# The University of Jordan

الجامعة الاردنية

| Form: Course Syllabus | Form Number | EXC-01-02-02A |
|---|---|---|
| | Issue Number and Date | 2/3/24/2022/2963 05/12/2022 |
| | Number and Date of Revision or Modification | |
| | Deans Council Approval Decision Number | 2/3/24/2023 |
| | The Date of the Deans Council Approval Decision | 23/01/2023 |
| | Number of Pages | 06 |

| 1. | Course Title | **Number Theory** |
|---|---|---|
| 2. | Course Number | 0301342 |
| 3. | Credit Hours (Theory, Practical) | 3 |
| | Contact Hours (Theory, Practical) | 3 |
| 4. | Prerequisites/ Corequisites | 0301211 |
| 5. | Program Title | B.Sc. Mathematics |
| 6. | Program Code | |
| 7. | School/ Center | Science |
| 8. | Department | Mathematics |
| 9. | Course Level | Compulsory Specialization Requirement |
| 10. | Year of Study and Semester (s) | 3rd 1st and 2nd or summer semester |
| 11. | Other Department(s) Involved in Teaching the Course | None |
| 12. | Main Learning Language | English |
| 13. | Learning Types | ■Face to face learning ☐Blended ☐Fully online |
| 14. | Online Platforms(s) | ■Moodle ☐Microsoft Teams |
| 15. | Issuing Date | 13-10-2024 |
| 16. | Revision Date | |

**17. Course Coordinator:**

| | |
|---|---|
| Name: Prof. Manal Ghanem | Contact hours: 8:30-10 |
| Office number: Math 321 | Phone number: 22101 |
| Email: m.ghanem@ju.edu.jo | |

**18. Other Instructors:**

Name:   Prof. Omar  Abughneim

Office number: Math 329

Phone number:

Email: o.abughneim

Contact hours: 9:30-10:30

**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. Program Student Outcomes (SO's):**

(To be used in designing the matrix linking the intended learning outcomes of the course with the intended

  learning outcomes of the program)

**7.** Utilize research methods, critical and creative thinking skills to assess and analyze information to solve

  problems properly, then draw valid reasoning and logical conclusions leading to true consequences.

**8**. Utilize techniques, skills, and modern scientific tools such as mathematical packages, statistical software,

  graphing calculators, and online resources necessary for professional practice.

**21. Course Intended Learning Outcomes (CLO's):**

(Upon completion of the course, the student will be able to achieve the following intended learning outcomes)

1.  The students prove theorems involving integer properties using logical reasoning and precise mathematical arguments.
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.  Students inspire to engage with Number Theory by considering famous unsolved problems and by understanding the connections between Number Theory and other branches of mathematics.

| Course CLOs | The learning levels to be achieved | | | | | |
|:---:|:---:|:---:|:---:|:---:|:---:|:---:|
| | Remembering | Understanding | Applying | Analysing | evaluating | Creating |
| 1 | | ● | | ● | | ● |
| 2 | | | ● | | ● | ● |
| 3 | ● | ● | | | | |
| 4 | | ● | | ● | | ● |

**22. The matrix linking the intended learning outcomes of the course with the intended learning outcomes**

   **of the program:**

| Program SO's / Course CLO's | SO (1) | SO (2) | SO (3) | SO (4) | SO (5) | SO (6) | SO (7) | SO (8) |
|:---:|:---:|:---:|:---:|:---:|:---:|:---:|:---:|:---:|
| CLO (1) | | | | | | | ● | ● |
| CLO (2) | | | | | | | ● | ● |
| CLO (3) | | | | | | | ● | ● |
| CLO (4) | | | | | | | ● | ● |

