

4/1/4. Course Specification:

COURSE SPECIFICATIONS

Form

Course Title: **Algebraic number theory**

Course Code: **4046408-4**

Course Specifications

Institution:Umm Alqura University, Makkah Date of Report:05 November 2018
College/Department: College of Applied Science, Mathematical Science

A. Course Identification and General Information

1. Course Title and Code: : Algebraic Number Theory 4046408-4	
2. Credit hours: 4 Credit hours.	
3. Program(s) in which the course is offered: (If general elective available in many programs indicate this rather than list programs) Master in Mathematics	
4. Name of faculty member responsible for the course Prof. Dr. Ahmad Mohammed Ahmad Alghamdi	
5. Level/year at which this course is offered: Master/ Semester 1	
6. Pre-requisites for this course (if any) Groups and Rings+ Number theory	
7. Co-requisites for this course (if any)-	
8. Locations: Main campus+Girls Sections	
9. Mode of Instruction (mark all that apply)	
a. Traditional classroom	<input checked="" type="checkbox"/> What percentage? <input type="text" value="100"/>
b. Blended (traditional and online)	<input type="checkbox"/> What percentage?- <input type="text"/>
c. e-learning	<input type="checkbox"/> What percentage? <input type="text"/>
d. Correspondence	What percentage?
f. Other	What percentage?
Comments:Mainly traditional classroom will dominant the mode on instruction. There is a need to apply some modes in some situations.	

B Objectives

1. What is the main purpose for this course?

The aim of the course is to introduce graduate students into Algebraic Number Theory. In particular, we shall cover the following topics:

- Revision of some well known domains such as integral domain, Euclidian domain, Principal ideal domain
- Algebraic extensions of a field and algebraic number field.
- More Domain such as Noetherian domain, Dedekend domain and unique factorization domain and the relationship with algebraic number field.
- Norm of ideals and factoring primes in a number field.
- Units in Real quadratic fields. Ideal class groups.
- Dirichlet's unit theorem. Applications of Diophantian equations.

2. Briefly describe any plans for developing and improving the course that are being implemented. (e.g. increased use of IT or web based reference material, changes in content as a result of new research in the field):

- 1- Encourage students to use the most updated books.
- 2- Advise Students to use MathSciNet.
- 3- Advise students to submit the homework online and using internet.
- 4- Encourage students to write their homework and essays using LaTeX.

C. Course Description (Note: General description in the form to be used for the Bulletin or handbook should be attached)

1. Topics to be Covered

List of Topics	No. of Weeks	Contact Hours
Introduction and motivation: Revision of some well known domains such as integral domain, Euclidian domain, Principal ideal domain. Algebraic extensions of a field and algebraic number field.	2	8
More Domain such as Noetherian domain, Dedekend domain and unique factorization domain and the relationship with algebraic number field.	3	12
Norm of ideals and factoring primes in a number field.	3	12
Units in Real quadratic fields	2	8
Ideal class groups.	2	8
Dirichlet's unit theorem. Applications of Diophantine equations.	3	12

2. Course components (total contact hours and credits per semester):

	Lecture	Tutorial	Laboratory	Practical /Clinical	Other: PBL	Total

Contact Hours	60	0	--	N/A	N/A	60
Credit	4					4

3. Additional private study/learning hours expected for students per week.

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4. Course Learning Outcomes in NQF Domains of Learning and Alignment with Assessment Methods and Teaching Strategy

Course Learning Outcomes, Assessment Methods, and Teaching Strategy work together and are aligned. They are joined together as one, coherent, unity that collectively articulate a consistent agreement between student learning, assessment, and teaching.

The *National Qualification Framework* provides five learning domains. Course learning outcomes are required. Normally a course has should not exceed eight learning outcomes which align with one or more of the five learning domains. Some courses have one or more program learning outcomes integrated into the course learning outcomes to demonstrate program learning outcome alignment. The program learning outcome matrix map identifies which program learning outcomes are incorporated into specific courses.

On the table below are the five NQF Learning Domains, numbered in the left column.

First, insert the suitable and measurable course learning outcomes required in the appropriate learning domains (see suggestions below the table). **Second**, insert supporting teaching strategies that fit and align with the assessment methods and intended learning outcomes. **Third**, insert appropriate assessment methods that accurately measure and evaluate the learning outcome. Each course learning outcomes, assessment method, and teaching strategy ought to reasonably fit and flow together as an integrated learning and teaching process. **Fourth**, if any program learning outcomes are included in the course learning outcomes, place the @ symbol next to it.

Every course is not required to include learning outcomes from each domain.

