



UNIVERSITAS PAKUAN FACULTY OF MATHEMATICS AND NATURAL SCIENCES
FACULTY OF NATURAL SCIENCES
STUDY PROGRAM OF MATHEMATICS
SEMESTER LEARNING PLAN

COURSE / MATA KULIAH (MK)	CODE	COURSE CLUSTER		COURSE CREDIT (SKS)		SEMESTER	DOCUMENT NO. & DATE
Ordinary Differential Equation				T=2	P=1	III	
AUTHORIZATION	SLP Developer		Coordinator of Course Cluster			Head of Study Program	
	Dr. Embay Rohaeti, M.Si.					Dr. Fitria Virgantari	
Learning Achievement / Capaian Pembelajaran (CP)	CPL - Study Program on Course						
	CPL 3	Discipline, responsible, and have an entrepreneurial spirit based on values, norms, and ethics.					
	CPL 6	Ability to use and develop mathematical concepts, including procedural/computational, exploration, logical reasoning, generalization, abstraction, and formal proof.					
	CPL 7	Ability to formulate, solve, interpret, and analyze a real world problem through a mathematical approach with or without the help of software in a comprehensive manner.					
	CPL 8	Ability to master mathematical theoretical concepts and mathematical model concepts in a complete and in-depth manner.					
	Course Learning Outcomes / Capaian Pembelajaran Mata Kuliah (CPMK)						
	CPMK 1	Ability to understand and explain the basic concepts of ordinary differential equations (ODE).					
	CPMK 2	Ability to understand first-order ODE and solving techniques for first-order ODE, analytically and numerically with the help of software.					
	CPMK 3	Ability to understand and explain second-order ODE, ability to determine general and specific solutions of second-order ODE, analytically and numerically with the help of software.					
	CPMK 4	Ability to understand the basic concepts of a system of differential equations (ODEs), phase fields, ability to determine general and specific solutions of ODEs system analytically and numerically with the help of software, ability to apply differential equation models in real-life problems or natural phenomena.					
	Outcomes of Each Learning Stage (Sub-CPMK)						
	Sub-CPMK 1	Ability to explain the meaning of ordinary differential equation (ODE), ODE order, ODE rank, initial value problem, general and specific solutions, first-order linear ODE and non-linear ODE					
	Sub-CPMK 2	Ability to explain and determine general and special solutions of separable ODE, mixed but separable ODE, initial value problems, ability to master integration factor techniques, ability to determine numerical solutions with the help of software.					
	Sub-CPMK 3	Ability to explain homogeneous and non-homogeneous ODE, ability to determine general and specific solutions of homogeneous and non-homogeneous first-order ODE, analytically and numerically with the help of software.					
	Sub-CPMK 4	Ability to explain exact and non-exact ODE, ability to determine general and specific solutions from exact and non-exact ODE, analytically and numerically with the help of software.					
	Sub-CPMK 5	Ability to explain homogeneous second-order linear ODE with constant coefficients and non-homogeneous second-order linear ODE, ability to explain and use the order reduction method in solving differential equations.					
	Sub-CPMK 6	Ability to explain systems of linear and non-linear differential equations, phase planes, fixed points, stability points, reproduction ratio numbers, and ability to determine general and specific solutions from ODEs system analytically and numerically with the help of software, and ability to apply them to real-life problems or natural phenomena through differential equation models.					
	Correlation of CPL and Sub-CPMK						
		Sub-CPMK 1	Sub-CPMK 2	Sub-CPMK 3	Sub-CPMK 4	Sub-CPMK 5	Sub-CPMK 6
	CPL 3	√	√	√	√	√	√
CPL 6	√	√	√	√	√	√	
CPL 7			√	√	√	√	
CPL 8			√	√	√	√	
Short Description of the Course	Ordinary Differential Equation (ODE) course is one of the solutions in modeling, which can be used to illustrate natural phenomena. ODE course consists of the basic concepts of ODE, types of linear and non-linear ODE, first-order and second-order linear ODE, analytical and numerical ODE, and ODE applications in other fields.						

