



مركز الاعتماد
وإضمان الجودة
ACCREDITATION & QUALITY ASSURANCE CENTER



The University of Jordan

Accreditation & Quality Assurance Center

Course Syllabus

Course Name: Number Theory

Course Syllabus

1	Course title	Number Theory	
2	Course number	(0301342)	
3	Credit hours	3	
	Contact hours (theory, practical)	3	
4	Prerequisites/corequisites	(0301211)	
5	Program title	B.Sc.	
6	Program code		
7	Awarding institution	The University of Jordan	
8	School	Science	
9	Department	Mathematics	
10	Course level	Compulsory Specialization requirement	
11	Year of study and semester (s)	3 rd 1 st and 2 nd or summer semester	
12	Other department (s) involved in teaching the course	None	
13	Main teaching language	English	
14	Delivery method	<input type="checkbox"/> Face to face learning <input checked="" type="checkbox"/> Blended <input type="checkbox"/> Fully online	
15	Online platforms(s)	<input checked="" type="checkbox"/> Moodle <input checked="" type="checkbox"/> Microsoft Teams <input type="checkbox"/> Skype <input type="checkbox"/> Zoom <input type="checkbox"/> Others.....	
16	Issuing/Revision Date	3-11-2022	

17 Course Coordinator:

Name: Prof. Omar Abughneim

Contact hours: 10:30-11:30

Office number:329

Phone number:

Email:o.abughneim

**18 Other instructors:**

Name:

Office number:

Phone number:

Email:

Contact hours:

Name:

Office number:

Phone number:

Email:

Contact hours:

19 Course Description:

As stated in the approved study plan.

Division algorithm; divisibility; greatest common divisor and least common multiple; Diophantine equations; prime numbers and their distribution; fundamental theorem of arithmetic; congruence; linear congruence equations; Chinese remainder theorem; tests of divisibility. Fermat little theorem; Wilson's theorem; arithmetic functions; cryptography as an application of number theory.

20 Course aims and outcomes:

Aims:

Elementary Number Theory is concerned with exploring properties of integers. The course requires some knowledge in foundations of mathematics.

Many of the problems discussed can be adapted for use by elementary, middle, or secondary school teachers. In recent times, number-theoretical ideas have found important applications, perhaps most notably in the area of computer and network security, and we will mention some of these applications. The course will also emphasize reading and writing proofs; consequently, it will enrich the student's analytical and problem solving skills.

The major objectives of the course are the following:

- 1) The students prove theorems about integers.
- 2) The students use the computer to formulate conjectures and develop proofs through their investigations of number theoretic properties
- 3) The students explore the historical development of integer properties and the contributions of famous mathematician to number theory.
- 4) The students inspire the student towards an involvement in the subject by considering some famous unsolved problems of number theory and by exploring the connections that number theory has with other branches of mathematics.

B- Students Learning Outcomes (SLOs):

Upon successful completion of this course, students will be able to:

SLOs	SLO (1)	SLO (2)	SLO (3)	SLO (4)	SLO (5)	SLO (6)	SLO (7)	SLO (8)
SLOs of the course								
1 Investigate various number systems and divisibility tests.							•	
2 Use some factorization methods							•	
3 Demonstrate their knowledge of divisibility, prime numbers and the Euclidean Algorithm							•	
4 Solve linear Diophantine equations and congruences of various types, and use the theory of congruences in applications							•	
5 Use mathematical reasoning							•	

21 . Topic Outline and Schedule:

