	Universitas Negeri Surabaya **Fakultas Matematika dan Ilmu Pengetahuan Alam** **Program Studi S1 Pendidikan Ilmu Pengetahuan Alam**	**Kode Dokumen**

RENCANA PEMBELAJARAN SEMESTER

MATA KULIAH (MK)	KODE	Rumpun MK	BOBOT (sks)			SEMESTER	Tgl Penyusunan
Matematika Ipa	8420103087	Mata Kuliah Wajib Program Studi	T=3	P=0	ECTS=4.77	2	1 Februari 2024

OTORISASI	Pengembang RPS	Koordinator RMK	Koordinator Program Studi
	Ahmad Fauzi Hendratmoko, M.Pd.; Muhamad Arif Mahdiannur, S.Pd., M.Pd.	Dr. Mohammad Budiyanto, M.Pd.	Prof. Dr. Erman, M.Pd.

Model Pembelajaran	**Case Study**

Capaian Pembelajaran (CP)

CPL-PRODI yang dibebankan pada MK

Capaian Pembelajaran Mata Kuliah (CPMK)

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

Matrik CPL - CPMK

CPMK
CPMK-1
CPMK-2
CPMK-3

Matrik CPMK pada Kemampuan akhir tiap tahapan belajar (Sub-CPMK)

CPMK	Minggu Ke															
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
CPMK-1																
CPMK-2																
CPMK-3																

Deskripsi Singkat MK

This course discusses the application of basic mathematics concepts to solve the real-world problem related to science phenomena and giving 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.

Pustaka

Utama :

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.

Pendukung :

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

Mg Ke-	**Kemampuan akhir tiap tahapan belajar (Sub-CPMK)**	**Penilaian**		**Bantuk Pembelajaran, Metode Pembelajaran, Penugasan Mahasiswa, [Estimasi Waktu]**		**Materi Pembelajaran [Pustaka]**	**Bobot Penilaian (%)**
		Indikator	**Kriteria & Bentuk**	**Luring (*offline*)**	**Daring (*online*)**		
(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**

1	1. Explain the substantive concept of matrices, determinant, and linear system 2. Apply the procedural concept of matrices, determinant, and linear system to solve and understand the real-world problem related to science phenomena	1. Explain the substantive concept of matrices, determinant, and linear system 2. Apply the procedural concept of matrices, determinant, and linear system to solve and understand the real-world problem related to science phenomena	**Kriteria:** Accuracy in explaining and applying the substantive and procedural concepts of matrices, determinant, and linear system to solve the real-world problem related to science phenomena **Bentuk Penilaian** : Aktifitas Partisipasif	Case study 3 x 50'	Case Study through Unesa's Learning Management System (LMS) 3 x 60'	**Materi:** Matrices, Determinant, and Linear System **Pustaka:** *Boas, M. L. (2006). Mathematical methods in the physical science (3rd Ed.). John Wiley & Sons.* **Materi:** Matrices, Determinant, and Linear System **Pustaka:** *Roswati Mudjiarto, dkk. 2004. Matematika Fisika I. Universitas Pendidikan Indonesia. Bandung.* **Materi:** Matrices, Determinant, and Linear System **Pustaka:** *Kreyszig, E. (2006). Advanced engineering mathematics (9th Ed.). John Wiley & Sons.* **Materi:** Matrices, Determinant, and Linear System **Pustaka:** *Wospakrik,H.J. (1993).Dasar-Dasar Matematika untuk Fisika,DirjenDikti, Depdiknas, Jakarta.* **Materi:** Matrices, Determinant, and Linear System **Pustaka:** *Goodson, D. Z. (2011). Mathematical methods for physical and analytical chemistry. Wiley.* **Materi:** Matrices, Determinant, and Linear System **Pustaka:** *Logan, J. D., & Wolensensky, W. (2009). Mathematical methods in biology (Vol. 96). John Wiley & Sons.* **Materi:** Matrices, Determinant, and Linear System **Pustaka:** *Arfken, G. B., Weber, H. J., & Harris, F. E. (2013). Mathematical methods for physicists: A comprehensive guide (7th Ed.). Academic Press.*	5%

