SEMESTER STUDY PLAN INTRODUCTION TO FINANCIAL MATHEMATICS (ELECTIVE COURSE)



DEPARTMENT OF MATHEMATICS AND DATA SCIENCE FACULTY OF MATHEMATICS AND NATURAL SCIENCES UNIVERSITAS ANDALAS

2023



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

	SEMESTER STUDY PLAN											
Course Na	me	Course Code	URL I-Learn		Credits	Semester	Compilation Date					
INTRODUCTION TO MATHEMAT	FINANCIAL ICS	MAT61242 <u>https://sci.ilearn.unand.ac.id</u>		n.unand.ac.id	3	5	August 1, 2023					
Authorization		Study Pla	n Creator	Head of Rea	search Group	Head of	Study Program					
		Dr. Mahdhiv	van Syafwan	Dr. Ahma	d Iqbal Baqi	Dr. Arr	ival Rince Putri					
	Intended Learn	ning Outcomes (IL	0)									
	ILO-2	Have in-depth kno	Have in-depth knowledge of basic mathematical concepts.									
		PI-1: Able to explain basic mathematical concepts.										
		PI-2: Able to provide examples that are relevant to basic mathematical concepts. PI-3: Able to determine solutions to simple problems using basic mathematical concepts.										
Intended Learning	ILO-4	Able to use basic mathematical concepts and techniques in solving simple mathematical problems.										
Outcomes (ILO) and		PI-1: Able to choose appropriate basic mathematical concepts and techniques in solving simple mathematical										
Performance Indicator		problems.										
(PI)		PI-2: Able to illus	trate simple mather	natical problems l	based on appropriat	e basic mathemati	cal concepts and					
		techniques.										
		PI-3: Able to solv	e simple mathemati	cal problems usin	g appropriate basic	mathematical cor	cepts and techniques.					
	ILO-5	Able to prove form	nally and correctly	a simple mathema	atical statement usin	ng the facts and m	ethods learned.					
		PI-3: Able to pres	ent proof of simple	mathematical stat	ements rigorously (sequentially and t	horoughly).					
		PI-4: Able to conc	lude or interpret th	e results of the pro	oof of simple mathe	ematical statement	S.					

ILO-6	Have data and technology literacy skills and can apply them in solving simple mathematical problems or other
	relevant fields.
	PI-2: Able to use data and technology and apply them to solve simple mathematical statements or other areas.
	PI-3: Able to process data using available technology in simple mathematical problems or other fields.
	PI-4: Able to conclude and interpret data processing results for simple mathematical problems or other fields.
	PI-5: Able to design an algorithm to solve simple mathematical problems or other fields.
ILO-7	Able to communicate effectively, especially in the field of mathematics, with diverse communities.
	PI-1: Able to convey ideas or study results orally, especially in the field of mathematics.
	PI-2: Able to present ideas or study results in writing, especially in the field of mathematics.
	PI-3: Able to respond to feedback given.
ILO-8	Able to work in a team.
	PI-1: Able to actively participate in a team with full responsibility.
	PI-2: Able to respond well to any feedback in the team.
	PI-3: Able to complete tasks according to the set schedule.
	PI-4: Able to adapt in a team.
Course Learnin	ng Outcomes (CLO)
1	Understand and use the concept of probability theory in the context of simple financial problems (ILO-2: PI-1, PI-2,
	PI-3)
2	Understand and use the concept of Brownian motion/geometric Brownian motion in solving problems related to
	relevant stock price probability (ILO-4: PI-1, PI-2, PI-3)
3	Solving the problem of changes in investment value within a certain period of time which involves calculating the
	interest rate and present value (ILO-4: PI-1, PI-2, PI-3)
4	Explain the concept and properties of financial derivative products: options (call/put) and shares (ILO-4: PI-1, PI-2,
	PI-3)
5	Understand the arbitrage process that allows for a sure-win strategy (ILO-5: PI-1, PI-2, PI-3)
6	Determine and analyze put and call option prices with a simple model using Matlab programming (ILO-6: PI-2, PI-
	3, PI-4, PI-5, ILO-7: PI-1, PI-2, PI-3, ILO-8: PI-1, PI-2, PI-3, PI-4)