	NQF Learning Domains And Course Learning Outcomes	Course Teaching Strategies	Course Assessment Methods
1.0	Knowledge		
1.1	To define and recognize several types of domains such as integral domain, unique factorization domain principal ideal domain, Noetherian domain and Dedekind domain.	Lectures: <ul style="list-style-type: none"> • Build on what students already know. • present new concepts and principles • use questioning and encouraging students. • Doing practice and involving students in the class. • Draw facts and doing responds. 	<ul style="list-style-type: none"> • Questions in the classes • Quizzes • Two periodical exams • Homework assignments Final exam
1.2	To describe algebraic extensions of fields and algebraic number field.		
1.3	To recognize the concept of norm of ideals.		
1.4	To Describe units in real quadratic fields.		
1.5	To state and label several facts and theorems in algebraic number fields.		
1.6	To use norm in the theory of algebraic numbers.		
1.7	To state and use Dirichlet's unit theorem.		
2.0	Cognitive Skills		
2.1	To interpret and criticize as well as construct relationship between several kinds of domains.	<ul style="list-style-type: none"> • Request from students to do some preparations for the lectures. • Give students challenging exercise and problems. • Asking students for doing generalizations and extensions for the theoretical 	<ul style="list-style-type: none"> • Questions in the classes • Quizzes • Two periodical exams • Homework assignments • Final written exam
2.2	To explain factoring primes in a number field.		
2.3	To understand Ideal class groups.		
2.4	To interpret norm of ideals and factoring primes.		
2.5	To explain and interpret Dirichlet's theorem and use it.		
2.6	To evaluate and calculate norms of ideals.		
2.7	To prove and develop Dirichlet's theorem and to do some application of Diophantine equations.		

		<p>parts of the lectures.</p> <ul style="list-style-type: none"> Request from students via discussions to compare the lectures with other topics in the same level. Doing extensive discussions <p>Doing Quizzes.</p>	
3.0 Interpersonal Skills & Responsibility			
3.1	Demonstrate communication skills with the teacher and other students in the class.	<p>Encourage students to:</p> <ul style="list-style-type: none"> Work in groups. Visit library regularly. Participate in the university activities. Participate in college and department days and activities. Joint and participate evocatively in college and department committees. Joint and use useful media for education. 	
3.2	Analyze and illustrate basic facts.		
3.3	To show and exhibit ethical behavior.		
3.4	To show skills for judging basic facts.		
3.5	To write and work independently.		
3.6	To work effectively in teams.		
3.7	To manage time properly, meet deadlines.		
4.0 Communication, Information Technology, Numerical			
4.1	Demonstrate mathematics to others in oral form.	<p>Encourage students to:</p> <ul style="list-style-type: none"> Work in groups. Visit library regularly. Participate in 	
4.2	illustrate mathematics to others in others in written form.		
4.3	Evaluate mathematics in a well-organized form.		
4.4	Research library in an excellent way.		

4.5	Research MathSciNet and good databases.	<p>the university activities.</p> <ul style="list-style-type: none"> • Participate in college and department days and activities. • Joint and participate evocatively in college and department committees. • Joint and use useful media for education. • To use emails and internet evocatively. • Give presentations • Doing competitions and participate in mathematical discussions. 	
4.6	Operate and use the university facilities in a good manner.		
4.7	Criticize and evaluate as well as express a judgment on the art of mathematics in this field.		
5.0	Psychomotor		
5.1	Not Applicable	Not Applicable	Not Applicable

Suggested Guidelines for Learning Outcome Verb, Assessment, and Teaching

NQF Learning Domains	Suggested Verbs
Knowledge	list, name, record, define, label, outline, state, describe, recall, memorize, reproduce, recognize, record, tell, write
Cognitive Skills	estimate, explain, summarize, write, compare, contrast, diagram, subdivide, differentiate, criticize, calculate, analyze, compose, develop, create, prepare, reconstruct, reorganize, summarize, explain, predict, justify, rate, evaluate, plan, design, measure, judge, justify, interpret, appraise
Interpersonal Skills & Responsibility	demonstrate, judge, choose, illustrate, modify, show, use, appraise, evaluate, justify, analyze, question, and write
Communication, Information Technology, Numerical	demonstrate, calculate, illustrate, interpret, research, question, operate, appraise, evaluate, assess, and criticize
Psychomotor	demonstrate, show, illustrate, perform, dramatize, employ, manipulate, operate, prepare, produce, draw, diagram, examine, construct, assemble, experiment, and reconstruct

Suggested **verbs not to use** when writing measurable and assessable learning outcomes are as follows:

Consider	Maximize	Continue	Review	Ensure	Enlarge
Understand					
Maintain	Reflect	Examine	Strengthen	Explore	Encourage
Deepen					

Some of these verbs can be used if tied to specific actions or quantification.

