SEMESTER STUDY PLAN INTRODUCTION TO FOURIER ANALYSIS (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 I	Name		Course Code	URL I	-Learn	Credits	Semester	Compilation Date		
Introduction to Fo	ourier An	alysis	MAT61225	https://sci.ilea	rn.unand.ac.id	3	7	13 May 2024		
Dorson In	Charge		Study Plan	Creator	Head of Research Group		Head of Study Program			
r erson m	Charge		Dr. Shelvi I	Ekariani	Dr. Hari	pamyu	Dr. No	verina Alfiany		
	Intende	ed Learning	Outcomes							
Intended Learning	ILO-2	Possesses p	profound knowledge	e of the basic con	cept mathematic	CS				
Outcomes (ILO) and		PI-1: An al	pility to explain basic	c mathematical co	oncepts					
Performance		PI-2: An ab	I-2: An ability to provide examples that are relevant to basic mathematical concepts							
Indicator (PI)		PI-3: An ab	PI-3: An ability to determine solutions to simple problems using basic mathematical concepts							
	ILO-3	An ability	to identify, explain a	and generalize si	nple mathemati	cal		•		
		PI-1: An al	pility to identify simp	ple mathematical	problems					
		PI-2: An ab	2: An ability to explain simple mathematical problems							
		PI-3: An al	In ability to generalize simple mathematical problems							
	ILO-4	An ability	to use concept and f	undamental tech	nique of mathen	natics in solvir	ng simple ma	thematical		
		problems								
		PI-1: An a	bility to choose appr	opriate basic ma	thematical conce	epts and techn	iques in solv	ing simple		
		math	ematical problems							
		PI-2: An ability to illustrate simple mathematical problems based on appropriate basic mathematical								
		concepts and techniques								
		PI-3: An a	bility to solve simpl	e mathematical p	problems using a	ppropriate ba	sic mathema	tical concepts and		
		techr	niques							

	ILO-5	An ability formally and correctly proves a simple mathematical statements using facts and methods that
		have been studied
		PI-1: An ability to identify the formal structures and analogous forms in mathematics
		PI-2: An ability to use fact and apply methods to prove simple mathematical statements
		PI-3: An ability to present simple mathematical statement proof rigorously (sequentially and conscientious)
		PI-4: An ability to conclude or interpret result of the proving simple mathematical statement
	ILO-9	An ability to apply knowledge of mathematics in career and involve in lifelong learning
		PI-1: An ability to carry out learning independently to deepen and expand the knowledge that has been
		obtained
	Course	Learning Outcomes
		An ability to mastery the basic concepts of fourier analysis, as well as their related properties. (ILO-2: PI-1,
	1	PI-2, PI-3)
		An ability to apply the basic properties learned to solve problems related to the course material. (ILO-4: PI-
	2	1, PI-2, PI-3)
		As shifted a constraint we have related to the subject method of this second (HO 2 , DI 1 , DI 2 , DI 2)
	3	An ability to generalize problems related to the subject matter of this course. (ILO-3: PI-1, PI-2, PI-3)
		An ability to identify the formal structure of statements related to the course material and their analogous
	4	forms. (ILO-5: PI-1-4)
		An ability to mastery of fundamental techniques necessary for problem-solving within the scope of this
	5	course material. (ILO-4: PI-1, PI-2, PI-3)
	6	An ability to independently solve problems related to the fourier analysis. (ILO-9: PI-1)
Brief Description	The the	me of this course is the analysis and synthesis of functions or signals. The emphasis in the course is more on
	the the	pretical aspects, but participants will have the opportunity to learn about various applications. Understanding
	the con	cepts of limit of sequences and continuity of functions is a prerequisite for this course.
		cepte et mine et equences and containing of functions to a prefequence for and course.

Course Materials	Some classic partial differential equation	Some classic partial differential equations, classic Fourier series, generalized Fourier series in the space L ² (D), their								
course materials	usage in boundary value problems, For	urier transforms, the inverse Fourier theorem, and their application in partial								
	differential equations.									
References	Main:	Main:								
	1. G. B. Folland. (1992). Fourier An	1. G. B. Folland. (1992). <i>Fourier Analysis and Its Applications</i> . Wadsworth & Brooks/Cole, Pacific Grove Ca.								
	Additional:									
	2. E. M. Stein and R. Shakarci. (200	3). Fourier Analysis: An Introduction. Princeton Univ. Press, New Jersey								
Learning Media	Software:	Hardware:								
	• I MS Unand	• Computer/Lapton								
	(http://fmipa ilearn upand ac id/)									
	(<u>intp://inipu.icurii.urunu.uc.iu/</u>)	• Smartphone								
	• Zoom meeting									
	• Whatsapp									
Team Teaching	Dr. Shelvi Ekariani									
Assessment	Homework, Quizzes, Mid-Term exam,	Final exam								
Required courses	Real Analysis 2									
Academic Norms	https://akademik.unand.ac.id/images	<u>s/2022-03-</u>								
	30%20Peraturan%20Rektor%20Nomor	%207%20Tahun%202022%20Penyelenggaraan%20Pendidikan-								
	khusus%20Bab%20II.pdf									

