The University of Jordan

Accreditation & Quality Assurance Center

Course Syllabus

Course Name

0301944 Number Theory

1	Course title	Number Theory
2	Course number	0301944
3	Credit hours (theory, practical)	3
	Contact hours (theory, practical)	3
4	Prerequisites/corequisites	0301941
5	Program title	PhD. In Mathematics
6	Program code	
7	Awarding institution	The University of Jordan
8	Faculty	Science
9	Department	Mathematics
10	Level of course	Elective specialization requirement
11	Year of study and semester (s)	2nd year, 1st semester
12	Final Qualification	PhD. In Mathematics
13	Other department (s) involved in teaching the course	--
14	Language of Instruction	English
15	Date of production/revision	29/3/2017

16. Course Coordinator:

Dr. Osama Alkam
Math 310

17. Other instructors:

18. Course Description:

As stated in the approved study plan.
Algebraic numbers, algebraic integers, trace, norm, discriminant, integral bases, ideal factorization, Dirichlet's unit Theorem, ideal class group, class number, Minkowski's bound.

19. Course aims and outcomes:

A- **Aims:**

To study the algebraic structure of number fields and their number rings and the behavior of ideals in these number rings and to relate the properties of these rings to the existence of solutions of Diophantine equations.

B- Intended Learning Outcomes (ILOs): Upon successful completion of this course students will be able to answer questions and write proofs about …

B1. basic abstract algebra background material including commutative algebra, field extensions and Galois Theory
B2 algebraic numbers, algebraic integers, number fields, number rings, monogenic number fields, conjugates and embeddings.
B3. trace, norm and discriminant .
B4. the algebraic structure of number rings and integral basis.
B5. fractional ideals and their norms and unique factorization.
B6. ramification index, inertia degree and their relation to the degree of the number field .
B7. factoring primes in monogenic number fields
B8. the Group of units of a number ring and Dirichlet's Unit Theorem
B9. Minkowski's bound and finiteness of the ideal class group.

20. Topic Outline and Schedule:

Topic	Week	Instructor	Achieved ILOs	Evaluation Methods	Reference
1. Preliminaries: Noetherian rings and Dedekind domains, Galois Theory for number fields.	1+2		B1	Homework	D. A. Marcus
2. Algebraic numbers, algebraic integers, algebraic number fields, traces, norms, discriminants and integral bases.	3+4+5+6		B2+B3+B4	Homework	D. A. Marcus
3. Quadratic and cyclotomic fields.	7		B7	First Exam	D. A. Marcus
4. Ideals, and the prime factorization of ideals.	8+9+10		B5+B6+B7	Homework	D. A. Marcus
5. The group of units, Dirichlet's unit Theorem	11+12		B8	Second Exam	D. A. Marcus
6. The ideal class group, Minkowski's bound.	13+14		B9	Presentation	D. A. Marcus

21. Teaching Methods and Assignments:

Development of ILOs is promoted through the following teaching and learning methods:
In order to succeed in this course, each student needs to be an active participant in learning – both in class and out of class.

- Class time will be spent on lecture as well as discussion of homework problems and some group work.
- To actively participate in class, you need to prepare by reading the textbook and doing all assigned homework before class (homework will be assigned each class period, to be discussed the following period).
- You should be prepared to discuss your homework (including presenting your solutions to the class) at each class meeting - your class participation grade will be determined by your participation in this.

You are encouraged to work together with other students and to ask questions and seek help from the professor, both in and out of class.

22. Evaluation Methods and Course Requirements:

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

ILO/s	Learning Methods	Evaluation Methods	Related ILO/s to the program
	Lectures	**Exams**	
		Presentation	
		Homework	

23. Course Policies:

1. The student is not allowed to take the course and its pre-requisite in the same time.
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 on moodle.
7. Cheating is prohibited. The University of Jordan regulations on cheating will be applied to any student who cheats in exams or on homework.

24. Required equipment:

25. References:

1. Daniel A. Marcus, Number Fields, Springer.
2. Ian Stewart and David Tall, Algebraic Number Theory and Fermat's Last Theorem, third edition, 2002.
3. Gerald J. Janusz, Algebraic Number Fields, Graduate Studies in Mathematics, 2nd edition.

26. Additional information:

Name of Course Coordinator: Osama Alkam Signature: ---O. Alkam--- Date: 29/3/2017

Head of curriculum committee/Department: ---------- Signature: ----------

Head of Department: ---------- Signature: ----------

Head of curriculum committee/Faculty: ---------- Signature: ----------

Dean: ---------- -Signature: ----------

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Head of Department
Assistant Dean for Quality Assurance
Course File