Suggested assessment methods and teaching strategies are:

According to research and best practices, multiple and continuous assessment methods are required to verify student learning. Current trends incorporate a wide range of rubric assessment tools; including web-based student performance systems that apply rubrics, benchmarks, KPIs, and analysis. Rubrics are especially helpful for qualitative evaluation. Differentiated assessment strategies include: exams, portfolios, long and short essays, log books, analytical reports, individual and group presentations, posters, journals, case studies, lab manuals, video analysis, group reports, lab reports, debates, speeches, learning logs, peer evaluations, self-evaluations, videos, graphs, dramatic performances, tables, demonstrations, graphic organizers, discussion forums, interviews, learning contracts, antidotal notes, artwork, KWL charts, and concept mapping.

Differentiated teaching strategies should be selected to align with the curriculum taught, the needs of students, and the intended learning outcomes. Teaching methods include: lecture,

5. Schedule of Assessment Tasks for Students During the Semester

	Assessment task (e.g. essay, test, group project, examination, speech, oral presentation, etc.)	Week Due	Proportion of Total Assessment
1	Continuous Assessment Evaluation	Weekly	20%
2	First Periodic Exam	6	20 %
3	Second Periodic Exam	10	20%
4	Final Examination (written Exam)	End of the semester	40%

D. Student Academic Counseling and Support

1. Arrangements for availability of faculty and teaching staff for individual student consultations and academic advice. (include amount of time teaching staff are expected to be available each week)

-Each group of students is assigned to a particular faculty where he or she will provide academic advising during specific academic hours. Each staff will provide at least one session/week.

-There will be an academic advisor how will be a responsible for helping the student by doing the general supervision .

- The people in the library will support the students during the time of the course.

E. Learning Resources

- 1- SabanAlacaand Kenneth S. Williams, Introductory Algebraic Number Theory, Cambridge University PressSeptember 2012, Print publication year: 2003, Online ISBN: 9780511791260
- 2- Hilbert David, The theory of Algebraic number field, Springer, 1998, ISBN: 978-3-662-03545-0
- 3- Gerald J. Janusz, Algebraic number fields, American Mathematical Society, December 5, 2005. ISBN: 978-0821804294.

2. List Essential References Materials (Journals, Reports, etc.)

Journal of Algebra and number theory, journal of number theory.

3. List Recommended Textbooks and Reference Material (Journals, Reports, etc)

- 1- John William, etal..Algebraic Number Theorey, London Mathematical Socity, March 12, 2010. ISBN: 9780950273426
- 2- A. FrohlichandM Taylor, Algebraic Number Theory, Cambridge University Press, Febrauary 26, 1993. ISBN: 978-05214383346.

4. List Electronic Materials(eg. Web Sites, Social Media, Bblackboard, etc.)

- https://en.wikipedia.org/wiki/algebraic_numbers_theory

5. Other learning material such as computer-based programs/CD, professional standards or regulations and software.

-LaTeX and Latexbeamer.

-Magma

-Gap

F. Facilities Required

Indicate requirements for the course including size of classrooms and laboratories (i.e. number of seats in classrooms and laboratories, extent of computer access etc.)

Accommodation (Classrooms, laboratories, demonstration rooms/labs, etc.)

- Lecture classroom which can accommodate 30 students for lectures (normal and classical classroom)

2. Computing resources (AV, data show, Smart Board, software, etc.)

Data Show (projector): sometimes shall be used.

3. Other resources (specify, e.g. if specific laboratory equipment is required, list requirements or attach list)

This course is a foundation and fundamental course in algebraic number theory and basic invariants such as rings of integers, class groups, norm, Dirichlet's theorem and some applications in Diophantine equations.

G Course Evaluation and Improvement Processes

1 Strategies for Obtaining Student Feedback on Effectiveness of Teaching

Following completion of the prescribed course study in Pediatrics module, an evaluation should be conducted through the following:

- A student questionnaire feedback should be carried out on the quality & effectiveness of teaching and evaluation

2 Other Strategies for Evaluation of Teaching by the Program/Department Instructor

- A staff questionnaire feedback about course

3 Processes for Improvement of Teaching

- Submission of a final evaluation report at the end of the course
- A review of the recommended teaching strategies should be submitted after evaluation.

4. Processes for Verifying Standards of Student Achievement (e.g. check marking by an independent member teaching staff of a sample of student work, periodic exchange and remarking of tests or a sample of assignments with staff at another institution)

- Compare the standards of students' achievements' with standards archived elsewhere (inside KSA or students from outside the kingdom) by checking the marking of a sample of some student work : tests, course work

- Assignment by an independent member of teaching staff either from the UQU or other universities

5 Describe the planning arrangements for periodically reviewing course effectiveness and planning for improvement.

- Reviewing feedback on the quality of course report from staff members, other university' staffs.
- Looking for strengthen and weak points gathered at the end of the course and working on it.
- Plan to introduce updating material and technology that could improve the quality

Faculty or Teaching Staff: Prof. Dr. Ahmad Mohammed Ahmad Alghamdi

Signature: ___Ahmad Mohammed Ahmad Alghamdi___

Date Report Completed: 05 November 2018_____

Received by: _____ Dean/Department Head

Signature: _____ Date: _____