Weekly Study Plan

	Activities/Forms of Learning [Time estimated]									
Week/ Meet	Course	Indicator	Assessment	Synchro	nous*	Asynchro	nous**		Subject.	Weight
(1)	Outcomes (2)	(3)	(4)	Face to face Offline (5)	Face to face Online (6)	Individual (7)	Collaboration (8)	Media (9)	references (10)	(11)
1	CLO-1 An ability to mastery the basic concepts of fourier analysis, as well as their related properties. (ILO-2: PI-1, PI-2, PI-3)	 Discipline in carrying out the course contract. Accuracy in understanding related material. 	Non test Test Mid-Term exam: 10% Quizzes 1: 3%	 Teaching and discussion: Explanation of Semester Learning Plan explanation of learning material explanation of the task explanation of the assessment [1 × 3 × 50 minutes] 	 Teaching and discussion: Explanation of Semester Learning Plan explanation of learning material explanation of the task explanation of the assessment [1 × 3 × 50 minutes] (Specific conditions: The total number of 	Students read and study learning materials related to real number systems and their properties [1 × 3 × 120 minutes]		 PPT I learn (LMS Unand) (Specific condition: Zoom meeting, WA group, learning video) 	Course Introduction: • Introduction (complex numbers, Hilbert spaces, measures) • heat equation, and wave equation. References: Main Reference 1.	13%

					blended learning meetings is 40% of the total number of meetings)				
2	CLO-3 An ability to generalize problems related to the subject matter of this course. (ILO-3 : PI-1, PI- 2, PI-3)	 Accuracy in understanding related material Accuracy in answering assignment questions Neatness in completing assignments Originality of assignment results 	Non test Test Mid-Term exam: 3% Quizzes 1: 3%	Lectures and discussions [1 × 3 × 50 minutes]		Students read and study materials from the main reference and others. [1 × 3 × 120 minutes]	 PPT I learn (LMS Unand) (Specific condition: Zoom meeting, WA group, learning video) 	 Fourier series and its convergence: 2π-periodic functions, Fourier series, space of piecewise continuous functions PC(a,b), convergence theorem. Reference: Main Reference 1. 	3%

3	CLO-2 An ability to apply the basic properties learned to solve problems related to the course material. (ILO-4 : PI-1, PI-2, PI-3)	 Accuracy in understanding related material Accuracy in answering assignment questions Neatness in completing assignments Originality of assignment results 	Non test: Homework 1: 3% Test Mid-Term exam: 5%	Lectures and discussions [1 × 3 × 50 minutes]		Students read and study materials from the main reference and others. [1 × 3 × 120 minutes]		•	PPT I learn (LMS Unand) (Specific condition: Zoom meeting, WA group, learning video)	 Fourier series on arbitrary intervals and its applications: sine Fourier series, cosine Fourier series, Fourier series on arbitrary intervals, applications to the heat equation, and some notes. Reference: Main Reference 1. 	8%
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4-5	CLO-1 An ability to mastery the basic concepts of fourier analysis, as well as their related properties. (ILO-2: PI-1, PI- 2, PI-3) CLO-6 An ability to independently solve problems related to fourier analysis. (ILO-9: PI-1)	 Accuracy in understanding related material Accuracy in answering assignment questions Neatness in completing assignments Originality of assignment results 	Non test : - Test: Mid-Term exam: 10% Quizzes 1: 2%	Lectures and discussions [2 × 3 × 50 minutes]	Students read and study materials from the main reference and others [2 × 3 × 120 minutes]	 PPT I learn (LMS Unand) (Specific condition: Zoom meeting, WA group, learning video 	 Space PC(a,b) and space L²(a,b): Space PC(a,b), convergence in the norm in space PC(a,b), space L²(a,b), Bessel's inequality. Reference: Main Reference 1. 	12%
6-7	CLO-2 An ability to apply the basic properties learned to solve problems related to the course material. (ILO-4: PI-1, PI- 2, PI-3) CLO-3 An ability to generalize	 Accuracy in understanding related material Accuracy in answering assignment questions Neatness in completing assignments 	Non test: Homework 1: 2% Test Mid-Term exam: 7% Quizzes 1: 2%	Lectures and discussions [2 × 3 × 50 minutes]	Students read and study materials from the main reference and others $[2 \times 3 \times 120$ minutes]	 PPT I learn (LMS Unand) (Specific condition: Zoom meeting, WA group, learning video) 	 Generalized Fourier series: Orthonormal basis, generalized Fourier series, best approximatio n in L²(a,b). 	11%