<p>Study Materials</p>	<ol style="list-style-type: none"> 1. Basic concept of ordinary differential equation (ODE) 2. First-order linear ODE, the difference between linear and non-linear ODE 3. Separable ODE, mixed but separable ODE 4. Initial value problems and integration factors 5. Homogeneous ODE 6. Non-homogeneous ODE 7. Exact and non-exact ODE 8. Midterm Examp 9. Second-order linear ODE 10. Order reduction method 11. Homogeneous second-order linear ODE with constant coefficients 12. Non-homogeneous second-order linear ODE 13. System of linear differential equations 14. System of non-linear differential equations 15. Fixed point, stability point, phase plane, ratio reproduction number 16. Final Exam 						
<p>References</p>	<p>Main References:</p> <ol style="list-style-type: none"> 1. Farlow SJ. 1994 . <i>An Introduction to Differential Equations and Their Application</i> s. New York : Mc Graw-Hill. 2. Hethcote H W. 2000. The Mathematic of Infectious Diseases. <i>SIAM Review</i> 42 . No.4 5599-653. 3. Rohaeti E. <i>et.al</i>. 2015. Stability Analysis Model of Spreading and Controlling of Tuberculosis. <i>Applied Mathematical Sciences</i> .9(52):2559-2566 4. Rohaeti E. <i>et.al</i>. 2015. The Effect of Combining Herbal and Synthetic Medicines on Stability Analysis of Tuberculosis. <i>Far East Journal of Mathematical Sciences</i> .98(6):769-775 5. Rohaeti E. 2023. <i>Modul praktikum persamaan differensial biasa</i> . <p>Supporting References:</p> <p>Latest journals on the application of Ordinary Differential Equations</p>						
<p>Lecturer</p>	<p>Dr. Embay Rohaeti, M.Si.</p>						
<p>Prerequisite Courses</p>	<p>Advanced Calculus II</p>						
<p>Week-</p>	<p>Outcomes of Each Learning Stage (Sub-CPMK)</p>	<p>Evaluation</p>		<p>Learning Form, Learning Method, Student Assignment [Time Estimation]</p>		<p>Learning Material [Reference]</p>	<p>Evaluation Weight %</p>
		<p>Indicator</p>	<p>Criteria & Form</p>	<p>Offline</p>	<p>Online</p>		
<p>1,2</p>	<p>Ability to explain the meaning of ordinary differential equation (ODE), ODE order, ODE degree, initial value problems, general and specific solutions, first-order linear ODE and non-linear ODE. (Sub-CPMK 1)</p>	<p>1. Accuracy in explaining the meaning of ODE, order and rank of ODE, initial value problems, general and specific solutions 2. Be able to explain and analyze first-order linear ODE 3. Be able to explain and analyze non-linear ODE.</p>	<p>Criteria: analysis mastery and accuracy; Form: Written test assessment, activity and attitude assessment</p>	<p>Form: Face-to-face lecture, discussion, question and answer session; independent and structured assignments Method : Problem-based learning Assignment: practice questions (solving questions) TM & BM: 2 x (2 x 50) minutes</p>	<p>Gmeet and (https://lms.unpak.ac.id/course/view.php?id=16896) [3x50"]</p>	<p>1. Farlow SJ. 1994 . <i>An Introduction to Differential Equations and Their Applications</i> . New York : Mc Graw-Hill. 2. Hethcote H W. 2000. The Mathematic of Infectious Diseases. <i>SIAM Review</i> 42 . No.4 5599-653. 3. Rohaeti E. <i>et.al</i>. 2015. Stability Analysis Model of Spreading and Controlling of Tuberculosis. <i>Applied Mathematical Sciences</i> .9(52):2559-2566 4. Rohaeti E. <i>et.al</i>. 2015. The Effect of Combining Herbal and Synthetic Medicines on Stability Analysis of Tuberculosis. <i>Far East Journal of Mathematical Sciences</i> .98(6):769-775 5. Rohaeti E. 2023. <i>Modul praktikum persamaan differensial biasa</i> .</p>	<p>5</p>