	7	Understand the derivation and completion of the Black-Scholes formula and its application in calculating												
		option prices (ILO-4: PI-1, PI-2, PI-3, ILO-5: PI-3, PI-4, ILO-6: PI-2, PI-3)												
	8	Understand the basic concepts of sharia finance and apply its application to financial transaction												
		problems(ILO-4: PI-1, PI-2, PI-3, ILO-6: PI-2, PI-3, ILO-7: PI-1, PI-2, PI-3, ILO-8: PI -1, PI-2, PI-3, PI-												
		4)												
	9	Understand and apply profit sharing modeling in small capital investments (ILO-4:PI-1, PI-2, PI-3, ILO-												
		6:PI-2, PI-3, ILO-7: PI-1, PI-2, PI-3, ILO-8: PI-1, PI-2, PI-3, PI-4)												
Brief Description	This course is an	n introduction to the study of financial mathematics to build the ability to determine basic financial transactions from												
	stocks and optio	ns. Basic topics in probability theory are reviewed at the initial meeting. The second topic is Brownian and geometric												
	Brownian motio	n, which is used to construct a return simulation model for stock prices. The next topics are interest rate and present												
	values analysis,	inalysis, determining contract prices through arbitrage, arbitrage theorem, and the Black-Scholes formula, an essential formula												
	in financial mat	nathematics. Next, the basic concepts of sharia finance and profit-sharing modeling in small capital investments are												
	discussed. Apar	t from routine (personal) assignments, this lecture also provides big assignments where students will be divided into												
	groups and given	a various financial cases to be presented and discussed.												
Course Materials	1. Probability a	and Normal Random Variables												
	2. Geometric B	rownian Motion												
	3. Interest Rate	and Present Value Analysis												
	4. Options Pric	nig es formula												
	6. Basic Conce	pts of Sharia Finance												
	7. Profit Sharin	g Modeling in Small Capital Investments												
References	Main:													
	1. Sheldon M.	Ross, An Elementary Introduction to Financial Mathematics, Cambridge University Press, 2011												
	Additional:													
	2. Kuntjoro Ad	ji Sidarto, Muhammad Syamsuddin and Novriana Sumarti, Financial Mathematics, ITB Press, 2019												
	3. Novriana Su	marti, Sharia Financial Mathematics, ITB Press, 2019												

Learning Media	Software:	Hardware:									
	• LMS Unand (<u>https://sci.ilearn.unand.ac.id</u>)	Computer/Laptop									
	Zoom meetings/MS Teams	Smartphones									
	WhatsApp	LCD Projector									
	Matlab/Excel										
Team Teaching	Dr. Mahdhivan Syafwan										
Assessment	Homework, Quizzes, Big Assignment, Mid-	-Term Exam, Final Exam									
Prerequisite Courses	MAT61151 Data Analysis										
	MAT62151 Mathematical Statistics I	MAT62151 Mathematical Statistics I									
	MAT62143 Introduction to Partial Differential E	quations									
	MAT62142 Numerical Methods										
Academic Norms	1. Follow the Academic Regulations of the Andalas	University Undergraduate Program.									
	2. The lateness tolerance is 10 minutes (also applies course lecturer.	s to lecturers). If one encounters network problems, he/she must confirm with the									
	3. Assignments are submitted before the specified d submit assignments late.	eadline. The assignment value will be reduced (10 xn days late) % for those who									
	4. Those who cannot attend due to illness must be a later than when they return to college.	4. Those who cannot attend due to illness must be accompanied by a sick note/letter notifying them of sickness and sent via WA no later than when they return to college.									
	5. Assignments that are the result of plagiarism are g	given a zero mark.									
	6. Students who cheat in an exam will be given a zer	ro mark.									
	7. Other matters not listed in these academic norms	will be determined later.									