2	1. Explain the substantive concept of matrices, determinant, and linear system 2. Apply the procedural concept of matrices, determinant, and linear system to solve and understand the real-world problem related to science phenomena	1. Explain the substantive concept of matrices, determinant, and linear system 2. Apply the procedural concept of matrices, determinant, and linear system to solve and understand the real-world problem related to science phenomena	**Kriteria:** Accuracy in explaining and applying the substantive and procedural concepts of matrices, determinant, and linear system to solve the real-world problem related to science phenomena **Bentuk Penilaian** : Aktifitas Partisipasif	Case study 3 x 50'	Case Study through Unesa's Learning Management System (LMS) 3 x 60'	**Materi:** Matrices, Determinant, and Linear System **Pustaka:** *Boas, M. L. (2006). Mathematical methods in the physical science (3rd Ed.). John Wiley & Sons.* **Materi:** Matrices, Determinant, and Linear System **Pustaka:** *Roswati Mudjiarto, dkk. 2004. Matematika Fisika I. Universitas Pendidikan Indonesia. Bandung.* **Materi:** Matrices, Determinant, and Linear System **Pustaka:** *Kreyszig, E. (2006). Advanced engineering mathematics (9th Ed.). John Wiley & Sons.* **Materi:** Matrices, Determinant, and Linear System **Pustaka:** *Wospakrik,H.J. (1993).Dasar-Dasar Matematika untuk Fisika,DirjenDikti, Depdiknas, Jakarta.* **Materi:** Matrices, Determinant, and Linear System **Pustaka:** *Goodson, D. Z. (2011). Mathematical methods for physical and analytical chemistry. Wiley.* **Materi:** Matrices, Determinant, and Linear System **Pustaka:** *Logan, J. D., & Wolensensky, W. (2009). Mathematical methods in biology (Vol. 96). John Wiley & Sons.* **Materi:** Matrices, Determinant, and Linear System **Pustaka:** *Arfken, G. B., Weber, H. J., & Harris, F. E. (2013). Mathematical methods for physicists: A comprehensive guide (7th Ed.). Academic Press.*	5%

3	1. Explain the substantive concept of matrices, determinant, and linear system 2. Apply the procedural concept of matrices, determinant, and linear system to solve and understand the real-world problem related to science phenomena	1. Explain the substantive concept of matrices, determinant, and linear system 2. Apply the procedural concept of matrices, determinant, and linear system to solve and understand the real-world problem related to science phenomena	**Kriteria:** Accuracy in explaining and applying the substantive and procedural concepts of matrices, determinant, and linear system to solve the real-world problem related to science phenomena **Bentuk Penilaian** : Aktifitas Partisipasif, Tes	Case study 3 x 50'	Case Study through Unesa's Learning Management System (LMS) 3 x 60'	**Materi:** Matrices, Determinant, and Linear System **Pustaka:** *Boas, M. L. (2006). Mathematical methods in the physical science (3rd Ed.). John Wiley & Sons.* **Materi:** Matrices, Determinant, and Linear System **Pustaka:** *Roswati Mudjiarto, dkk. 2004. Matematika Fisika I. Universitas Pendidikan Indonesia. Bandung.* **Materi:** Matrices, Determinant, and Linear System **Pustaka:** *Kreyszig, E. (2006). Advanced engineering mathematics (9th Ed.). John Wiley & Sons.* **Materi:** Matrices, Determinant, and Linear System **Pustaka:** *Wospakrik,H.J. (1993).Dasar-Dasar Matematika untuk Fisika,DirjenDikti, Depdiknas, Jakarta.* **Materi:** Matrices, Determinant, and Linear System **Pustaka:** *Goodson, D. Z. (2011). Mathematical methods for physical and analytical chemistry. Wiley.* **Materi:** Matrices, Determinant, and Linear System **Pustaka:** *Logan, J. D., & Wolensensky, W. (2009). Mathematical methods in biology (Vol. 96). John Wiley & Sons.* **Materi:** Matrices, Determinant, and Linear System **Pustaka:** *Arfken, G. B., Weber, H. J., & Harris, F. E. (2013). Mathematical methods for physicists: A comprehensive guide (7th Ed.). Academic Press.*	5%

