

**SEMESTER STUDY PLAN
BOUNDARY VALUE PROBLEMS
(ELECTIVE COURSE)**



**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
		Boundary Value Problems	MAT62244	https://sci.ilearn.unand.ac.id	3	6	9 January 2023
Person In Charge		Study Plan Creator		Head of Research Group		Head of Study Program	
		Dr. Arrival Rince Putri Dr. Noverina Alfiany		Dr. Ahmad Iqbal Baqi		Dr. Arrival Rince Putri	
Intended Learning Outcomes (ILO) and Performance Indicator (PI)	Intended Learning Outcomes						
	ILO-4	An ability to use concept and fundamental technique of mathematics in solving simple mathematical problems PI-1: An ability to choose appropriate basic mathematical concepts and techniques in solving simple mathematical problems 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 availAn ability 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
	ILO-8	An ability to work in team PI-1: An ability to actively participate in a team with full responsibility PI-2: An ability to respond well to any feedback within the team PI-3: An ability to complete tasks according to the set schedule PI-4: An ability to adapt in a team
	Course Learning Outcomes	
	1	An ability to solve initial value problems for linear differential equations. (ILO-4 : PI-1, PI-2, PI-3)
	2	An ability to determine the Fourier series representation of a given function. (ILO-4 : PI-1, PI-2, PI-3)
	3	An ability to solve problems related to heat conduction, wave propagation, and Dirichlet boundary conditions. (ILO-4 : PI-1, PI-2, PI-3, ILO-6 : PI-1, PI-2, PI-3, PI-4)
	4	An ability to develop the ability to think critically, analytically, and innovatively. An ability to argue logically and in a structured manner, and effectively discuss the results. (ILO-7 : PI-1, PI-2, PI-3; ILO-8 : PI-1, PI-2, PI-3, PI-4)
Brief Description	This course provides an in-depth explanation of the definition of Boundary Value Problems and the related modeling scenarios, including Hanging Cable, Heat Conduction in a Rod, Bucking of a Column, Radial Heat Flow, and Cooling Finn. It covers single boundary value problems at singular points and boundary value problems where the original equation's domain includes a semi-infinite interval. The course also covers topics such as Fourier series of periodic functions, derivation of the heat conduction equation, steady-state temperature distributions, nonhomogeneous boundary value problems (MNASB), wave equations, and the Laplace equation (potential equation). The Case-Based Method (CBM) is employed in this course, where students gain understanding and solve cases related to the studied material.	
Course Materials	1. Definition of Boundary Value Problems	

	2. Boundary Value Problems at Singular Points and Domains Originating from Semi-infinite Intervals 3. Cases Related to Partial Differential Equations (PDEs)	
References	Main:	
	1. Power David L, 2006, <i>Boundary Values Problem and Partial Differential equations</i> , Elsevier 2. Dawkins Paul, I, Nash, 2009, <i>Differential equations</i>	
	Additional:	
	-	
Learning Media	Software:	Hardware:
	• LMS Unand (http://fmipa.ilearn.unand.ac.id/) • Zoom meeting • Whatsapp	• Computer/Laptop • Smartphone
Team Teaching	1. Dr. Arrival Rince Putri 2. Dr. Noverina Alfiany	
Assessment	-	
Required courses	MAT62143 Introduction to Partial Differential Equations (PDEs)	
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]					Subject, references (10)	Weight (11)
				Synchronous*		Asynchronous**		Media (9)		
				Face to face Offline (5)	Face to face Online (6)	Individual (7)	Collaboration (8)			
1	An ability to understand the Course Specifications (RPS), Syllabus, Assessment Guidelines, and Course Contract	Discipline in adhering to the course contract.		- Lecture: - Introduction to the Course Syllabus (RPS). - Explanation of assignments and group task distribution. - The lecturer provides several examples. [1 x 3 x 50 minutes]		Students search for references and study learning materials	Students discuss learning materials and assignments in groups	LMS (ilearn UNAND)	Assessment Rules, Course Syllabus (RPS), Course Outline, Course Contract [1], [2]	
2	CLO-4 An ability to solve initial value	Accuracy in understanding related	Non test	Group presentation		Students search for references and study	Students discuss in groups about	LMS (ilearn UNAND)	- Examples - Application Cases	10%

