SEMESTER STUDY PLAN

INTRODUCTION TO PARTIAL DIFFERENTIAL EQUATIONS

(COMPULSORY COURSE)

(Project Based Learning Method)

DEPARTMENT OF MATHEMATICS AND DATA SCIENCE

FACULTY OF MATHEMATICS AND NATURAL SCIENCES

UNIVERSITAS ANDALAS

2024

SEMESTER STUDY PLAN (SSP)
BACHELOR PROGRAM OF MATHEMATICS
FACULTY OF MATHEMATICS AND NATURAL SCIENCES
UNIVERSITAS ANDALAS

Course Name	Course Code	URL *I-Learn*	Credits	Semester	Compilation Date
Introduction to Partial Differential Equations	MAT61244	https://sci.ilearn.unand.ac.id	3	4	11 May 2024

Person In Charge	Study Plan Creator	Head of Research Group	Head of Study Program
	Dr. Noverina Alfiany Dr. Arrival Rince Putri Dr. Mahdhivan Syafwan	Dr. Ahmad Iqbal Baqi	Dr. Noverina Alfiany

Intended Learning Outcomes (ILO) and Performance Indicator (PI)	Intended Learning Outcomes	
	ILO-3	An ability to identify, explain and generalize simple mathematical PI-1: An ability to identify simple mathematical problems PI-2: An ability to explain simple mathematical problems PI-3: An ability to generalize simple mathematical problems
	ILO-4	An ability to use concept and fundamental technique of mathematics in solving simple mathematical problems PI-1: An ability to illustrate simple mathematical problems based on appropriate basic mathematical concepts and techniques PI-2: An ability to illustrate simple mathematical problems based on appropriate basic mathematical concepts and techniques PI-3: An ability to solve simple mathematical problems using appropriate basic mathematical concepts and techniques
	ILO-6	Have ability data literacy and technology and can apply them in solving simple mathematical problems or other relevant fields

		PI-1: An ability to identify the right data and technology to solve simple mathematical problems or other fields PI-2: An ability to use data and technology and apply them to solve simple mathematical statements or other areas PI-3: An ability to process data using available technology in simple mathematical problems or other fields PI-4: An ability to conclude and interpret data processing results for simple mathematical problems or other fields PI-5: An ability to design an algorithm to solve simple mathematical problems or other fields
	ILO-7	An ability to communicate effectively especially in the area of mathematics in with diverse communities PI-1: An ability to convey ideas or study results orally, especially in the field of mathematics PI-2: An ability to present ideas or study results in writing, especially in the field of mathematics PI-3: An ability to respond to feedback given
	Course Learning Outcomes	
	1	Have an understanding of the basic concepts, definitions, and classification of partial differential equations (ILO-3: PI-1, PI-2, PI-3)
	2	Skilled in using various solution methods, such as the direct integration method, variable separation method, characteristic method, and Fourier series method (ILO-4: PI-1, PI-2, PI-3)
	3	Have an understanding of the transport equation, heat (diffusion) equation, wave equation, and Laplace's equation, as well as being skilled at determining solutions to these equations using the pde solution method given previously (ILO-3: PI-1, PI-2, PI-3; ILO-4: PI-1, PI-2, PI-3)
	4	Skilled in using Laplace and Fourier transforms in pde problems (ILO-4: PI-2; PI-2, PI-3)
	5	Have an understanding of the physical aspects of the theory discussed and the ability to interpret the solutions obtained (ILO-6: PI-1, PI-2, PI-3, PI-4, PI-5; ILO-7: PI-1, PI-2, PI-3)
Brief Description	This lecture discusses the terminology and classification of partial differential equations (PDE), the three main problems in PDE (heat/diffusion equation, wave equation, and Laplace's equation), the Fourier series method, integral	

<table>
<tr><td></td><td colspan="2">transformation, separation of variables, and characteristics of solving PDE. This course is carried out using the Project Based Learning (PjBL) learning method.