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 science 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 science phenomena	**Kriteria:** Accuracy in explaining and applying the substantive and procedural concepts of matrices, determinant, and linear system to solve the real-world problem related to science phenomena **Bentuk Penilaian** : Aktifitas Partisipasif, Tes	Case study 3 x 50‘	Case Study through Unesa‘s Learning Management System (LMS) 3 x 60'	**Materi:** Eigenvalues and Eigenvectors **Pustaka:** *Boas, M. L. (2006). Mathematical methods in the physical science (3rd Ed.). John Wiley & Sons.* **Materi:** Eigenvalues and Eigenvectors **Pustaka:** *Roswati Mudjiarto, dkk. 2004. Matematika Fisika I. Universitas Pendidikan Indonesia. Bandung.* **Materi:** Eigenvalues and Eigenvectors **Pustaka:** *Kreyszig, E. (2006). Advanced engineering mathematics (9th Ed.). John Wiley & Sons.* **Materi:** Eigenvalues and Eigenvectors **Pustaka:** *Arfken, G. B., Weber, H. J., & Harris, F. E. (2013). Mathematical methods for physicists: A comprehensive guide (7th Ed.). Academic Press.* **Materi:** Eigenvalues and Eigenvectors **Pustaka:** *Wospakrik,H.J. (1993).Dasar-Dasar Matematika untuk Fisika,DirjenDikti, Depdiknas, Jakarta.* **Materi:** Eigenvalues and Eigenvectors **Pustaka:** *Goodson, D. Z. (2011). Mathematical methods for physical and analytical chemistry. Wiley.* **Materi:** Eigenvalues and Eigenvectors **Pustaka:** *Logan, J. D., & Wolensensky, W. (2009). Mathematical methods in biology (Vol. 96). John Wiley & Sons.*	5%
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	**Kriteria:** Accuracy in applying open-source software for problem-solving matrix problems in the science field	Case study 3 x 50‘	Case Study through Unesa‘s Learning Management System (LMS) 3 x 60'	**Materi:** Matrices, Determinant, Linear System, Eigenvalues, and Eigenvectors	10%

			Bentuk Penilaian : Penilaian Praktikum			**Pustaka:** *Boas, M. L. (2006). Mathematical methods in the physical science (3rd Ed.). John Wiley & Sons.* **Materi:** Matrices, Determinant, Linear System, Eigenvalues, and Eigenvectors **Pustaka:** *Kreyszig, E. (2006). Advanced engineering mathematics (9th Ed.). John Wiley & Sons.* **Materi:** Matrices, Determinant, Linear System, Eigenvalues, and Eigenvectors **Pustaka:** *Allonso, M. and Finn, D.J. 1993. Fundamental University Fisic, Vol I, Edisons Wesley Pub.Co..* **Materi:** Matrices, Determinant, Linear System, Eigenvalues, and Eigenvectors **Pustaka:** *Arfken, G. B., Weber, H. J., & Harris, F. E. (2013). Mathematical methods for physicists: A comprehensive guide (7th Ed.). Academic Press.* **Materi:** Matrices, Determinant, Linear System, Eigenvalues, and Eigenvectors **Pustaka:** *Sahara Muslim. 2004. Gelombang dan Optik. Jakarta : Depdikbud Dikti* **Materi:** Matrices, Determinant, Linear System, Eigenvalues, and Eigenvectors **Pustaka:** *Wospakrik,H.J. (1993).Dasar-Dasar Matematika untuk Fisika,DirjenDikti, Depdiknas, Jakarta.* **Materi:** Matrices, Determinant, Linear System, Eigenvalues, and Eigenvectors **Pustaka:** *Goodson, D. Z. (2011). Mathematical methods for physical and analytical chemistry. Wiley.* **Materi:** Matrices, Determinant, Linear System, Eigenvalues, and		

