



Course Specifications

Course Title:	Number Theory
Course Code:	30114406-3
Program:	BSc. Mathematics 301100
Department:	Mathematics
College:	Al Leith University College
Institution:	Umm Al Qura University

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A. Course Identification

1. Credit hours:			
2. Course type			
a.	University <input type="checkbox"/>	College <input type="checkbox"/>	Department <input checked="" type="checkbox"/>
b.	Required <input checked="" type="checkbox"/>	Elective <input type="checkbox"/>	Others <input type="checkbox"/>
3. Level/year at which this course is offered: 7 th Level / Fourth Year			
4. Pre-requisites for this course (if any): Sets and Algebraic Structures 30112401-4			
5. Co-requisites for this course (if any): None			

6. Mode of Instruction (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	(3 hours) x (15 weeks)	100%
2	Blended	0	0%
3	E-learning	0	0%
4	Correspondence	0	0%
5	Other	0	0%

7. Actual Learning Hours (based on academic semester)

No	Activity	Learning Hours
Contact Hours		
1	Lecture	45 hours
2	Laboratory/Studio	0
3	Tutorial	0
4	Others (specify)	8 hours
	Total	53 hours
Other Learning Hours*		
1	Study	75 hours
2	Assignments	15 hours
3	Library	0
4	Projects/Research Essays/Theses	15 hours
5	Others (workgroup)	0
	Total	105 hours

* The length of time that a learner takes to complete learning activities that lead to achievement of course learning outcomes, such as study time, homework assignments, projects, preparing presentations, library times

B. Course Objectives and Learning Outcomes

<p>1. Course Description</p> <p>This course will provide a detailed introduction to modern abstract number theory, which is a basic part of the language of much of modern mathematics. The course begins by recognizing the fundamental concepts of Primes, Divisibility and the Fundamental Theorem of Arithmetic, and a short reminder of Greatest Common Divisor (GCD), Euclidean Algorithm. Then, it studies the question of congruence and some examples of this concept. In addition, the arithmetic functions are studied. Finally, a brief introduction to cryptography is formatting.</p>
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2. Course Main Objective

The course is intended to allow students to be exposed to some foundational ideas in number theory without the technical baggage often associated with a more advanced courses. The course provides students an opportunity to develop an appreciation of pure mathematics while engaged in the study of number theoretic results. The course is also designed to provide students an opportunity to work with conjectures, proofs, and analyzing mathematics.

3. Course Learning Outcomes

CLOs		Aligned PLOs
1	Knowledge:	
1.1	Define the concepts of divisibility, congruence, greatest common divisor, prime, and prime factorization	K1
1.2	State the elementary properties of congruences	K3
1.3	Recall the main properties of arithmetic functions	K3
1.4	Recognize the relation between the continued fraction algorithm and Euclid's algorithm	K2
1.5	Present briefly introduction of cryptography notion	K4
2	Skills :	
2.1	Solve problems involving divisibility, prime numbers and Euclidean algorithm	S7
2.2	Extend the Chinese Remainder Theorem	S9
2.3	Examine Euler's function and its properties	S6
2.4	Apply techniques to solve linear Diophantine equations	S5
2.5	Derive the representation of an irreducible rational fraction by a simple continued fraction	S3
3	Competence:	
3.1	Evaluate theoretical concepts in number theory to understand real world applications	C5
3.2	Develop the theories, methods and techniques of the course to solve complex mathematical problems	C4
3.3	Work effectively in teams	C1

C. Course Content

No	List of Topics	Contact Hours
1	Primes, Divisibility and the Fundamental Theorem of Arithmetic	6
2	Greatest Common Divisor (GCD), Euclidean Algorithm	6
3	Congruences, Chinese Remainder Theorem, Hensel's Lemma, Primitive Roots	9
4	Quadratic Residues and Reciprocity	6
5	Arithmetic Functions, Diophantine Equations	6
6	Continued Fractions	6
7	Introduction of cryptography	6
Total		45