To show the use of the theory taught during lectures and at the same time introduce simple research to students, this lecture is also equipped with project assignments that are carried out in groups. This project is an implementation of lecture materials with topics taken from simple but interesting real problems. It is hoped that this project assignment can increase student motivation in studying teaching material, as well as encourage student creativity in the learning process.</td></tr>
<tr><td>Course Materials</td><td colspan="2">1. ODE Review;
2. Definition, classification and basic concepts of PDE;
3. PDE's Three Main Problems;
4. Fourier Series;
5. Integral Transformation;
6. Solving the PDE's Three Main Problems;
7. Characteristic Method.</td></tr>
<tr><td>References</td><td colspan="2">Main:
1. M. P. Coleman, An Introduction to Partial Differential Equations with Matlab, Taylor & Francis, 2013.
2. D. Arrigo, An Introduction to Partial Differential Equations, Springer, 2nd Edition, 2023.
Additional:
3. T. Myint-U, Linear Partial Differential Equations for Scientist and Engineers, Birkhäuser, 2007.
4. W. E. Boyce and R. C. DiPrima, Elementary Differential Equations and Boundary Value Problems, John Wiley & Sons, 2009.
5. Sri Redjeki Pudjaprasetya, Diktat Kuliah: Persamaan Diferensial Parsial (ITB).</td></tr>
<tr><td>Learning Media</td><td>Software:</td><td>Hardware:</td></tr>
<tr><td></td><td>● LMS Unand (http://fmipa.ilearn.unand.ac.id/)
● Zoom meeting
● Whatsapp</td><td>● Computer/Laptop
● Smartphone</td></tr>
</table>

Team Teaching	1. Dr. Mahdhivan Syafwan 2. Dr. Arrival Rince Putri 3. Dr. Noverina Alfiany
Assessment	Homework, Quizzes, Mid-Term exam, Final exam, Project
Required courses	MAT61122 Calculus 3 MAT61142 Ordinary Differential Equations
Academic Norms	https://akademik.unand.ac.id/images/2022-03-30%20Peraturan%20Rektor%20Nomor%207%20Tahun%202022%20Penyelenggaraan%20Pendidikan-khusus%20Bab%20II.pdf

Weekly Study Plan

Week / Meet (1)	Course Outcomes (2)	Indicator (3)	Assessment (4)	Activities/Forms of Learning [Time estimated]				Media (9)	Subject, references (10)	Weight (11)
				Synchronous*		Asynchronous**				
				Face to face Offline (5)	Face to face Online (6)	Individual (7)	Collaboration (8)			
1/1	CLO-1 Have an understanding of the basic concepts, definitions, and classification of partial differential equations (ILO-3: PI-1, PI-2, PI-3)	• Discipline in carrying out course contracts • Accurate understanding of related material • Accuracy in answering assignment questions • Neatness of task	Non-test: Test: Mid-term exam: 2,5%	Teaching and discussion: - Introduction to SSP - material explanation - task explanation - discussion and question-and-answer		Students read and study the learning materials individually [1 x 3 x 120 minute]		• PPT • i-learn (LMS Unand) (Specific condition: Zoom meeting, WA group, learning video)	• Assessment Rules, SSP, Syllabus, Tuition Contract • Definition, motivation, ODE review • Definition, classification and basic concepts of PD.	2,5%

		execution ● Originality of task results		lecture material - brief explanation of the final project [1 x 3 x 50 minute]					● Examples, initial conditions and boundary conditions ● Linear PDE, superposition principle [1], [2], [3], [4]	
2/2	CLO-1 Have an understanding of the basic concepts, definitions, and classification of partial differential equations (ILO-3: PI-1, PI-2, PI-3)	● Discipline in carrying out course contracts ● Accurate understanding of related material ● Accuracy in answering assignment questions ● Neatness of task execution ● Originality of task results	Non-test: Test: Mid-term exam: 2,5%	Teaching and discussion: - material explanation - task explanation - discussion and question-and-answer lecture material [1 x 3 x 50 minute]	(Certain conditions: total *blended learning* 40%)	Students read and study the learning materials individually [1 x 3 x 60 minute]	Students discuss in groups about lecture material and assignments [1 x 3 x 60 minutes]	● PPT ● i-learn (LMS Unand) (Specific condition: Zoom meeting, WA group, learning video)	● Variable separation method for homogeneous linear PDE ● The eigenvalue problem ● PDE 2nd order linear homogeneous constant coefficients [1], [2], [3], [4]	2,5%
3/3	CLO-2 Skilled in using various solution methods, such	● Discipline in carrying out course contracts	Non-test: Homework 1 (1%) Test:	Teaching and discussion: - material explanation	(Certain conditions: total *blended learning* 40%)	Students read and study the learning materials individually	Students discuss in groups about lecture	● PPT ● i-learn (LMS Unand)	● Heat (diffusion) equation, wave	3,5%