Week/Mee	Course Learning	Assessment	Form of		Learning materials	Assessme				
ting (1)	Outcomes (CLO) (2)	Indicators (3)	Assessment (4)	Synch	ronous	Asynch	ronous		[Reference]	Weight
(-)	(-)	(-)		Face to Face Offline	Face to Face Online	Independent	Collaborative	Media		(7)
1/1	CLO 1 Understand and use the concept of probability theory in the context of simple financial problems (ILO-2: PI-1, PI-2, PI-3)	 Discipline in carrying out study contracts 	 Activenes s 	 Explanation of Lecture Material Discussion and Questions and Answers on Lecture Material [1 x 3 x 50 minutes] 				 Learning Slides / Videos LMS (iLearn Unand) 	 Explanation of Semester Study Plan Explanation of study contracts. Probabilities and events [1] 	
2/2	CLO 1 Understand and use the concept of probability theory in the context of simple financial problems (ILO-2: PI-1, PI-2, PI-3)	 Accurate understanding of related material 	 Activenes s 	 Explanation of Lecture Material Discussion and Questions and Answers on Lecture Material [1 x 3 x 50 minutes] 				 Learning Slides / Videos LMS (iLearn Unand) 	 Conditional Probability Random Variables and Expected Values Covariance and Correlation [1] 	
3/3	CLO 1 Understand and use the concept of probability theory in the context of simple financial problems (ILO-2: PI-1, PI-2, PI-3)	 Accurate understanding of related material 	 Activenes s 	 Explanation of Lecture Material Discussion and Questions and Answers on Lecture Material 				 Learning Slides / Videos LMS (iLearn Unand) 	 Continuous Random Variable Normal Random Variables Central Limit Theorem [1] 	

Weekly Lecture Plan

				[1 x 3 x 50 minutes]				
4/4	CLO 2 Understand and use the concept of Brownian motion/geometric Brownian motion in solving problems related to relevant stock price probabilities (ILO- 4: PI-1, PI-2, PI-3)	 Accuracy in explaining and understandin g related material Accuracy in answering assignment questions Neatness of task execution Originality of task results 	 Activeness Routine Tasks 	 Explanation of Lecture Material Discussion and Questions and Answers on Lecture Material [1 x 3 x 50 minutes] 		 Learning Slides / Videos LMS (iLearn Unand) 	- Brownian Motion - Geometric Brownian Motion [1,2]	5%
5/5	CLO 3 Solving the problem of changes in investment value within a certain period of time which involves calculating the interest rate and present value (ILO- 4: PI-1, PI-2, PI-3)	 Accurate understanding of related material 	• Activenes s	 Explanation of Lecture Material Discussion and Questions and Answers on Lecture Material X 3 x 50 minutes 		 Learning Slides / Videos LMS (iLearn Unand) 	- Interest Rate - Present Value Analysis [1,2]	
6/6	CLO 3 Solving the problem of changes in investment value within a certain period of time which involves calculating the interest rate and present value (ILO- 4: PI-1, PI-2, PI-3)	 Accuracy in explaining and understandin g related material Accuracy in answering assignment questions 	 Activeness Routine Tasks Quiz 	 Explanation of Lecture Material Discussion and Questions and Answers on Lecture Material x 3 x 50 minutes 		 Learning Slides / Videos LMS (iLearn Unand) 	- Rate of Return - Continuous Interest Rate [1,2]	5% 2.5%

		 Neatness of task execution Originality of task results Accuracy in answering quizzes 							
7/7	CLO 1-3	 Accurate understanding of related material 	 Activenes s 	 Explanation of Lecture Material Discussion and Questions and Answers on Lecture Material X 3 x 50 minutes 			 Learning Slides / Videos LMS (iLearn Unand) 	 Material review Discussion of previuos UTS [1,2] 	
8-9 / -					Midterm Exam (U	JTS)			20%
10/8	CLO 4 Explain the concept and properties of financial derivative products: options (call/put) and shares (ILO-4: PI-1, PI-2, PI-3) CLO 5 Understand the arbitrage process that allows for a sure-win strategy (ILO-5: PI-1, PI-2, PI-3)	 Accuracy in explaining and understandin g related material Accuracy in answering assignment questions Neatness of task execution Originality of task results 	• Activeness	 Explanation of Lecture Material Discussion and Questions and Answers on Lecture Material [1 x 3 x 50 minutes] 			 Learning Slides / Videos LMS (iLearn Unand) 	 Options (Call and Put Options) Option Pricing with Arbitrage [1,2] 	
11/9	CLO 6 Determine and analyze put and call option prices with a	Accurate understandin g of related material	 Activeness Routine Tasks 	• Explanation of Lecture Material			 Learning Slides / Videos 	- Derivatives markets and option pricing [2]	5%