D. Teaching and Assessment

1. Alignment of Course Learning Outcomes with Teaching Strategies and Assessment Methods

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
1.0	Knowledge		
1.1	Define the concepts of divisibility, congruence, greatest common divisor, prime, and prime factorization	Lecture Tutorials	Exams (Quizzes, Midterm and Final). Written and possibly oral exam at the end of the course. In addition, compulsory work may be given during the course
1.2	State the elementary properties of congruences	Lecture Tutorials	
1.3	Recall the main properties of arithmetic functions	Lecture Tutorials	
1.4	Recognize the relation between the continued fraction algorithm and Euclid's algorithm	Lecture Tutorials	
1.5	Present briefly introduction of cryptography notion	Lecture Tutorials	
2.0	Skills		
2.1	Solve problems involving divisibility, prime numbers and Euclidean algorithm	Lecture Individual or group work	Exams (Quizzes, Midterm and Final). Homework
2.2	Extend the Chinese Remainder Theorem	Lecture Individual or group work	
2.3	Examine Euler's function and its properties	Lecture Individual or group work	
2.4	Apply techniques to solve linear Diophantine equations	Lecture Individual or group work	
2.5	Derive the representation of an irreducible rational fraction by a simple continued fraction	Lecture Individual or group work	
3.0	Competence		
3.1	Evaluate theoretical concepts in number theory to understand real world applications	Lecture Individual or group work	Exams (Quizzes, Midterm and Final). Research Essays
3.2	Develop the theories, methods and techniques of the course to solve complex mathematical problems	Lecture Individual or group work	
3.3	Work effectively in teams	Lecture Individual or group work	

2. Assessment Tasks for Students

#	Assessment task*	Week Due	Percentage of Total Assessment Score
1	Midterm 1	6 th week	20 %
2	Midterm 2	12 th week	20%
3	Homework + reports + Quizzes	During the semester	10%

#	Assessment task*	Week Due	Percentage of Total Assessment Score
4	Final exam	End of semester	50 %

*Assessment task (i.e., written test, oral test, oral presentation, group project, essay, etc.)

E. Student Academic Counseling and Support

Arrangements for availability of faculty and teaching staff for individual student consultations and academic advice :

Each group of students is assigned to a faculty member where he or she will provide academic advising. All faculty members are required to be in their offices outside teaching hours. Each faculty member allocates at least 4 hours per week to give academic advice and to answer to the questions of students about concepts studied during the lectures.

F. Learning Resources and Facilities

1. Learning Resources

Required Textbooks	Introduction to the Theory of Numbers, 1960 by G.H.; Wright, E.M. Hardy Publisher: Oxford University Press; Fourth Edition edition (1960) Language: English ISBN-10: 0198533101 ISBN-13: 978-0198533108 Elementary Number Theory (Springer Undergraduate Mathematics Series) Corrected Edition by Gareth A. Jones; Publisher: Springer; Corrected edition (July 31, 1998) Language: English ISBN-10: 3540761977 ISBN-13: 978-3540761976
Essential References Materials	Number Theory October 12, 1994 by George E. Andrews; Publisher: Dover Publications; 1 edition (October 12, 1994) Language: English ISBN-10: 0486682528 ISBN-13: 978-0486682525 Modern Algebra: An Introduction 6th Edition, by John R. Durbin
Electronic Materials	- https://en.wikipedia.org/wiki/Number_theory - http://mathworld.wolfram.com/NumberTheory.html
Other Learning Materials	None

2. Facilities Required

Item	Resources
Accommodation (Classrooms, laboratories, demonstration rooms/labs, etc.)	Large classrooms that can accommodate more than 30 students.
Technology Resources (AV, data show, Smart Board, software, etc.)	Data Show.
Other Resources (Specify, e.g. if specific laboratory equipment is required, list requirements or attach a list)	None.

G. Course Quality Evaluation

Evaluation Areas/Issues	Evaluators	Evaluation Methods
Effectiveness of teaching and assessment.	Students	Direct
Quality of learning resources.	Students	Direct
Extent of achievement of course learning outcomes.	Faculty member	Direct

Evaluation areas (e.g., Effectiveness of teaching and assessment, Extent of achievement of course learning outcomes, Quality of learning resources, etc.)

Evaluators (Students, Faculty, Program Leaders, Peer Reviewer, Others (specify))

Assessment Methods (Direct, Indirect)

H. Specification Approval Data

Council / Committee	Council of the Mathematics Department	The mathematical sciences (college of applied sciences) and the mathematics (Al-Leith University College) department s first meeting of the coordinative committee
Reference No.	4101050782	First meeting
Date	Sunday, 17 November 2019	Thursday, 17 October 2019

Department Head



Dr. Ali Hassani