**23. Topic Outline and Schedule:**

| Week | Lecture | Topic | CLO/s Linked to the Topic | Learning Types (Face to Face (FF)/ Blended(B)/ Fully Online (FO)) | platform Used | Synchronous (S)/ Asynchronous(A) Lecturing | Evaluation Methods | Learning Resources |
|:---:|:---:|:---|:---:|:---:|:---:|:---:|:---:|:---:|
| 1 | 1.1 | Mathematical Induction | 1 | FF | | S | Exam | Textbook |
| | 1.2 | The Binomial Theorem | 1 | FF | | S | Exam | Textbook & you tube |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **2** | 2.1 | The Binomial Theorem | 1 | FF | | S | Exam | Textbook |
| | 2.2 | The Division Algorithm | 1 | FF | | S | Exam | Textbook |
| **3** | 3.1 | The Division Algorithm | 1 | FF | | S | Exam | Textbook |
| | 3.2 | The Greatest Common Divisor | 1, 2 | FF | | S | Exam | Textbook |
| | 3.3 | The Greatest Common Divisor | 1, 2 | FF | | S | Exam | Textbook |
| **4** | 4.1 | The Euclidean Algorithm | 1, 2 | FF | | S | Exam | Textbook & you tube |
| | 4.2 | The  Euclidean Algorithm | 1, 2 | FF | | S | Exam | Textbook |
| **5** | 5.1 | Diophantine Equations | 1, 3 | FF | | S | Exam | Textbook &you tube |
| | 5.2 | Diophantine Equations | 1, 3 | FF | | S | Exam | Textbook |
| **6** | 6.1 | The Fundamental Theorem of Arithmetic | 1 | FF | | S | Exam | Textbook &you tube |
| | 6.2 | The Fundamental Theorem of Arithmetic | 1, 2 | FF | | S | Exam | Textbook |
| **7** | 7.1 | The Fundamental Theorem of Arithmetic | 1, 2 | FF | | S | Exam | Textbook |
| | 7.2 | The Fundamental Theorem of Arithmetic | 1, 2 | FF | | S | Exam | Textbook |
| **8** | 8.1 | The Sieve of Eratosthenes | 3, 4 | FF | | S | Exam | Textbook |
| | 8.2 | The Goldbach Conjecture | 3, 4 | FF | | S | Exam | Textbook & you tube |
| **9** | 9.1 | Basics of Congruences | 1, 2, 4 | FF | | S | Exam | Textbook & you tube |
| | 9.2 | Basics of Congruences | 1, 2, 4 | FF | | S | Exam | Textbook & you tube |
| **10** | 10.1 | Representation of Integers | 1 | FF | | S | Exam | Textbook |
| | 10.2 | Representation of Integers | 1 | FF | | S | Exam | Textbook |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **11** | 11.1 | The Chinese Remainder Theory | 1, 3 | FF | | S | Exam | Textbook & you tube |
| | 11.2 | The Chinese Remainder Theory | 1, 2 | FF | | S | Exam | Textbook |
| **12** | 12.1 | Fermat's Little Theorem | 1, 3 | FF | | S | Exam | Textbook & you tube |
| | 12.2 | Wilson's Theorem | 1, 3 | FF | | S | Exam | Textbook |
| **13** | 13.1 | Factorization Methods | 1, 2 | FF | | S | Exam | Textbook |
| | 13.2 | Sum and Number of Divisors | 1, 2 | FF | | S | Exam | Textbook |
| **14** | 14.1 | Sum and Number of Divisors | 1, 2 | FF | | S | Exam | Textbook |
| | 14.2 | Mobius Formula | 1 | FF | | S | Exam | Textbook |
| **15** | 15.1 | Euler's Phi Function | 1, 4 | FF | | S | Exam | Textbook & you tube |
| | 15.2 | Euler's Theorem | 1, 2 | FF | | S | Exam | Textbook |

### 24. Evaluation Methods:

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

| Evaluation Activity | Mark | Topic(s) | CLO/s Linked to the Evaluation activity | Period (Week) | Platform |
|---|---|---|---|---|---|
| **First Exam** | 20 | Ch 1+ Ch2 | 1, 2 | 5 | On Campus |
| **Midterm Exam** | 30 | Ch 3+Ch4 | 1, 2, 3 | 11 | On Campus |
| **Final Exam** | 50 | | 1, 2, 3, 4 | | On Campus |

### 25. Course Requirements:

(e.g.: students should have a computer, internet connection, webcam, account on a specific

software/platform…etc.):

-Account on Microsoft Teams.

**26. Course Policies:**

**A.** Attendance policies: 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.

**B.** Absences from exams and submitting assignments on time: If a student is absent for more than 10% of lectures without an excuse of sickness or due to other insurmountable difficulties, then he/she shall be barred from the final examination also he/she will get a failing grade in this course.

**C.** Health and safety procedures: Medical certificates shall be given to the University Physician for his authorization. They should be presented to the Dean of the Faculty within two weeks of the student's ceasing to attend classes.

**D.** Honesty policy regarding cheating, plagiarism, and misbehavior: Cheating is prohibited. The University of Jordan regulations on cheating will be applied to any student who cheats in exams or on homework.

**E.** Grading policy: Test papers shall be returned to students after correction. One week after their return, their mark is considered final.

**27. References:**

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

Elementary Number Theory; 7$^{th}$ edition by David Burton, 2011.

**B-** Recommended books, materials, and media:

An Introduction to The Theory of Numbers, 5$^{th}$ edition ,by I. Niven, H. Zuckerman and H. Montgomery.

A Friendly Introduction to Number Theory, 2$^{nd}$ edition, by Joseph H. Silverman

**28. Additional information:**

| | Signature: | Date: |
|---|---|---|
| Name of the Instructor or the Course Coordinator: **Prof. Manal Ghanem** | Signature: ……………………… | Date: 16-10-2024 |
| Name of the Head of Quality Assurance Committee/ Department **Prof. Manal Ghanem** | Signature: ……………………… | Date: ……………… |
| Name of the Head of Department **Prof. Baha Alzalg** | Signature: ……………………… | Date: ……………… |
| Name of the Head of Quality Assurance Committee/ School of Science **Prof. Emad A. Abuosba** | Signature: ……………………… | Date: ……………… |
| Name of the Dean or the Director **Prof. Mahmoud I. Jaghoub** | Signature: ……………………… | Date: ……………… |