	as the direct integration method, variable separation method, characteristic method, and Fourier series method (ILO-4: PI-1, PI-2, PI-3)	• Accurate understanding of related material • Accuracy in answering assignment questions • Neatness of task execution • Originality of task results	Mid-term exam: 2,5%	- task explanation - discussion and question-and-answer lecture material [1 x 3 x 50 minute]		[1 x 3 x 60 minute]	material and assignments [1 x 3 x 60 minute]	(Specific condition: Zoom meeting, WA group, learning video)	equation, Laplace equation • Initial conditions and boundary conditions for heat, wave, and Laplace equations • Variable separation method [1], [2], [3], [4]	
4/4	CLO-2 Skilled in using various solution methods, such as the direct integration method, variable separation method, characteristic method, and Fourier series method (ILO-4: PI-1, PI-2, PI-3)	• Discipline in carrying out course contracts • Accurate understanding of related material • Accuracy in answering assignment questions • Neatness of task execution • Originality of	Non-test: Homework 2 (2%) Test: Mid-term exam: 2,5%	Kuliah dan Teaching and discussion: - material explanation - task explanation - discussion and question-and-answer lecture material [1 x 3 x 50 minute]	(Certain conditions: total *blended learning* 40%)	Students read and study the learning materials individually [1 x 3 x 60 minute]	Students discuss in groups about lecture material and assignments [1 x 3 x 60 minutes]	• PPT • i-learn (LMS Unand) (Specific condition: Zoom meeting, WA group, learning video)	• Introduction to Fourier series • Properties of sine and cosine functions, definition • Theorems about Fourier series, Fourier series of sines and	4,5%

		task results							cosines [1], [2], [3], [4]	
5/5	CLO-3 Have an understanding of the transport equation, heat (diffusion) equation, wave equation, and Laplace's equation, as well as being skilled at determining solutions to these equations using the pde solution method given previously (ILO-3: PI-1, PI-	• Discipline in carrying out course contracts • Accurate understanding of related material • Accuracy in answering assignment questions • Neatness of task execution • Originality of task results	Non-test: Test: Mid-term exam: 5%	Teaching and discussion: - material explanation - task explanation - discussion and question-and-answer lecture material [1 x 3 x 50 minute]	(Certain conditions: total *blended learning* 40%)	Students read and study the learning materials individually [1 x 3 x 60 minute]	Students discuss in groups about lecture material and assignments [1 x 3 x 60 minutes]	• PPT • i-learn (LMS Unand) (Specific condition: Zoom meeting, WA group, learning video)	• Solving homogeneous equation problems in finite domains [1], [2], [3], [4]	5%

	2, PI-3; ILO-4: PI-1, PI-2, PI-3)									
6/6	CLO-4 Skilled in using Laplace and Fourier transforms in pde problems (ILO-4: PI-2; PI-2, PI-3)	• Discipline in carrying out course contracts • Accurate understanding of related material • Accuracy in answering assignment questions • Neatness of task execution • Originality of task results	Non-test: Homework 3 (1%) Test: Mid-term exam: 2,5%	Teaching and discussion: - material explanation - task explanation - discussion and question-and-answer lecture material [1 x 3 x 50 minute]	(Certain conditions: total *blended learning* 40%)	Students read and study the learning materials individually [1 x 3 x 60 minute]	Students discuss in groups about lecture material and assignments [1 x 3 x 60 minutes]	• PPT • i-learn (LMS Unand) (Specific condition: Zoom meeting, WA group, learning video)	• Solving problems of non-homogeneous equations [1], [2], [3], [4]	3,5%
7/7	CLO-4 Skilled in using Laplace and Fourier transforms in pde problems (ILO-4: PI-2; PI-2, PI-3)	• Discipline in carrying out course contracts • Accurate understanding of related material • Accuracy in answering assignment questions • Neatness of task execution	Non-test: Test: Mid-term exam: 2,5%	Teaching and discussion: - material explanation - task explanation - discussion and question-and-answer lecture material [1 x 3 x 50 minute]	(Certain conditions: total *blended learning* 40%)	Students read and study the learning materials individually [1 x 3 x 60 minute]	Students discuss in groups about lecture material and assignments [1 x 3 x 60 minutes]	• PPT • i-learn (LMS Unand) (Specific condition: Zoom meeting, WA group, learning video)	• Solving problems of non-homogeneous equations [1], [2], [3], [4]	2,5%