	problems of linear equations.	materials	Group Report:: 10%	Discussion and Q&A on course material and group assignments [1 x 3 x 50 minutes]		learning materials [1 x 1 x 120 minutes]	examples of applications of boundary value problems. [1 x 2 x 120 minutes]		[1,2]	
3	CLO-4 An ability to solve initial value problems for linear equations	Accuracy in understanding related materials	Test Midterm: 5%	Lecture: - The lecturer provides several case examples related to the topic of one-dimensional linear dynamic systems and logistic growth models. - The lecturer poses several challenging questions to encourage students to think about how to		Students search for references and study learning materials [1 x 1 x 120 minutes]	Students discuss in groups about the concepts and terminology of boundary value problems. [1 x 2 x 120 minutes]	LMS (ilearn UNAND)	Definition of boundary value problems [1,2]	5%

				solve the given cases. • The student groups are asked to find their own relevant cases related to logistic growth models and solve the problems to discuss within their respective groups. • Discussion and Q&A session on course material and assignments [1×3×50 minutes]						
4	CLO-7, CLO-8 An ability to think critically, analytically, and	• Accuracy in understanding related materials	Non test Group Report:: 10%	• Group presentation		Students search for references and study learning materials	Students discuss in groups regarding examples of	• LMS (ilearn UNAND)	• Examples • Application Cases	10%

	innovatively, to argue logically and structurally, and to discuss results effectively			Discussion and Q&A on course material and group assignments [1 x 3 x 50 minutes]		[1 x 1 x 120 minutes]	applications of boundary value problems. [1 x 2 x 120 minutes]		[1,2]	
5	CLO-4 An ability to solve initial value problems for linear equations.	Accuracy in understanding related materials	Test Midterm: 5%	Lecture: - The lecturer provides several case examples related to the topic of boundary value problems at singular points - The lecturer poses several challenging questions to encourage students to think about how to solve the given cases.		Students search for references and study learning materials [1 x 1 x 120 minutes]	Students discuss in groups regarding examples of applications of boundary value problems. [1 x 2 x 120 minutes]	LMS (ilearn UNAND)	Boundary Value Problems at Singular Points [1,2]	5%

				The student groups are asked to find their own relevant cases related to logistic growth models and solve the problems to discuss within their respective groups. Discussion and Q&A session on course material and assignments [1×3×50 minutes]						
6	CLO-7, CLO-8 An ability to think critically, analytically, and innovatively, to argue logically and coherently,	Accuracy in understanding related materials	Non test Group Report:: 10%	- Group presentation - Discussion and Q&A on course material and group		Students search for references and study learning materials	Students discuss in groups regarding examples of applications of boundary value problems.	LMS (ilearn UNAND)	- Examples - Application Cases [1,2]	10%

	and to discuss findings the results			assignment s [1 x 3 x 50 minutes] [1 x 3 x 50 minutes]		- [1 x 1 x 120 minutes]	[1 x 2 x 120 minutes]			
7	CLO-4, CLO-6 An ability to solve heat conduction, wave propagation, and Dirichlet boundary value problems	Accuracy in understanding related materials	Test Midterm: 5%	Lecture: - The lecturer provides several examples related to the course topic of boundary value problems with domains involving semi-infinite intervals. - The lecturer poses several challenging questions to encourage students to think about how to		Students search for references and study learning materials [1 x 1 x 120 minutes]	Students discuss in groups about boundary value problems involving domains with semi-infinite intervals [1 x 2 x 120 minutes]	LMS (ilearn UNAND)	Boundary value problems with domains involving semi-infinite intervals. [1,2]	10%

				solve the given cases. • Student groups are asked to find relevant cases on their own related to boundary value problems with domains involving semi-infinite intervals, and then discuss these cases within their respective groups. Discussion and Q&A session on course material and assignments [1×3×50 minutes]						
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8	MID-TERM EXAM									
9	CLO-7, CLO-8 An ability to think critically, analytically, and innovatively, to argue logically and coherently, and to discuss the results	Accuracy in understanding related materials	Non test Group Report:: 10%	- Group presentation - Discussion and Q&A on course material and group assignments [1 x 3 x 50 minutes]		Students search for references and study learning materials [1 x 1 x 120 minutes]	Students discuss in groups to address application problems related to boundary value issues [1 x 2 x 120 minutes]	LMS (ilearn UNAND)	- Examples - Application Cases [1,2]	10%
10	CLO-4 An ability to determine the Fourier series of a function	Accuracy in understanding related materials	Test Final exam: 5%	Lecture: - The lecturer provides several example cases related to the topic of Fourier series of periodic functions. - The lecturer poses challenging questions to encourage students to think about how to solve		Students search for references and study learning materials [1 x 1 x 120 minutes]	Students discuss in groups regarding the Fourier series of periodic functions. [1 x 2 x 120 minutes]	LMS (ilearn UNAND)	Fourier Series of a Periodic Functions	5%