3,4	Ability to explain, to determine general and specific solutions of separable ODE, mixed but separable ODE, initial value problems, integration factor techniques, ability to determine numerical solutions using software. (Sub-CPMK 2)	1. Accuracy in determining ODE type 2. Be able to use direct integration and integration factor methods in solving separate ODE and mixed but separable ODE 3. Be able to determine numerical solutions of separable ODE and mixed but separate ODE using software.	Criteria: analysis mastery and accuracy; Form: Written test assessment, activity and attitude assessment	Form: Face-to-face lecture, discussion, question and answer session; independent and structured assignments Method : Problem-based learning Assignment: practice questions (solving questions) TM & BM: 2 x (2 x 50) minutes	Gmeet and (https://lms.unpak.ac.id/course/view.php?id=16896) [3x50"]	1. Farlow SJ. 1994 . <i>An Introduction to Differential Equations and Their Applications</i> . New York : Mc Graw-Hill. 2. Hethcote H W. 2000. The Mathematic of Infectious Diseases. <i>SIAM Review</i> 42 . No.4 5599-653. 3. Rohaeti E. <i>et.al</i> . 2015. Stability Analysis Model of Spreading and Controlling of Tuberculosis. <i>Applied Mathematical Sciences</i> .9(52):2559-2566 4. Rohaeti E. <i>et.al</i> . 2015. The Effect of Combining Herbal and Synthetic Medicines on Stability Analysis of Tuberculosis. <i>Far East Journal of Mathematical Sciences</i> .98(6):769-775 5. Rohaeti E. 2023. <i>Modul praktikum persamaan differensial biasa</i> .	5
5,6	Ability to explain homogeneous and non-homogeneous ODE, ability to determine general and specific solutions of homogeneous and non-homogeneous first-order ODE, analytically and numerically using software. (Sub-CPMK 3)	1. Accuracy in determining homogeneous ODE and non-homogeneous ODE 2. Be able to determine general and specific solutions of homogeneous and non-homogeneous ODE. 3. Be able to determine numerical solutions of homogeneous and non-homogeneous ODE using software.	Criteria: analysis mastery and accuracy; Form: Written test assessment, activity and attitude assessment	Form: Face-to-face lecture, discussion, question and answer session; independent and structured assignments Method : Problem-based learning Assignment: practice questions (solving questions) TM & BM: 2 x (2 x 50) minutes	Gmeet and (https://lms.unpak.ac.id/course/view.php?id=16896) [3x50"]	1. Farlow SJ. 1994 . <i>An Introduction to Differential Equations and Their Applications</i> . New York : Mc Graw-Hill. 2. Hethcote H W. 2000. The Mathematic of Infectious Diseases. <i>SIAM Review</i> 42 . No.4 5599-653. 3. Rohaeti E. <i>et.al</i> . 2015. Stability Analysis Model of Spreading and Controlling of Tuberculosis. <i>Applied Mathematical Sciences</i> .9(52):2559-2566 4. Rohaeti E. <i>et.al</i> . 2015. The Effect of Combining Herbal and Synthetic Medicines on Stability Analysis of Tuberculosis. <i>Far East Journal of Mathematical Sciences</i> .98(6):769-775 5. Rohaeti E. 2023. <i>Modul praktikum persamaan differensial biasa</i> .	10
7	Ability to explain exact and non-exact ODE, ability to determine general and specific solutions of exact and non-exact ODE, analytically and numerically using software. (Sub-CPMK 4)	1. Accuracy in determining exact and non-exact ODE 2. Be able to determine general and specific solutions of exact and non-exact ODE. 3. Be able to determine numerical solutions of exact and non-exact ODE using software.	Criteria: analysis mastery and accuracy; Form: Written test assessment, activity and attitude assessment	Form: Face-to-face lecture, discussion, question and answer session; independent and structured assignments Method : Problem-based learning Assignment: practice questions (solving questions) TM & BM: 1 x (2 x 50) minutes	Gmeet and (https://lms.unpak.ac.id/course/view.php?id=16896) [3x50"]	1. Farlow SJ. 1994 . <i>An Introduction to Differential Equations and Their Applications</i> . New York : Mc Graw-Hill. 2. Hethcote H W. 2000. The Mathematic of Infectious Diseases. <i>SIAM Review</i> 42 . No.4 5599-653. 3. Rohaeti E. <i>et.al</i> . 2015. Stability Analysis Model of Spreading and Controlling of Tuberculosis. <i>Applied Mathematical Sciences</i> .9(52):2559-2566 4. Rohaeti E. <i>et.al</i> . 2015. The Effect of Combining Herbal and Synthetic Medicines on Stability Analysis of Tuberculosis. <i>Far East Journal of Mathematical Sciences</i> .98(6):769-775 5. Rohaeti E. 2023. <i>Modul praktikum persamaan differensial biasa</i> .	5
8	Midterm Exam						