	problems related to the subject matter of this course. (ILO-3 : PI-1, PI- 2, PI-3)	• Originality of assignment results							Reference: Main Reference 1.	
8			r	1	MID-TERN	A EXAM	1	1		T
9-10	CLO-3 An ability to generalize problems related to the subject matter of this course. (ILO-3: PI-1, PI-2, PI-3) CLO-4 An ability to identify the formal structure of statements related to the course material and their analogous forms. (ILO-5: PI-1-4)	 Accuracy in understanding related material Accuracy in answering assignment questions Neatness in completing assignments Originality of assignment results 	Non test : Test Final exam: 12% Quizzes 2: 1%	Lectures and discussions $[2 \times 3 \times 50 \text{ minutes}]$		Students read and study materials from the main reference and others [2 × 3 × 120 minutes]		 PPT I learn (LMS Unand) (Specific condition: Zoom meeting, WA group, learning video) 	 Fourier transform: Space L¹ and L², Fourier transform, and its properties. Reference: Main Reference 1. 	13%
11-13	CLO-4 An ability to identify the formal structure of	• Accuracy in understanding related material	Non test: Homework 2: 5% Test	Lectures and discussions		Students read and study materials from the main		 PPT I learn (LMS Unand) 	Convolution: • Convolution and	27%

	statements related to the course material and their analogous forms. (ILO-5: PI-1-4) CLO-5 An ability to mastery of fundamental techniques necessary for problem- solving within the scope of this course material. (ILO-4: PI-1, PI- 2, PI-3) CLO-6 An ability to independently solve problems related to fourier analysis. (ILO-9: PI-1)	 Accuracy in answering assignment questions Neatness in completing assignments Originality of assignment results 	Final exam: 15% Quizzes 2: 7%	[2 × 3 × 50 minutes]	reference and others [2 × 3 × 120 minutes]	• (Specific condition: Zoom meeting, WA group, learning video)	 properties of the Fourier transform related to convolution. Inverse theorem and Fourier transform in L² 	
14-15	CLO-2 An ability to apply the basic properties learned to solve problems	 Accuracy in understanding related material 	Non test: Test Final exam: 8%	Lectures and discussions $[2 \times 3 \times 50$ minutes]	Students read and study materials from the main reference and others	 PPT I learn (LMS Unand) 	Applications to partial differential equations and	10%

	related to the course material. (ILO- 4: PI-1, PI-2, PI-3) CLO-4 An ability to identify the formal structure of statements related to the course material and their analogous forms. (ILO-5: PI-1-4) CLO-6 An ability to independently solve problems related to	 Accuracy in answering assignment questions Neatness in completing assignments Originality of assignment results 	Quizzes 2: 2%		[2 × 3 × 120 minutes]	• (Specific condition: Zoom meeting, WA group, learning video)	signal processing.	
	related to fourier analysis. (ILO-9 : PI-1)							
						l	Total Weight	100%
16				FINAL EX	AM		•	

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	35
2	Final Exam	35
3	Homework	10
4	Quizzes	20
	TOTAL	100

- 2. Assessment weight for Intended Learning Outcome
 - CLO-1: 20 %
 - CLO-2: 20 %
 - CLO-3: 20 %
 - CLO-4: 10 %
 - CLO-5: 20 %
 - CLO-6: 10%

Assessment Plan Table:

			Asse	essment		
No.	CLO	Homework (%)	Quizzes (%)	Mid-Term Exam (%)	Final Exam (%)	Weigth (%)
1	An ability to mastery the basic concepts of fourier analysis, as well as their related properties. (ILO-2 : PI- 1, PI-2, PI-3)		Quizzes 1: 5	15		20
2	An ability to apply the basic properties learned to solve problems related to the course material. (ILO- 4 : PI-1, PI-2, PI-3)	Homework 1: 5		10	5	20
3	An ability to generalizing problems related to the subject matter of this course. (ILO-3 : PI-1, PI-2, PI-3)		Quizzes 1: 5	5	10	20
4	An ability to identifying the formal				5	10

	structure of statements related to the course material and their analogous forms. (ILO- 5 : PI-1-4)		Quizzes 2: 5			
5	An ability to mastery of fundamental techniques necessary for problem-solving within the scope of this course material. (ILO- 4 : PI-1, PI-2, PI-3)	Homework 2: 5	Quizzes 2: 5		10	20
6	An ability to independently solve problems related to fourier analysis. (ILO- 9 : PI-1)			5	5	10
	Total	10	20	35	35	100

Matrix of CLO and ILO

		ILO																														
CLO	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					٥	٥																										
2										۵	۵	۵																				
3							٥	۵	۵																							
4													۵	۵	۵																	
5																																
6																																