	simple model using Matlab programming (ILO- 6: PI-2, PI-3, PI-4, PI-5, ILO-7: PI-1, PI-2, PI-3, ILO-8: PI-1, PI-2, PI-3, PI- 4)	 Accuracy and neatness in presentation 		 Discussion and Questions and Answers on Lecture Material [1 x 3 x 50 minutes] 		 LMS (iLearn Unand) 		
12/10	CLO 7 Understand the derivation and completion of the Black-Scholes formula and its application in calculating option prices (ILO-4: PI-1, PI-2, PI-3, ILO-5: PI-3, PI-4, ILO-6: PI-2, PI-3)	 Accuracy in explaining and understandin g related material Accuracy in answering assignment questions Neatness of task execution Originality of task results Accuracy in answering quizzes 	 Activeness Quiz 	 Explanation of Lecture Material Discussion and Questions and Answers on Lecture Material [1 x 3 x 50 minutes] 		 Learning Slides / Videos LMS (iLearn Unand) 	- Black-Scholes formula [1,2]	2.5%
13/11	CLO 8 Understand the basic concepts of sharia finance and apply its application to financial transaction problems (ILO-4: PI-1, PI-2, PI-3, ILO-6: PI-2, PI-3, ILO-7: PI-1, PI -2, PI-3, ILO-8: PI-1, PI-2, PI-3, PI-4)	 Accuracy in explaining and understandin g related material Accuracy in answering assignment questions Neatness of task execution 	 Activeness Routine Tasks 	 Explanation of Lecture Material Discussion and Questions and Answers on Lecture Material [1 x 3 x 50 minutes] 		 Learning Slides / Videos LMS (iLearn Unand) 	 Basic principles of sharia finance Form of production sharing cooperation contract Related examples [3] 	5%

		• Originality of task results							
14/12	CLO 8 Understand the basic concepts of sharia finance and apply its application to financial transaction problems (ILO-4: PI-1, PI-2, PI-3, ILO-6: PI-2, PI-3, ILO-7: PI-1, PI -2, PI-3, ILO-8: PI-1, PI-2, PI-3, PI-4)	 Accuracy in explaining and understandin g related material Neatness and discipline in carrying out tasks 	Activeness	 Explanation of Lecture Material Discussion and Questions and Answers on Lecture Material [1 x 3 x 50 minutes] 			 Learning Slides / Videos LMS (iLearn Unand) 	- Exploring the ins and outs of sharia finance, impacts, and challenges. [3]	
15/13	CLO 9 Understand and apply profit-sharing modeling in small capital investments (ILO-4: PI-1, PI-2, PI-3, ILO-6: PI-2, PI-3, ILO-6: PI-2, PI-3, ILO-7: PI-1, PI-2, PI-3, ILO-8: PI-1, PI-2, PI-3, PI-4)	 Accuracy in explaining and understandin g related material Accuracy and neatness in presentation Accuracy in answering assignment questions Neatness of task execution Originality of task results 	 Activeness Big mission 	 Explanation of Lecture Material Discussion and Questions and Answers on Lecture Material x 3 x 50 minutes 		• Collaborative Learning [1 x 3 x 60 minutes]	 Learning Slides / Videos LMS (iLearn Unand) 	 PLS mathematical model Daily profit data generation Ratio optimization [3] 	30%
16/14	CLO 4-9	 Accurate understanding of related material 	 Activenes s 	 Explanation of Lecture Material Discussion and Questions 		◆ Collaborative Learning [1 x 3 x 60 minutes]	 Learning Slides / Videos LMS (iLearn Unand) 	 Material review Discussion of previuos UAS [1,2,3] 	

	and Answers on Lecture Material [1 x 3 x 50 minutes]									
17 – 18 / -	Final Semester Examination (UAS)									