9,10	Ability to explain second-order linear ODE, ability to explain and use order reduction method when solving differential equations. (Sub-CPMK 5)	1. Accuracy in determining second-order linear ODE. 2. Be able to use the reduction method when solving second-order ODE. 3. Be able to determine numerical solutions of second-order linear ODE using software.	Criteria: analysis mastery and accuracy; Form: Written test assessment, activity and attitude assessment	Form: Face-to-face lecture, discussion, question and answer session; independent and structured assignments Method : Problem-based learning Assignment: practice questions (solving questions) TM & BM: 2 x (2 x 50) minutes	Gmeet and (https://lms.unpak.ac.id/course/view.php?id=16896) [3x50"]	1. Farlow SJ. 1994 . <i>An Introduction to Differential Equations and Their Applications</i> . New York : Mc Graw-Hill. 2. Hethcote H W. 2000. The Mathematic of Infectious Diseases. <i>SIAM Review</i> 42 . No.4 5599-653. 3. Rohaeti E. <i>et.al.</i> 2015. Stability Analysis Model of Spreading and Controlling of Tuberculosis. <i>Applied Mathematical Sciences</i> .9(52):2559-2566 4. Rohaeti E. <i>et.al.</i> 2015. The Effect of Combining Herbal and Synthetic Medicines on Stability Analysis of Tuberculosis. <i>Far East Journal of Mathematical Sciences</i> .98(6):769-775 5. Rohaeti E. 2023. <i>Modul praktikum persamaan differensial biasa.</i>	5
11,12	Ability to explain homogeneous second-order linear ODE with constant coefficients and non-homogeneous second-order linear ODE, ability to determine the solution of homogeneous and non-homogeneous second-order linear ODE. (Sub-CPMK 5)	1. Accuracy in determining homogeneous and non-homogeneous second-order linear ODE. 2. Be able to determine general and specific solutions of homogeneous and non-homogeneous second-order linear ODE with constant coefficients. 3. Be able to determine numerical solutions of homogeneous and non-homogeneous second-order linear ODE using software.	Criteria: analysis mastery and accuracy; Form: Written test assessment, activity and attitude assessment	Form: Face-to-face lecture, discussion, question and answer session; independent and structured assignments Method : Problem-based learning Assignment: practice questions (solving questions) TM & BM: 2 x (2 x 50) minutes	Gmeet and (https://lms.unpak.ac.id/course/view.php?id=16896) [3x50"]	1. Farlow SJ. 1994 . <i>An Introduction to Differential Equations and Their Applications</i> . New York : Mc Graw-Hill. 2. Hethcote H W. 2000. The Mathematic of Infectious Diseases. <i>SIAM Review</i> 42 . No.4 5599-653. 3. Rohaeti E. <i>et.al.</i> 2015. Stability Analysis Model of Spreading and Controlling of Tuberculosis. <i>Applied Mathematical Sciences</i> .9(52):2559-2566 4. Rohaeti E. <i>et.al.</i> 2015. The Effect of Combining Herbal and Synthetic Medicines on Stability Analysis of Tuberculosis. <i>Far East Journal of Mathematical Sciences</i> .98(6):769-775 5. Rohaeti E. 2023. <i>Modul praktikum persamaan differensial biasa.</i>	5
13, 14	Ability to explain systems of linear and non-linear differential equations, ability to determine general and specific solutions of ODEs system analytically and numerically using software, and ability to apply them to real problems or natural phenomena through differential equation models. (Sub-CPMK 6)	1. Ability to explain and determine linear and non-linear ODE system. 2. Be able to determine general and specific solutions of ODE system, both analytically and numerically using software. 3. Be able to apply the concept of ODE system in real-life problems or natural phenomena through differential models.	Criteria: analysis mastery and accuracy; Form: Written test assessment, activity and attitude assessment	Form: Face-to-face lecture, discussion, question and answer session; independent and structured assignments Method : Problem-based learning Assignment: practice questions (solving questions) TM & BM: 2 x (2 x 50) minutes	Gmeet and (https://lms.unpak.ac.id/course/view.php?id=16896) [3x50"]	1. Farlow SJ. 1994 . <i>An Introduction to Differential Equations and Their Applications</i> . New York : Mc Graw-Hill. 2. Hethcote H W. 2000. The Mathematic of Infectious Diseases. <i>SIAM Review</i> 42 . No.4 5599-653. 3. Rohaeti E. <i>et.al.</i> 2015. <i>Stability Analysis Model of Spreading and Controlling of Tuberculosis</i> . Applied Mathematical Sciences.9(52):2559-2566 4. Rohaeti E. <i>et.al.</i> 2015. The Effect of Combining Herbal and Synthetic Medicines on Stability Analysis of Tuberculosis. <i>Far East Journal of Mathematical Sciences</i> .98(6):769-775 5. Rohaeti E. 2023. <i>Modul praktikum persamaan differensial biasa.</i>	10

