COURSE DESCRIPTIONS

Faculty	Science and Information Technology				
Department	Mathematics			**NQF level**	
Course Title	Measure Theory	**Code**	505702	**Prerequisite**	
Credit Hours	3	**Theory**	3	**Practical**	-
Course Leader	Dr. Shawkat Alkhazaleh	**email**	s.alkhazaleh@jadara.edu.jo		
Lecturers	Dr. Shawkat Alkhazaleh	**emails**	s.alkhazaleh@jadara.edu.jo		
Lecture time	03:00-06:00	**Classroom**	D304		
Semester	First	**Production**		**Updated**	2022
Awards				**Attendance**	Fulltime

Short Description
This course is concerned with a generalization of the Riemann integral (of bounded real functions over bounded intervals) to Lebesgue integral of measurable functions over measurable sets of R. The course starts with the concept of outer measure and its properties then proceed to define the Lebesgue measure on certain sets of R that will be called measurable sets. The later will be studied along with its properties. Measurable functions over measurable sets will also be defined and studied. The Lebesgue integral of measurable functions over measurable sets will be defined along with some properties. Its relation with Riemann integral is given and certain related theorems will be proved. The course ends with a chapter on the spaces of measurable and Lebesgue integrable functions, in which some inequalities are studied that will be used to prove the completeness of these spaces.
Course Objectives
- This course will investigate many roles that are very important for students. - Also give an idea for real analysis and some prosperities of measure theory. - This course will present and emphasize many topics in mathematics in particular real analysis, in order to aid the student in his future mathematical studies.

Learning Outcomes
A. Knowledge - Theoretical Understanding
a1) Upon successful completion of this course, the learner should be able to make a good background on basic real analysis and topology.
B. Knowledge - Practical Application
a2) The learner should be able to learn the concept and properties of measure and give some examples starting with outer measure then the Lebesgue measure. a3) The learner should be able to study measurable sets and measurable functions and their properties, and understand Lebesgue integral and its relation with Riemann integral, and study spaces of measurable Lebesgue integrable functions, and prove some related results and theorems.
C. Skills - Generic Problem Solving and Analytical Skills
b1) Prove a selection of related theorems.
D. Skills - Communication, ICT, and Numeracy
b2) Describe different examples.
E. Competence: Autonomy, Responsibility, and Context
Teaching and Learning Methods
Lectures, discussions, and solving selected problems.
Assessment Methods
Assignments, Exams, Quizzes, Discussion and Interaction

Course Contents					
W	**Hours**	**CLOs**	**Topics**	**Teaching & Learning Methods**	**Assessment Methods**
1	**3:00-6:00**	a1,a2	**Background :** 1. Set theory, sequence of sets, Limit sup/ Limit inf of a sequence of sets. 2.Completeness of the real numbers. 3. sequences, limits, limit sup/ limit inf of a sequence.	Lectures, Cooperative Learning and Discussion	Assignments, Exams, Quizzes, Discussion and Interaction
2	**3:00-6:00**	a1, a2, a3, b1, b2	**Measure Theory:** 1. Sigma algebra: definition and examples. 2. Borel sigma algebra and	Lectures, Cooperative Learning and Discussion	Assignments, Exams, Quizzes, Discussion and Interaction

			Borel sets.		
3	**3:00-6:00**	a2, a3, b1, b2	3. The measure space : definition and examples. 4. The length function of open set.	Lectures, Cooperative Learning and Discussion	Assignments, Exams, Quizzes, Discussion and Interaction
4	**3:00-6:00**	a2, b1, b2	5. Lebesgue outer measure and some consequences. 6. The algebra of Measurable sets.	Lectures, Cooperative Learning and Discussion	Assignments, Exams, Quizzes, Discussion and Interaction
5	**3:00-6:00**	a1, a2, b1	7. Lebesgue Measure, properties, existence of non measurable sets. 8. Cantor set and cantor function	Lectures, Cooperative Learning and Discussion	Assignments, Exams, Quizzes, Discussion and Interaction
6	**3:00-6:00**	a1,a2	9. Lebesgue measure on R^n (product measure). **Measurable functions:** 1. The definition ofmeasurable functions.	Lectures, Cooperative Learning and Discussion	Assignments, Exams, Quizzes, Discussion and Interaction
7	**3:00-6:00**	a1, a2, a3, b1, b2	2. Limits of measurable functions. 3. Egoroff's theorem (almost uniform convergence).	Lectures, Cooperative Learning and Discussion	Assignments, Exams, Quizzes, Discussion and Interaction
8	**3:00-6:00**	a2, a3, b1, b2	**The integral:** 1. Riemann integral. 2. Lebesgue integration of bounded functions. Simple Functions.	Lectures, Cooperative Learning and Discussion	Assignments, Exams, Quizzes, Discussion and Interaction
9	**3:00-6:00**	a2, b1, b2	3. Lebesgue integral of non-negative functions. 4. The general Lebesgue integral.	Lectures, Cooperative Learning and Discussion	Assignments, Exams, Quizzes, Discussion and Interaction
10	**3:00-6:00**	a1, a2, b1	5. Fatou's and Monotone Convergence Theorems. 6. Lebesgue Dominated convergence theorem	Lectures, Cooperative Learning and Discussion	Assignments, Exams, Quizzes, Discussion and Interaction

11,12	**3:00-6:00**	a1,a2	**Functions of bounded variation:** 1. The definition of Functions of bounded variation. 2.Fundamental theorem of Lebesgue integral.	Lectures, Cooperative Learning and Discussion	Assignments, Exams, Quizzes, Discussion and Interaction
13	**3:00-6:00**	a1, a2, a3, b1, b2	3. absolute continuity.	Lectures, Cooperative Learning and Discussion	Assignments, Exams, Quizzes, Discussion and Interaction

Infrastructure	
Textbook	Real Analysis, by H. L. Royden and P. Fitzpatrick; 4th edition. Macmilan, New York, 2012.
References	1. Lebesgue Measure and Integration, by Gupta. 2. Measure theory and integration, by G. de Barra 3. مبادىء التحليل الحقيقي ونظرية القياس والتكامل عبدالله صالح السنونسي أ. محمد بن عبد الرحمن القويز
Required reading	
Electronic materials	
Other	

Course Assessment Plan						
Assessment Method	**Grade**	**CLOs**				
		a1	**a2**	**a3**	**b1**	**b2**
First (Midterm)	**30%**	6	6	6	6	6
Second (if applicable)						
Final Exam	**50%**	10	10	10	10	10

Coursework							
Coursework assessment methods	Assignments	10%	5		5		
	Case study	-					
	Discussion and interaction	-					
	Group work activities	-					
	Lab tests and assignments	-					
	Presentations	-					
	Quizzes	-		5	5		
Total		100%	20	25	30	25	

Plagiarism

Plagiarism is claiming that someone else's work is your own. The department has a strict policy regarding plagiarism and, if plagiarism is indeed discovered, this policy will be applied. Note that punishments apply also to anyone assisting another to commit plagiarism (for example by knowingly allowing someone to copy your code).

Plagiarism is different from group work in which a number of individuals share ideas on how to carry out the coursework. You are strongly encouraged to work in small groups, and you will certainly not be penalized for doing so. This means that you may work together on the program. What is important is that you have a full understanding of all aspects of the completed program. In order to allow proper assessment that this is indeed the case, you must adhere strictly to the course work requirements as outlined above and detailed in the coursework problem description. These requirements are in place to encourage individual understanding, facilitate individual assessment, and deter plagiarism.