

4/1/4. Course Specification:

COURSE SPECIFICATIONS

Form

Course Title: **Ordinary Representations of Groups**

Course Code: **4046411-4**

Course Specifications

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| 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

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| 1. Course title and code: Ordinary Representations of Groups 4046411-4 | |
| 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/ level 3 | |
| 6. Pre-requisites for this course (if any) Modules and homological algebra (4046402-4) | |
| 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 | <input type="checkbox"/> What percentage? |
| f. Other | <input type="checkbox"/> 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

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| <p>1. What is the main purpose for this course? The aim of the course is to introduce graduate students into ordinary representation of groups. In particular, we shall cover the following topics:</p> <ul style="list-style-type: none"> - Representation and Modules. - Characters of finite groups and character tables. - The regular representation. - Induced representation. - Burnside p-q theorem. - Clifford Theorem and restriction characters to normal subgroups. - Mackey decomposition formula of induced characters. |
| <p>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)</p> <ol style="list-style-type: none"> 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)

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| <p>Course Description: There are 4 credit hours for this course which are comprising approximately 60 hours of lectures.</p> |
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| 1. Topics to be Covered | | |
| List of Topics | No. of Weeks | Contact Hours |
| Introduction and motivation: Definition of a representation matrix representation and G-module, Maschke Theorem., examples | 2 | 8 |
| Characters and characters tables of some well known groups. Orthogonality relations. Shours lemma. | 3 | 12 |
| Regular representation and some applications (more character tables) | 2 | 8 |
| Induced representation. Mackey Decomposition formula of induced characters. | 3 | 12 |
| Clifford Theorem and restriction characters to normal subgroups. | 2 | 8 |
| Burnside (p-q) Theorems, Some applications and revisions | 3 | 12 |

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|--|---------|----------|------------|---------------------|------------|-------|
| 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 |

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| 3. Additional private study/learning hours expected for students per week. | 8 |
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| 4. Course Learning Outcomes in NQF Domains of Learning and Alignment with Assessment Methods and Teaching Strategy |
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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 matrix representation and modules over group algebras. | 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 written exam |
| 1.2 | To describe Permutations representation, ordinary representation of some well known groups of symmetries (triangle, rectangle, square), symmetric groups. | | |
| 1.3 | construct character tables of some well known groups.. | | |
| 1.4 | To Describe orthogonality relations and Shours Lemma. | | |
| 1.5 | To state and label linear Group Action on a basis of a vector space, Maschke theorem. | | |
| 1.6 | To use conjugacy classes, class sums as a basis of the center of group algebras. | | |
| 1.7 | To state Clifford theorem and use it for commute and construct the character tables. | | |
| 2.0 | Cognitive Skills | | |
| 2.1 | To interpret and criticize as well as construct character tables of some well known groups. | <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 | <ul style="list-style-type: none"> • Questions in the classes • Quizzes • Two periodical exams • Homework assignments • Final written exam |
| 2.2 | To explain Permutations representation, matrix representation | | |
| 2.3 | To reorganize Co-sets, and Direct Products of groups. | | |
| 2.4 | To interpret orthogonality relations between characters and use these relations to construct character tables | | |
| 2.5 | To explain and interpret Mackey decomposition formula and use them. | | |
| 2.6 | To prove and develop Burnside theorems of finite solvable groups | | |

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| 2.7 | To evaluate and calculate conjugacy classes, class sums as a basis of the center of group algebras. | <p>for the theoretical 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 Doing Quizzes. | |
| 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 the university activities. Participate 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 | | |

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| | in a good manner. | | |
| 4.7 | Criticize and evaluate as well as express a judgment on the art of mathematics in this field. | <p>department days and activities.</p> <ul style="list-style-type: none"> • 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. | |
| 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

- 1- John. L. Alperin and Rowen B. Bell, Groups and Representations, Springer, NewYork, September 11, 1995.ISBN:978-0387945262.
- 2- Gordan James and Martin Liebeck, Representations and Characters of Groups, Cambridge University Press 2001.ISBN: 97805118114532.
- 3- Martin Isaacs, Character Theory of Finite Groups, Dover Publications, INC, New York, November 2, 2011..ISBN: 978-0486680149.

2. List Essential References Materials (Journals, Reports, etc.)
Representations of Finite Groups,Andrew Baker

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

- 1- L. Dornhoff, Group Representation Theory, Part A: Ordinary representation theory. Marcel Dekker Inc., New York, (1972).
- 2- Charles W. Curtis and Irving Reiner, Representation Theory of Finite Groups and Associative Algebras, American Mathematical Society, New York, 1962.
- 3- Hiroshi Nagao and Yukio Tsushima, representation of finite groups, January 1989. 0-12-513660-9

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

- https://en.wikipedia.org/wiki/Representation_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 ordinary representation and characters theory as well as basic course for building character tables and the main theorems in this direction such as Burnside theorem for soluble groups and Clifford theorem for characters.

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: ___ Prof. Dr. Ahmad Mohammed Ahmad Alghamdi

Date Report Completed: 05 November 2018

Received by: _____ Dean/Department Head

Signature: _____ Date: _____