4/1/4. Course Specification:

COURSE SPECIFICATIONS
Form

Course Title: **Modules and homological algebra**

Course Code: **4046402-4**

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: : Modules and homological algebra 4046402-4
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**
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 [√] What percentage? [100] b. Blended (traditional and online) What percentage?- c. e-learning What percentage? d. Correspondence What percentage? f. Other What percentage? Comments: Mainly traditional classroom will dominant the mode on instruction.

B Objectives

1. What is the main purpose for this course?

The aim of the course is to introduce graduate students into Modules and homological algebra. In particular, we shall cover the following topics:

- Modules over a ring, module homomorphism, substructure of modules, exact sequences
- Modules over principal ideal domain, Free modules, projective modules, injective modules, flat modules,
- Tensor product of modules.
- Introduction of Homological algebra (Ext and Tor). categories and functors. More Extension of modules.
- Derived functors and Kunneth formula.
- Introduction of cohomolgy of groups.
- Cohomology of a finite cyclic groups. Spectral sequences.

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)

Course Description:
There are 4 credit hours for this course which are comprising approximately 60 hours of lectures.

1. Topics to be Covered

List of Topics	No. of Weeks	Contact Hours
Introduction and motivation: Modules over a ring, module homomorphism, substructure of modules, exact sequences	2	8
Modules over principal ideal domain, Free modules, projective modules, injective modules, flat modules, torsion and torsion-less modules.	3	8
Tensor product of modules. Introduction of Homological algebra (Ext and Tor)	3	12
categories and functors. More Extension of modules.	2	8
Derived functors and Kunneth formula. Introduction of cohomolgy of groups.	3	12
Cohomology of a finite cyclic groups and Spectral sequences.	2	8

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	0				4

3. Additional private study/learning hours expected for students per week.	8

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 modules over a ring and module homomorphism.	Lectures: • 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.	• Questions in the classes • Quizzes • Two periodical exams • Homework assignments • Final written exam
1.2	To describe modules over principal ideal domain as well as some special classes o modules such as free modules, projective modules, injective modules and flat modules and torsion modules.		
1.3	To give an algebraic structure to a set of module homomorphisms such as endomorphism algebra.		
1.4	To Describe some homological concept such as ext and tor and Shours Lemma for modules.		
1.5	To state and label and use isomorphism theorems for modules.		
1.6	To use tensor product of modules as well as exact sequences.		
1.7	To state some well know theorems in cohomology of finite cyclic groups and spectral sequences.		
2.0	**Cognitive Skills**		
2.1	1-To interpret and criticize as well as construct modules over principal ideal domain.	• 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 parts of the lectures. • Request from students via	• Questions in the classes • Quizzes • Two periodical exams • Homework assignments • Final written exam
2.2	To explain categories and functors.		
2.3	To reorganize Derived functor and Kunneth formula		
2.4	To interpret homological algebra such as ext and tor and give some examples.		
2.5	To explain and interpret free modules, projective modules, torsion modules, injective modules and flat modules.		
2.6	To evaluate and calculate cohomology groups of finite cyclic groups.		
2.7	To prove and develop natural transformation and adjoint functor.		

		discussions to compare the lectures with other topics in the same level. • Doing extensive discussions • Doing Quizzes.	
3.0	**Interpersonal Skills & Responsibility**		
3.1	Demonstrate communication skills with the teacher and other students in the class.	Encourage students to: • 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.	Encourage students to: • 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	
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.		
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.		

		department committees. • Joint and use useful media for education. • To use emails and internet evocatively. • Give presentations • Doing competitions and participate in mathematical discussions.	
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, debate, small

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

Text books: 1- Thomas W. Hungerford: Algebra, Springer, 1974, ISBN: 978-4612-6101-8. 2- David Dummit and Richard Foote: Abstract Algebra, Wily, July 14, 2003, ISBN: 978-0471433347 & 0471433349. 3- Rotman, Joseph: An introduction to Homological algebra, Springer, 2009, ISBN: 978-387-68324-9
2. List Essential References Materials (Journals, Reports, etc.) Hilton Peter, Stammbach: A course in Homological algebra, Springer, 1997, ISBN: 978-1-4419-8566-8
3. List Recommended Textbooks and Reference Material (Journals, Reports, etc) 1- Richard S. Pierce: Associative Algebras, Springer, 1982, ISBN: 978-1-4757-0163-0 2- Saunders Mac Lane: Categories for working mathematicians, Springer-Verlag, 1998, ISBN: 0-387-98403-8
4. List Electronic Materials(eg. Web Sites, Social Media, Blackboard, etc.) - https://en.wikipedia.org/wiki/Module_theory - https://en.wikipedia.org/wiki/Homologicalalgebra_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 basic and fundamental course in homological algebra and cohomology of groups. Module theory, category and functors as well as exact sequences are the main topic in this course.

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: _____