th Ed.). John Wiley & Sons.* **Material:** ODEs **References:** *Arfken, GB, Weber, HJ, & Harris, FE (2013). Mathematical methods for physicists: A comprehensive guide (7th Ed.). Academic*	10%

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16	Final Semester Test	Sub-CPMK 1 - Sub-CPMK 15	**Criteria:** Accuracy in explaining and applying the substantive and procedural concepts of matrices, determinants, linear systems, eigenvalues, eigenvectors, vectors, vector analysis, differential, integral, partial differentiation, multiple integral, and ODEs to solve the real-world problem related to science phenomena **Form of Assessment** : Test	Final Semester Test 100‘	Final Semester Test 100‘		10%

Evaluation Percentage Recap: Case Study

No	Evaluation	Percentage
1.	Participatory Activities	45%
2.	Practical Assessment	20%
3.	Test	35%
		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.