		• Originality of task results								
8	**MID-TERM EXAM**									
9/9	CLO-5 Have an understanding of the physical aspects of the theory discussed and the ability to interpret the solutions obtained (ILO-6: PI-1, PI-2, PI-3, PI-4, PI-5; ILO-7: PI-1, PI-2, PI-3)	• Discipline in carrying out course contracts • Accurate understanding of related material • Accuracy in answering assignment questions • Neatness of task execution • Originality of task results	Non-test: Homework 4 (2%) Test: Final exam: 5%	Teaching and discussion: - material explanation - task explanation - discussion and question-and-answer lecture material [1 x 3 x 50 minute]	(Certain conditions: total *blended learning* 40%)	Students read and study the learning materials individually [1 x 3 x 60 minute]	Students discuss in groups about lecture material and assignments [1 x 3 x 60 minutes]	• PPT • i-learn (LMS Unand) (Specific condition: Zoom meeting, WA group, learning video)	Characteristic method for first order PDE constant and variable coefficients [1], [2], [3], [4]	**7%**
10/10	CLO-5 Have an understanding of the physical aspects of the theory discussed and the ability to interpret the solutions obtained (ILO-6: PI-1, PI-2, PI-3, PI-4, PI-5;	• Discipline in carrying out course contracts • Accurate understanding of related material • Accuracy in answering assignment questions	Non-test: Homework 5 (2%) Test: Final exam: 5%	Teaching and discussion: - material explanation - task explanation - discussion and question-and-answer lecture material [1 x 3 x 50 minute]	(Certain conditions: total *blended learning* 40%)	Students read and study the learning materials individually [1 x 3 x 60 minute]	Students discuss in groups about lecture material and assignments [1 x 3 x 60 minutes]	• PPT • i-learn (LMS Unand) (Specific condition: Zoom meeting, WA group, learning video)	Characteristic method on • The infinite string problem • Semi-infinite and finite string problems [1], [2], [3], [4]	**7%**

	ILO-7: PI-1, PI-2, PI-3)	• Neatness of task execution • Originality of task results								
11/11	CLO-5 Have an understanding of the physical aspects of the theory discussed and the ability to interpret the solutions obtained (ILO-6: PI-1, PI-2, PI-3, PI-4, PI-5; ILO-7: PI-1, PI-2, PI-3)	• Discipline in carrying out course contracts • Accurate understanding of related material • Accuracy in answering assignment questions • Neatness of task execution • Originality of task results	Non-test: Homework 6 (2%) Test: Final exam: 5%	Teaching and discussion: - material explanation - task explanation - discussion and question-and-answer lecture material [1 x 3 x 50 minute]	(Certain conditions: total *blended learning* 40%)	Students read and study the learning materials individually [1 x 3 x 60 minute]	Students discuss in groups about lecture material and assignments [1 x 3 x 60 minutes]	• PPT • i-learn (LMS Unand) (Specific condition: Zoom meeting, WA group, learning video)	Characteristic method in 2nd order PDP [1], [2], [3], [4]	**7%**
12/12	CLO-5 Have an understanding of the physical aspects of the theory discussed and the ability to interpret the solutions obtained (ILO-6: PI-1, PI-2, PI-3, PI-4, PI-5;	• Discipline in carrying out course contracts • Accurate understanding of related material • Accuracy in answering assignment questions	Non-test: Test: Final exam: 5%	Teaching and discussion: - material explanation - task explanation - discussion and question-and-answer lecture material	(Certain conditions: total *blended learning* 40%)	Students read and study the learning materials individually [1 x 3 x 60 minute]	Students discuss in groups about lecture material and assignments [1 x 3 x 60 minutes]	• PPT • i-learn (LMS Unand) (Specific condition: Zoom meeting, WA group, learning video)	Integral transformation [1], [2], [3], [4]	**5%**

	ILO-7: PI-1, PI-2, PI-3)	● Neatness of task execution ● Originality of task results		[1 x 3 x 50 minute]						
13/13	CLO-5 Have an understanding of the physical aspects of the theory discussed and the ability to interpret the solutions obtained (ILO-6: PI-1, PI-2, PI-3, PI-4, PI-5; ILO-7: PI-1, PI-2, PI-3)	● Discipline in carrying out course contracts ● Accurate understanding of related material ● Accuracy in answering assignment questions ● Neatness of task execution ● Originality of task results	Non test : Project	● Discussion and giving opinions in large and small groups ● Presentation of final project results [1 x 3 x 50 minute]	(Certain conditions: total *blended learning* 40%)	Students read and study the learning materials individually [1 x 3 x 60 minute]	Students discuss in groups about lecture material and assignments [1 x 3 x 60 minutes]	● PPT ● i-learn (LMS Unand) (Specific condition: Zoom meeting, WA group, learning video)	Project	**50%**