						Eigenvectors **Pustaka:** *Logan, J. D., & Wolensensky, W. (2009). Mathematical methods in biology (Vol. 96). John Wiley & Sons.* **Materi:** Matrices, Determinant, Linear System, Eigenvalues, and Eigenvectors **Pustaka:** *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 problem related to science 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 problem related to science phenomena	**Kriteria:** Accuracy in explaining and applying the substantive and procedural concepts of vectors and vector analysis to solve the real-world problem related to science phenomena **Bentuk Penilaian** : Aktifitas Partisipasif	Case Study 3 x 50'	Case Study through Unesa's Learning Management System (LMS) 3 x 60'	**Materi:** Vectors and Vector Analysis **Pustaka:** *Boas, M. L. (2006). Mathematical methods in the physical science (3rd Ed.). John Wiley & Sons.* **Materi:** Vectors and Vector Analysis **Pustaka:** *Roswati Mudjiarto, dkk. 2004. Matematika Fisika I. Universitas Pendidikan Indonesia. Bandung.* **Materi:** Vectors and Vector Analysis **Pustaka:** *Kreyszig, E. (2006). Advanced engineering mathematics (9th Ed.). John Wiley & Sons.* **Materi:** Vectors and Vector Analysis **Pustaka:** *Allonso, M. and Finn, D.J. 1993. Fundamental University Fisic, Vol I, Edisons Wesley Pub.Co..* **Materi:** Vectors and Vector Analysis **Pustaka:** *Arfken, G. B., Weber, H. J., & Harris, F. E. (2013). Mathematical methods for physicists: A comprehensive guide (7th Ed.). Academic Press.* **Materi:** Vectors and Vector Analysis **Pustaka:** *Wospakrik,H.J. (1993).Dasar-Dasar Matematika untuk Fisika,DirjenDikti,*	5%

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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 problem related to science 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 problem related to science phenomena	**Kriteria:** Accuracy in explaining and applying the substantive and procedural concepts of vectors and vector analysis to solve the real-world problem related to science phenomena **Bentuk Penilaian** : Aktifitas Partisipasif, Tes	Case Study 3 x 50'	Case Study through Unesa's Learning Management System (LMS) 3 x 60'	**Materi:** Vectors and Vector Analysis **Pustaka:** *Boas, M. L. (2006). Mathematical methods in the physical science (3rd Ed.). John Wiley & Sons.* **Materi:** Vectors and Vector Analysis **Pustaka:** *Roswati Mudjiarto, dkk. 2004. Matematika Fisika I. Universitas Pendidikan Indonesia. Bandung.* **Materi:** Vectors and Vector Analysis **Pustaka:** *Kreyszig, E. (2006). Advanced engineering mathematics (9th Ed.). John Wiley & Sons.* **Materi:** Vectors and Vector Analysis **Pustaka:** *Allonso, M. and Finn, D.J. 1993. Fundamental University Fisic, Vol I, Edisons Wesley Pub.Co..* **Materi:** Vectors and Vector Analysis **Pustaka:** *Arfken, G. B., Weber, H. J., & Harris, F. E. (2013). Mathematical methods for physicists: A comprehensive guide (7th Ed.). Academic Press.* **Materi:** Vectors and Vector Analysis **Pustaka:** *Wospakrik,H.J.*	5%

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8	Mid-Semester Test	Sub-CPMK 1 - Sub-CPMK 7	**Kriteria:** Accuracy in explaining and applying the substantive and procedural concepts of matrices, determinant, linear system, eigenvalues, eigenvectors, vectors and vector analysis to solve the real-world problem related to science phenomena **Bentuk Penilaian** : Tes	Mid-Semester Test 100‘	Mid-Semester Test 100‘		10%
9	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 problem related to science 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 problem related to science phenomena	**Kriteria:** Accuracy in explaining and applying the substantive and procedural concepts of differential and integral to solve the real-world problem related to science phenomena **Bentuk Penilaian** : Aktifitas Partisipasif	Case Study 3 x 50‘	Case Study through Unesa‘s Learning Management System (LMS) 3 x 60‘	**Materi:** Differential and Integral **Pustaka:** *Boas, M. L. (2006). Mathematical methods in the physical science (3rd Ed.). John Wiley & Sons.* **Materi:** Differential and Integral **Pustaka:** *Roswati Mudjiarto, dkk. 2004. Matematika Fisika I. Universitas Pendidikan Indonesia. Bandung.* **Materi:** Differential and Integral **Pustaka:** *Kreyszig, E. (2006). Advanced engineering mathematics (9th Ed.). John Wiley & Sons.* **Materi:** Differential and Integral **Pustaka:** *Allonso, M. and Finn, D.J. 1993. Fundamental University Fisic, Vol I, Edisons Wesley Pub.Co..*	5%