				the given cases. Students are tasked with finding relevant cases related to Fourier series of periodic functions on their own and solving these problems to discuss within their respective groups. Discussion and Q&A on course material and assignments [1 x 3 x 50 minutes]						
11	CLO-7, CLO-8 An ability to think critically, analytically, and innovatively, to argue logically and coherently, and to discuss	Accuracy in understanding related materials	Non test Group Report:: 10%	- Group presentation - Discussion and Q&A on course material and group		Students search for references and study learning materials [1 x 1 x 120 minutes]	Students discuss in groups to address application problems related to boundary value issues	LMS (ilearn UNAND)	- Examples - Application Cases [1,2]	10%

	findings the results			assignment s [1 x 3 x 50 minutes]			[1 x 2 x 120 minutes]			
12	CLO-4, CLO-6 An ability to solve problems related to heat conduction, wave propagation, and Dirichlet boundary condition	Accuracy in understanding related materials	Test Final exam: 5%	Lecture: - The lecturer provides several example cases related to the topic of derivation of the heat conduction equation. - The lecturer poses challenging questions to encourage students to think about how to solve the given cases. - Students are tasked with finding relevant cases related to derivation of the heat conduction		Students search for references and study learning materials [1 x 1 x 120 minutes]	Students discuss in groups about the derivation of the heat conduction equation [1 x 2 x 120 minutes]	LMS (ilearn UNAND)	Derivation of the heat conduction equation [1,2]	5%

				equation on their own and solving these problems to discuss within their respective groups. Discussion and Q&A on course material and assignments [1 x 3 x 50 minutes]						
13	CLO-7, CLO-8 An ability to think critically, analytically, and innovatively, to argue logically and coherently, and to discuss findings the results	Accuracy in understanding related materials	Non test Group Report:: 10%	- Group presentation - Discussion and Q&A on course material and group assignments [1 x 3 x 50 minutes]		Students search for references and study learning materials [1 x 1 x 120 minutes]	Students discuss in groups to address application problems related to boundary value issues [1 x 2 x 120 minutes]	LMS (ilearn UNAND)	- Examples - Application Cases [1,2]	10%
14	CLO-4, CLO-6 An ability to solve problems related to	Accuracy in understanding related materials	Test Final exam: 10%	Lecture: The lecturer provides several example		Students search for references and study learning materials	Students discuss in groups about the Steady-	LMS (ilearn UNAND)	Steady-State Temperature [1,2]	10%

	heat conduction, wave propagation, and Dirichlet boundary condition			cases related to the topic of Steady-State Temperature . • The lecturer poses challenging questions to encourage students to think about how to solve the given cases. • Students are tasked with finding relevant cases related to Steady-State Temperature on their own and solving these problems to discuss within their respective groups. Discussion and Q&A on course		[1 x 1 x 120 minutes]	State Temperature [1 x 2 x 120 minutes]			
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				material and assignments [1 x 3 x 50 minutes]						
15	CLO-7, CLO-8 An ability to think critically, analytically, and innovatively, to argue logically and coherently, and to discuss findings the results	Accuracy in understanding related materials	Non test Group Report:: 10%	- Group presentation - Discussion and Q&A on course material and group assignments [1 x 3 x 50 minutes]		Students search for references and study learning materials [1 x 1 x 120 minutes]	Students discuss in groups to address application problems related to wave equation and Laplace's equation [1 x 2 x 120 minutes]	LMS (ilearn UNAND)	- Examples (wave equation and Laplace's equation) - Application Cases [1,2]	
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 2 credits = 2x50 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	Group Report (based on specific cases)	60
TOTAL		100

2. Assessment weight for Intended Learning Outcome

- CLO-1: 20 %
- CLO-2: 20 %
- CLO-3: 20 %
- CLO-4: 40 %

Assessment Plan Table:

No.	CLO	Assessment			Weight (%)
		Mid-Term Exam (%)	Final Exam (%)	Group Report (%)	
1	Students can solve initial value problems for linear equations (ILO-4).	10		10	20
2	Students can determine Fourier series of a function (ILO-4).	10		10	20
3	Students can solve problems related to heat conduction, wave propagation, and Dirichlet boundary conditions (ILO-4, ILO-6).		10	10	20
4	Students can demonstrate critical, analytical, and innovative thinking, capable of logical and structured argumentation, and able to discuss results effectively (ILO-7, ILO-8).		10	30	40
Total		20	30	30	100

Information:

TK: Group ask