14/14	CLO-5 Have an understanding of the physical aspects of the theory discussed and the ability to interpret the solutions obtained (ILO-6: PI-1, PI-2, PI-3, PI-4, PI-5; ILO-7: PI-1, PI-2, PI-3)	• Discipline in carrying out course contracts • Accurate understanding of related material • Accuracy in answering assignment questions • Neatness of task execution • Originality of task results	Non test : Project	• Discussion and giving opinions in large and small groups • Presentation of final project results [1 x 3 x 50 minute]	(Certain conditions: total *blended learning* 40%)	Students read and study the learning materials individually [1 x 3 x 60 minute]	Students discuss in groups about lecture material and assignments [1 x 3 x 60 minutes]	• PPT • i-learn (LMS Unand) (Specific condition: Zoom meeting, WA group, learning video)	Project	
15/15	CLO-5 Have an understanding of the physical aspects of the theory discussed and the ability to interpret the solutions obtained (ILO-6: PI-1, PI-2, PI-3, PI-4, PI-5; ILO-7: PI-1, PI-2, PI-3)	• Discipline in carrying out course contracts • Accurate understanding of related material • Accuracy in answering assignment questions • Neatness of task execution • Originality of task results	Non test : Project	• Discussion and giving opinions in large and small groups • Presentation of final project results [1 x 3 x 50 minute]	(Certain conditions: total *blended learning* 40%)	Students read and study the learning materials individually [1 x 3 x 60 minute]	Students discuss in groups about lecture material and assignments [1 x 3 x 60 minutes]	• PPT • i-learn (LMS Unand) (Specific condition: Zoom meeting, WA group, learning video)	Project	

	Total Weight	100%
16	**FINAL EXAM**	

1 credit = 50 minutes face-to-face meeting, 60 minutes structured study, 60 minutes independent study
Each meeting duration is 3 credits = 3×50 minutes

Indicators, Criteria, and Assessment Weights

1. Assessment weight for each Assessment

NO	Assessment	Weight (%)
1	Mid-Term Exam	20
2	Final Exam	20
3	Homework	10
4	Final Project	50

TOTAL	100

2. Assessment weight for Intended Learning Outcome
   - CLO-1: 20 %
   - CLO-2: 20 %
   - CLO-3: 20 %
   - CLO-4: 20 %
   - CLO-5: 20 %

Assessment Plan Table:

CLO	Assessment						
	Homework	**Research Plan Presentation**	**Project Presentation**	**Mid-Term Exam**	**Final Exam**	**Project Output**	**Total Weight**
1. Have an understanding of the basic concepts, definitions, and classification of partial differential equations (ILO-3: PI-1, PI-2, PI-3);	2%	2%	2%	2%	-	12%	**20%**
2. Skilled in using various solution methods, such as the direct integration method, variable	2%	2%	2%	3%	5%	6%	**20%**

separation method, characteristic method, and Fourier series method (ILO-4: PI-1, PI-2, PI-3);							
3. Have an understanding of the transport equation, heat (diffusion) equation, wave equation, and Laplace's equation, as well as being skilled at determining solutions to these equations using the pde solution method given previously (ILO-3: PI-1, PI-2, PI-3; ILO-4: PI-1, PI-2, PI-3);	2%	2%	2%	5%	5%	4%	**20%**
4. Skilled in using Laplace and Fourier transforms in pde problems (ILO-4: PI-2; PI-2, PI-3);	2%	2%	2%	5%	5%	4%	**20%**
5. Have an understanding of the physical aspects of the theory discussed and the ability to interpret the solutions obtained (ILO-6: PI-1, PI-2, PI-3, PI-4, PI-5; ILO-7: PI-1, PI-2, PI-3).	2%	2%	2%	5%	5%	4%	**20%**
Total Weight	**10%**	**10%**	**10%**	**20%**	**20%**	**30%**	**100%**

Matrix of CLO and ILO

CLO	ILO																															
	1			**2**			**3**			**4**			**5**				**6**					**7**			**8**				**9**			
	PI			**PI**			**PI**			**PI**			**PI**				**PI**					**PI**			**PI**				**PI**			
	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	4	1	2	3	4	5	1	2	3	1	2	3	4	1	2	3	4
1																																

2										□	□	□																			
3							□	□	□	□	□	□																			
4										□	□	□																			
5																	□	□	□	□	□	□	□	□							