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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 problem related to science 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 problem related to science phenomena	**Kriteria:** Accuracy in explaining and applying the substantive and procedural concepts of differential and integral to solve the real-world problem related to science phenomena **Bentuk Penilaian** : Aktifitas Partisipasif, Tes	Case Study 3 x 50'	Case Study through Unesa's Learning Management System (LMS) 3 x 60'	**Materi:** Differential and Integral **Pustaka:** *Boas, M. L. (2006). Mathematical methods in the physical science (3rd Ed.). John Wiley & Sons.* **Materi:** Differential and Integral **Pustaka:** *Roswati Mudjiarto, dkk. 2004. Matematika Fisika I. Universitas Pendidikan Indonesia. Bandung.* **Materi:** Differential and Integral **Pustaka:** *Kreyszig, E. (2006). Advanced engineering mathematics (9th Ed.). John Wiley & Sons.* **Materi:** Differential and Integral **Pustaka:** *Allonso, M. and*	5%

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11	1.Explain the substantive concept of partial differentiation and multiple integral 2.Apply the procedural concept of partial differentiation and multiple integral to solve and understand the real-world problem related to science phenomena	1.Explain the substantive concept of partial differentiation and multiple integral 2.Apply the procedural concept of partial differentiation and multiple integral to solve and understand the real-world problem related to science phenomena	**Kriteria:** Accuracy in explaining and applying the substantive and procedural concepts of partial differentiation and multiple integral to solve the real-world problem related to science phenomena **Bentuk Penilaian** : Aktifitas Partisipasif	Case Study 3 x 50‘	Case Study through Unesa‘s Learning Management System (LMS) 3 x 60'	**Materi:** Partial Differentiation and Multiple Integral **Pustaka:** *Strauss. W.A. 1992.Partial Differential Equations.John Wiley & Sons.* **Materi:** Partial Differentiation and Multiple Integral **Pustaka:** *Boas, M. L. (2006). Mathematical methods in the physical science (3rd Ed.). John Wiley & Sons.* **Materi:** Partial Differentiation and Multiple Integral **Pustaka:** *Kreyszig, E. (2006). Advanced engineering mathematics (9th Ed.). John Wiley & Sons.* **Materi:** Partial	5%

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12	1. Explain the substantive concept of partial differentiation and multiple integral 2. Apply the procedural concept of partial differentiation and multiple integral to solve and understand the real-world problem related to science phenomena	1. Explain the substantive concept of partial differentiation and multiple integral 2. Apply the procedural concept of partial differentiation and multiple integral to solve and understand the real-	**Kriteria:** Accuracy in explaining and applying the substantive and procedural concepts of partial differentiation and multiple integral to solve the real-world problem related to science phenomena **Bentuk Penilaian** : Aktifitas Partisipasif, Tes	Case Study 3 x 50‘	Case Study through Unesa's Learning Management System (LMS) 3 x 60'	**Materi:** Partial Differentiation and Multiple Integral **Pustaka:** *Strauss. W.A. 1992.Partial Differential Equations.John Wiley & Sons.* **Materi:** Partial Differentiation and Multiple Integral **Pustaka:** *Boas, M. L. (2006). Mathematical*	5%

			world problem related to science phenomena					*methods in the physical science (3rd Ed.). John Wiley & Sons.* **Materi:** Partial Differentiation and Multiple Integral **Pustaka:** *Kreyszig, E. (2006). Advanced engineering mathematics (9th Ed.). John Wiley & Sons.* **Materi:** Partial Differentiation and Multiple Integral **Pustaka:** *Roswati Mudjiarto, dkk. 2004. Matematika Fisika I. Universitas Pendidikan Indonesia. Bandung.* **Materi:** Partial Differentiation and Multiple Integral **Pustaka:** *Arfken, G. B., Weber, H. J., & Harris, F. E. (2013). Mathematical methods for physicists: A comprehensive guide (7th Ed.). Academic Press.* **Materi:** Partial Differentiation and Multiple Integral **Pustaka:** *Wospakrik,H.J. (1993).Dasar-Dasar Matematika untuk Fisika,DirjenDikti, Depdiknas, Jakarta.* **Materi:** Partial Differentiation and Multiple Integral **Pustaka:** *Goodson, D. Z. (2011). Mathematical methods for physical and analytical chemistry. Wiley.* **Materi:** Partial Differentiation and Multiple Integral **Pustaka:** *Logan, J. D., & Wolensensky, W. (2009). Mathematical methods in biology (Vol. 96). John Wiley & Sons.* **Materi:** Partial Differentiation and Multiple Integral **Pustaka:** *Buku Ajar Matematika*		