15	Ability to explain and determine fixed points, stability points, phase planes, ratio reproduction numbers, ability to apply the concepts in real-life problems or natural phenomena through differential equation models, ability to plot phase fields using software. (Sub-CPMK 6)	1. Be able to determine and calculate fixed points, stability points, ratio reproduction number. 2. Be able to plot the phase field with a directional field using software. 3. Be able to apply the concepts in real-life problems or natural phenomena through differential models.	Criteria: analysis mastery and accuracy; Form: Written test assessment, activity and attitude assessment	Form: Face-to-face lecture, discussion, question and answer session; independent and structured assignments Method : Problem-based learning, discovery learning Assignment: solving questions, presentation on journal review TM & BM: 1 x (2 x 50) minutes	Gmeet and (https://lms.unpak.ac.id/courses/view.php?id=16896) [3x50"]	1. Farlow SJ. 1994 . <i>An Introduction to Differential Equations and Their Applications</i> . New York : Mc Graw-Hill. 2. Hethcote H W. 2000. The Mathematic of Infectious Diseases. <i>SIAM Review</i> 42. No.4 5599-653. 3. Rohaeti E. <i>et.al</i> . 2015. Stability Analysis Model of Spreading and Controlling of Tuberculosis. <i>Applied Mathematical Sciences</i> .9(52):2559-2566 4. Rohaeti E. <i>et.al</i> . 2015. The Effect of Combining Herbal and Synthetic Medicines on Stability Analysis of Tuberculosis. <i>Far East Journal of Mathematical Sciences</i> .98(6):769-775 5. Rohaeti E. 2023. <i>Modul praktikum persamaan differensial biasa</i> .	5
16	Final Exam						

Evaluation Plan, Distribution, and Percentage of Ordinary Differential Equation Course

Sub-CPMK	Midterm Exam	Final Exam	Worksheet		Practicum			Activity	Attitude	Percentage	
			Coursework	Quiz	Performance	Reports	Midterm Exam				Final Exam
Sub-CPMK 1	5.0%		1.00%	3.0%	0.83%	0.83%	3%		0.67%	0.67%	15.0%
Sub-CPMK 2	5.0%		1.00%		0.83%	0.83%	3%		0.67%	0.67%	12.0%
Sub-CPMK 3	10.0%		1.00%		0.83%	0.83%	4%		0.67%	0.67%	18.0%
Sub-CPMK 4	5.0%		1.00%		0.83%	0.83%	3%		0.67%	0.67%	12.0%
Sub-CPMK 5		10.0%	1.00%	3.0%	0.83%	0.83%		3%	0.67%	0.67%	20.0%
Sub-CPMK 6		15.0%	1.00%		0.83%	0.83%		4%	0.67%	0.67%	23.0%
Percentage	25%	25%	6%	6%	5%	5%	13%	7%	4%	4%	100%

Bogor, August 2023



Dr. Embay Rohaeti, M.Si