Indicators, Criteria, and Assessment Weights

- a. Assessment Weight for Each Form of Assessment:
 - 1) Routine Assignment/Activeness: 20%
 - 2) Big Assignment (Group) : 30%
 - 3) Quiz : 5%
 - 4) Midterm Exam (UTS) : 20%
 - 5) Final Exam (UAS) : 25%

b. Assessment Weight for Each Course Learning Outcome (CLO):

1)	CLO 1	: 10%
2)	CLO 2	: 10%
3)	CLO 3	: 12.5%
4)	CLO 4	: 3.5%
5)	CLO 5	: 4.5%
6)	CLO 6	: 12%
7)	CLO 7	: 19.5%
8)	CLO 8	: 13%
9)	CLO 9	: 15%

Assessment Plan Table

Form of Assessment		Routine A	Assignmen	t	Big	Quiz		Midterm	Final Exam	
CLO	1	2	3	4	nt	1	2	(UTS)	(UAS)	Weight
CLO 1 Understand and use the concept of probability theory in the context of simple financial problems (ILO-2: PI-1, PI-2, PI-3)	5%							5%		10%
CLO 2 Understand and use the concept of Brownian motion/geometric Brownian motion in solving problems related to relevant stock price probabilities (ILO-4: PI-1, PI-2, PI-3)		3%						7%		10%
CLO 3 Solving the problem of changes in investment value within a certain period of time which involves calculating the interest rate and present value (ILO-4: PI- 1, PI-2, PI-3)		2%				2.5%		8%		12.5%
CLO 4 Explain the concept and properties of financial derivative products: options (call/put) and shares (ILO-4: PI-1, PI-2, PI-3)			1%						2.5%	3.5%
CLO 5 Understand the arbitrage process that allows for a sure- win strategy (ILO-5: PI-1, PI-2, PI-3)			2%						2.5%	4.5%
CLO 6 Determine and analyze put and call option prices with a simple model using Matlab programming (ILO-6: PI-2, PI-3, PI-4, PI-5, ILO-7: PI-1, PI-2, PI-3, ILO-8: PI-1, PI- 2, PI-3, PI-4)			2%		10%					12%
CLO 7				2%	5%		2.5%		10%	19.5%

Understand the derivation and completion of the Black-Scholes formula and its application in										
calculating option prices (ILO-4: PI-1, PI-2, PI-3,										
ILO-5: PI-3, PI-4, ILO-6: PI-2, PI-3)										
CLO 8										
Understand the basic concepts of sharia finance and										
apply its application to financial transaction				20/	50/				50/	120/
problems (ILO-4: PI-1, PI-2, PI-3, ILO-6: PI-2, PI-				3%	5%				5%	13%
3, ILO-7: PI-1, PI-2, PI-3, ILO-8: PI -1, PI-2, PI-3,										
PI-4)										
CLO 9										
Understand and apply profit sharing modeling in										
small capital investments (ILO-4:PI-1, PI-2, PI-3,					10%				5%	15%
ILO-6:PI-2, PI-3, ILO-7: PI-1, PI-2, PI-3, ILO-8: PI-1,										
PI-2, PI-3, PI-4)										
Total Weight	5%	5%	5%	5%	30%	2.5%	2.5%	20%	25%	100%

Matrix	of	CLO	and	ILO
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	ILO																															
CLO					2 PI			3			4			5			6 PI				7 PI			8 PI				9 PI				
CLO	PI PI			PI				PI			РІ																					
	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										~	~	~																				
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8										~	~	~						~	~			~	~	~	~	~	~	~				
9										~	~	~						~	~			~	~	~	~	~	~	~				