						Sains. (2004).	
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 science 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 science phenomena	**Kriteria:** 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 science phenomena **Bentuk Penilaian** : Aktifitas Partisipasif	Case Study 3 x 50'	Case Study through Unesa's Learning Management System (LMS) 3 x 60'	**Materi:** ODEs **Pustaka:** *Boas, M. L. (2006). Mathematical methods in the physical science (3rd Ed.). John Wiley & Sons.* **Materi:** ODEs **Pustaka:** *Roswati Mudjiarto, dkk. 2004. Matematika Fisika I. Universitas Pendidikan Indonesia. Bandung.* **Materi:** ODEs **Pustaka:** *Kreyszig, E. (2006). Advanced engineering mathematics (9th Ed.). John Wiley & Sons.* **Materi:** ODEs **Pustaka:** *Arfken, G. B., Weber, H. J., & Harris, F. E. (2013). Mathematical methods for physicists: A comprehensive guide (7th Ed.). Academic Press.* **Materi:** ODEs **Pustaka:** *Wospakrik,H.J. (1993).Dasar-Dasar Matematika untuk Fisika,DirjenDikti, Depdiknas, Jakarta.* **Materi:** ODEs **Pustaka:** *Goodson, D. Z. (2011). Mathematical methods for physical and analytical chemistry. Wiley.* **Materi:** ODEs **Pustaka:** *Logan, J. D., & Wolensensky, W. (2009). Mathematical methods in biology (Vol. 96). John Wiley & Sons.*	5%

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 science 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 science phenomena	**Kriteria:** 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 science phenomena **Bentuk Penilaian** : Aktifitas Partisipasif, Tes	Case Study 3 x 50'	Case Study through Unesa's Learning Management System (LMS) 3 x 60'	**Materi:** ODEs **Pustaka:** *Boas, M. L. (2006). Mathematical methods in the physical science (3rd Ed.). John Wiley & Sons.* **Materi:** ODEs **Pustaka:** *Roswati Mudjiarto, dkk. 2004. Matematika Fisika I. Universitas Pendidikan Indonesia. Bandung.* **Materi:** ODEs **Pustaka:** *Kreyszig, E. (2006). Advanced engineering mathematics (9th Ed.). John Wiley & Sons.* **Materi:** ODEs **Pustaka:** *Arfken, G. B., Weber, H. J., & Harris, F. E. (2013). Mathematical methods for physicists: A comprehensive guide (7th Ed.). Academic Press.* **Materi:** ODEs **Pustaka:** *Wospakrik,H.J. (1993).Dasar-Dasar Matematika untuk Fisika,DirjenDikti, Depdiknas, Jakarta.* **Materi:** ODEs **Pustaka:** *Goodson, D. Z. (2011). Mathematical methods for physical and analytical chemistry. Wiley.* **Materi:** ODEs **Pustaka:** *Logan, J. D., & Wolensensky, W. (2009). Mathematical methods in biology (Vol. 96). John Wiley & Sons.*	5%
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	**Kriteria:** 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 science phenomena **Bentuk Penilaian** : Penilaian Praktikum	Case Study 3 x 50'	Case Study through Unesa's Learning Management System (LMS) 3 x 60'	**Materi:** ODEs **Pustaka:** *Boas, M. L. (2006). Mathematical methods in the physical science (3rd Ed.). John Wiley & Sons.* **Materi:** ODEs **Pustaka:** *Roswati Mudjiarto, dkk. 2004. Matematika Fisika I. Universitas Pendidikan Indonesia.*	10%

						Bandung. **Materi:** ODEs **Pustaka:** *Kreyszig, E. (2006). Advanced engineering mathematics (9th Ed.). John Wiley & Sons.* **Materi:** ODEs **Pustaka:** *Arfken, G. B., Weber, H. J., & Harris, F. E. (2013). Mathematical methods for physicists: A comprehensive guide (7th Ed.). Academic Press.* **Materi:** ODEs **Pustaka:** *Wospakrik,H.J. (1993).Dasar-Dasar Matematika untuk Fisika,DirjenDikti, Depdiknas, Jakarta.* **Materi:** ODEs **Pustaka:** *Goodson, D. Z. (2011). Mathematical methods for physical and analytical chemistry. Wiley.* **Materi:** ODEs **Pustaka:** *Logan, J. D., & Wolensensky, W. (2009). Mathematical methods in biology (Vol. 96). John Wiley & Sons.* **Materi:** ODEs **Pustaka:** *Allonso, M. and Finn, D.J. 1993. Fundamental University Fisic, Vol I, Edisons Wesley Pub.Co..* **Materi:** ODEs **Pustaka:** *Sahara Muslim. 2004. Gelombang dan Optik. Jakarta : Depdikbud Dikti* **Materi:** ODEs **Pustaka:** *Open Source Software for Mathematics (like Octave, Mathlab, GeoGebra, etc).*	