Topic	Week	Instructor	Achieved ILOs	Evaluation Methods
1. Some Preliminary Considerations 1.1 Mathematical Induction Pages 6-8: Problems 1-4,7-9,11,13,14 1.2 The Binomial Theorem Pages 10-11: Problems 1,3	1-2		7	Exam
2. Divisibility Theory in the Integers 2.1 The Division Algorithm Pages 19-20: All problems except 7 2.2 The Greatest Common Divisor Pages 25-26: All problems except 22 2.3 The Euclidean Algorithm Pages 31-32: all problems except 11 and 12 2.4 The Diophantine Equation $ax + by = c$ Page 38: Problems 1-4,6,7.	3-5		7	Exam
3. Primes and Their Distribution 3.1 The Fundamental Theorem of Arithmetic Pages 44-45: All problems except 14,18 3.2 The Sieve of Eratosthenes Pages 50-51: Problems 1-4(a), 5, 9, 12. 3.3 The Goldbach Conjecture Pages 59-61: Problems 1, 2, 3, 6, 9, 10, 11, 12,18, 20, 21, 22, 24, 26	6-8		7	Exam
4. The Theory of Congruencies 4.2 Basic Properties of Congruence Pages 68-69: All problems except 15 4.3 Special Divisibility Tests Page 73: Problems 1-4, 6-8, 13-15 4.4 Linear Congruence Pages 82-83: Problems 1-6, 9-15,17,18,20	9-10		7	Exam
5. Fermat's Theorem 5.2 Fermat's Factorization Method Pages 90-91: Problems 1, 3, 5,6 5.3 The Little Theorem Pages 96-97: Problems 1-11, 13, 14, 16,18, 21. 5.4 Wilson's Theorem Page 101: Problems 1, 2, 4-12, 14, 15, 17, 18	11-12		7	Quiz
6. Number-Theoretic Functions 6.1 The Functions τ and σ Pages 109-111: Problems 1-9,13-15,17-21,23 6.2 The Mobius Inversion Formula Pages 115-116: Problems 1,3,4,6	13-14		7	Exam



7. Euler's Generalization of Fermat's Theorem 7.2 Euler's Phi Function Factorization Method Pages 133-134: Problems 1-6, 8-11, 13, 18-20 7.3 Euler's Theorem Pages 138-139 : Problems 1-5, 7-10, 13 7.4 Some Properties of the Phi-Function Pages 143-144: Problems 1-3, 6-10, 13-16 7.5 An Application to Cryptography	15		7	Quiz
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22 Evaluation Methods:

Opportunities to demonstrate achievement of the SLOs are provided through the following assessment methods and requirements:

Evaluation Activity	Mark	Topic(s)	SLOs	Period (Week)	Platform
Quiz #1	15		7		On Campus
Quiz #2	15		7		On Campus
Midterm	30		7		On Campus
Final Exam	40		7		On Campus

23 Course Requirements

(e.g: students should have a computer, internet connection, webcam, account on a specific software/platform...etc):

24 Course Policies:

1. The student is not allowed to take the course and its pre-requisite in the sametime.
2. Attendance is absolutely essential to succeed in this course. You are expected to attend every class; please notify your instructor if you know you are going to be absent. All exams must be taken at the scheduled time. Exceptions will be made only in extreme circumstances, by prior arrangement with the instructor.
3. If a student is absent for more than 10% of lectures without an excuse of sickness or due to other insurmountable difficulty, then he/she shall be barred from the final examination also he/she will get a failing grade in this course.
4. Medical certificates shall be given to the University Physician to be authorized by him. They should be presented to the Dean of the Faculty within two weeks of the student's ceasing to attend classes.
5. Test papers shall be returned to students after correction. His/her mark is considered final after a lapse of one week following their return.
6. Solutions for the exams questions and marks will be announced at the webpage of the



instructor: <http://eacademic.ju.edu.jo/eabuosba/default.aspx>

7. Cheating is prohibited. The University of Jordan regulations on cheating will be applied to any student who cheats in exams or on homeworks.

25 References:

A- Required book(s), assigned reading and audio-visuals:

Elementary Number Theory; 7th Edition by David Burton

B- Recommended books, materials, and media:

- 1) An Introduction to The Theory of Numbers, 5th edition, by I. Niven, H. Zuckerman and H. Montgomery.
- 2) A Friendly Introduction to Number Theory, 2nd edition, by Joseph H. Silverman

26 Additional information:

Name of Course Coordinator: Prof. Omar AbuGhneim--Signature: ----- Date: --3-11-2022
Head of Curriculum Committee/Department: Prof. Ahmad Al Zghoul-- Signature: ----- -----
Head of Department: -Prof. Manal Ghanem - Signature: -M. Ghanem
Head of Curriculum Committee/Faculty: ----- Signature: ----
Dean: Mahmoud Jaghoub Signature: -----