QF01/0408-4.0E	Course Plan for Master program - Study Plan Development and Updating Procedures/ Mathematics Department

Study plan No.	**2021/2022**		**University Specialization**	**Master of Math.**	
Course No.	**0101711**		**Course name**	**Real Analysis**	
Credit Hours	**3**		**Prerequisite/ Co-requisite**	**None**	
Course type	☐ MANDATORY UNIVERSITY REQUIREMENT	☐ UNIVERSITY ELECTIVE REQUIREMENTS	☐ FACULTY MANDATORY REQUIREMENT	☐ Support course family requirements	✓ **Mandatory requirements**	Elective requirements
Teaching style	☐ Full online learning		☐Blended learning		✓**Traditional learning**	
Teaching model	☐ 1 Synchronous: 1 asynchronous		☐2 face to face : 1 asynchronous		✓**2 Traditional**	

Faculty member and study divisions' information (to be filled in each semester by the subject instructor)

Name	Academic rank	Office No.	Phone No.	E-mail	
Division number	**Time**	**Place**	**Number of students**	**Teaching style**	**Approved model**

Brief description

Riemann integral, σ-Algebra of Lebesgue, Outer measure, measurable sets and Lebesgue measure. Measurable functions. Lebesgue integral, integral of a nonnegative function, general Lebesgue integral, convergence in measure. Differentiation and integration, differentiation of monotone functions. The L^P spaces, Holder and Minkowski inequalities.

Learning resources

Course book information (Title, author, date of issue, publisher ... etc)	**1.** Introduction to Real Analysis". By: R. Bartle and D. Sherbert. John Wiley & Sons, Third Edition (2000). **2.** "Mathematical Analysis". By: T. Apostol Addison-Wesley Publishing Company, Second Edition (1974).			
Supportive learning resources (Books, databases, periodicals, software, applications, others)	1. Introduction to Mathematical Analysis". By: S. Douglass Pearson, 3rd Edition (1996). 2. "The Elements of Real Analysis". By: R. Bartle John Wiley & Sons, 2nd Edition (1975). 3. "Principals of Mathematical Analysis. By: W. Rudin McGraw Hill, 3rd Edition (1976)			
Supporting websites	https://en.wikipedia.org/wiki/Mathematical_analysis#Measure_theory			
The physical environment for teaching	✓ Class room	☐ labs	✓ Virtual educational platform	☐ Others
Necessary equipment and software				
Supporting people with special needs				
For technical support				

Course learning outcomes (S= *Skills, C= Competences K= Knowledge,)*

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No.	Course learning outcomes	The associated program learning output code
	Knowledge	
K1	Apply the theorems of Riemann integral, σ-Algebra of Lebesgue, Measurable Sets, and Measurable functions.	**MK 2**
K2	Understand the basic facts about Lebesgue Integral.	**MK 1**
	Skills	
S1	Recognize littlewood's three principles, Egoroff, Lusin, Lebesgue, and Jordan theorems.	**MS 2**
S2	Comprehend between Young, Holder and Minkowski inequalities.	**MS 2**
	Competences	
C1	Cooperate to work effectively in the group assignments.	**MC 1**
C2	Be able to think in mathematical analysis.	**MC 2**

Mechanisms for direct evaluation of learning outcomes

Type of assessment / learning style	Fully electronic learning	Blended learning	Traditional Learning (Theory Learning)	Traditional Learning (Practical Learning)
Midterm exam	30%	**30%**	40%	30%
Participation / practical applications	0	**0**	10%	30%
Asynchronous interactive activities	30%	**30%**	0	0
Final exam	40%	**40%**	50%	40%

Schedule of simultaneous / face-to-face encounters and their topics

Week	Subject	learning style*	Reference **
1	Riemann integral	Lecture	
2	The σ-Algebra of Lebesgue Measurable Sets. Four Characterizations for Measurable Sets.	Lecture	
3	Outer and Inner Approximation of Lebesgue Measurable Sets. Lebesgue Measure	Lecture	
4	Countable Additivity. Non-measurable sets. The Cantor Set and the Cantor-Lebesgue Function	Lecture	
5	Lebesgue Measurable functions. Sums, Products and Compositions.	Lecture	
6	Littlewood's Three Principles, Egoroff's Theorem, and Lusin's Theorem	Lecture	
7	Review of the Riemann Integral. Simple Functions. The Lebesgue Integral of a Bounded Measurable	Lecture	
8	Function over a Set of Finite Measure.	Lecture	

	Properties of the integral. Fatou's Lemma.		
9	Lebesgue Integral of a Measurable Nonnegative Function. The General Lebesgue Integral.	Lecture	
10	Countable Additivity and Continuity of Integration. Uniform Integrability.	Lecture	
11	Continuity of Monotone Functions. Differentiability of Monotone Functions: Lebesgue Theorem. Functions of Bounded	Lecture	
12	Jordan's Theorem. Absolutely Continuous Functions.	Lecture	
13	Integrating Derivatives: Differentiating Indefinite Integrals.	Lecture	
14	L^P Spaces. Inequalities of Young.	Lecture	
15	Inequalities of Holder and Minkowski.	Lecture	
16	**Final Exam Midterm exam**		

Schedule of asynchronous interactive activities (in the case of e-learning and blended learning)

Week	Task / activity	Reference	Expected results
1	Background	Real Analysis 1	Self-reading and Discussion
2	Video 1 Solving exercises	E-learning	Discussion in the class
3	Home work1: On the subjects studied on the first three weeks	(Lecture notes and Ref.1)	Submit a pdf or word sheet
4	Quiz 1	On the subjects studied on the first three weeks	Submitting on the E-learning
5	Assignment 1	Internet sources and the other Supportive learning resources	Presentation
6	Video 2	Solving exercises	Discussion in the class
7	Home work 2 On the subjects studied in the weeks 4,5 and 6	(Lecture notes and Ref.1)	Submit a pdf or word sheet
8	Assignment 2	Internet sources and the other Supportive learning resources	Submitted with the mid exam
9	Self-reading for selected topic	(Ref.2)	Talk
10	Video3 Solving exercises	E-learning	Discussion in the class
11	Home work 3: On the subjects studied after the Midterm exam	(Lecture notes and Ref.1)	Submit a pdf or word sheet
12	Self-reading for selected topic	(Ref.2)	Talk
13	Quiz 2	On the subjects studied on the subject studied after Midterm exam	Submitting on the E-learning
14	Presentation of the selected subject	Internet sources and the reference book	Video

15	Video 4 Revision of all the course	E-learning	
16	**Final Exam**	-	