16	Final Semester Test	Sub-CPMK 1 - Sub-CPMK 15	**Kriteria:** Accuracy inexplaining andapplying thesubstantive andproceduralconcepts ofmatrices,determinant, linearsystem, eigenvalues, eigenvectors, vectors, vectoranalysis, differential, integral, partial differentiation, multiple integral, and ODEs to solvethe real-worldproblem related tosciencephenomena **Bentuk Penilaian** : Tes	Final Semester Test 100‘	Final Semester Test 100‘		10%

Rekap Persentase Evaluasi : Case Study

No	Evaluasi	Persentase
1.	Aktifitas Partisipasif	45%
2.	Penilaian Praktikum	20%
3.	Tes	35%
		100%

Catatan

1. **Capaian Pembelajaran Lulusan Prodi (CPL - Prodi)** adalah kemampuan yang dimiliki oleh setiap lulusan prodi yang merupakan internalisasi dari sikap, penguasaan pengetahuan dan ketrampilan sesuai dengan jenjang prodinya yang diperoleh melalui proses pembelajaran.
2. **CPL yang dibebankan pada mata kuliah** adalah beberapa capaian pembelajaran lulusan program studi (CPL-Prodi) yang digunakan untuk pembentukan/pengembangan sebuah mata kuliah yang terdiri dari aspek sikap, ketrampulan umum, ketrampilan khusus dan pengetahuan.
3. **CP Mata kuliah (CPMK)** adalah kemampuan yang dijabarkan secara spesifik dari CPL yang dibebankan pada mata kuliah, dan bersifat spesifik terhadap bahan kajian atau materi pembelajaran mata kuliah tersebut.
4. **Sub-CPMK Mata kuliah (Sub-CPMK)** adalah kemampuan yang dijabarkan secara spesifik dari CPMK yang dapat diukur atau diamati dan merupakan kemampuan akhir yang direncanakan pada tiap tahap pembelajaran, dan bersifat spesifik terhadap materi pembelajaran mata kuliah tersebut.
5. **Indikator penilaian** kemampuan dalam proses maupun hasil belajar mahasiswa adalah pernyataan spesifik dan terukur yang mengidentifikasi kemampuan atau kinerja hasil belajar mahasiswa yang disertai bukti-bukti.
6. **Kreteria Penilaian** adalah patokan yang digunakan sebagai ukuran atau tolok ukur ketercapaian pembelajaran dalam penilaian berdasarkan indikator-indikator yang telah ditetapkan. Kreteria penilaian merupakan pedoman bagi penilai agar penilaian konsisten dan tidak bias. Kreteria dapat berupa kuantitatif ataupun kualitatif.
7. **Bentuk penilaian:** tes dan non-tes.
8. **Bentuk pembelajaran:** Kuliah, Responsi, Tutorial, Seminar atau yang setara, Praktikum, Praktik Studio, Praktik Bengkel, Praktik Lapangan, Penelitian, Pengabdian Kepada Masyarakat dan/atau bentuk pembelajaran lain yang setara.
9. **Metode Pembelajaran:** Small Group Discussion, Role-Play & Simulation, Discovery Learning, Self-Directed Learning, Cooperative Learning, Collaborative Learning, Contextual Learning, Project Based Learning, dan metode lainnya yg setara.
10. **Materi Pembelajaran** adalah rincian atau uraian dari bahan kajian yg dapat disajikan dalam bentuk beberapa pokok dan sub-pokok bahasan.
11. **Bobot penilaian** adalah prosentasi penilaian terhadap setiap pencapaian sub-CPMK yang besarnya proposional dengan tingkat kesulitan pencapaian sub-CPMK tsb., dan totalnya 100%.
12. TM=Tatap Muka, PT=Penugasan terstruktur, BM=Belajar mandiri.