

King Saud University
College of Science
Department of Mathematics

Course specification
Group Theory, MATH343
(A mandatory course)

1432H/2011G

Institution: King Saud University

College/Department: College of Sciences / Department of Mathematics

A Course Identification and General Information

1. Course title and code: Group Theory, MATH343

2. Credit hours: 4 (3+1+0)

3. Program(s) in which the course is offered.
Bachelor of Science in Mathematics

4. Name of faculty member responsible for the course
Dr. Salman Al Salman for males
Dr. Azza M. Eltahan for females

5. Level/year at which this course is offered : Level 6/ Third year

6. Pre-requisites for this course (if any) :
Linear Algebra (MATH246) and Number Theory (MATH243)

7. Co-requisites for this course (if any) None

8. Location if not on main campus
At Diriya, Main campus: College of Science, Building No. 4, for males
At Malaz for females.

B Objectives

Students enrolled in this course will learn the following concepts:

- 1- Definition of groups , subgroups, cyclic groups, and some examples
- 2- Cosets and Lagrange's theorem.
- 3- Normal subgroups, quotient groups, and simple groups
- 4- Group homomorphism, isomorphism, automorphism, isomorphism theorems, Cayley's theorem and its generalization
- 5- Symmetric groups, group action on a set and Sylow's theorems
- 6- Direct product

1. Summary of the main learning outcomes for students enrolled in the course.
By the end of this course the student is expected to be able to:
 - 1- Define and recognize different types of: groups , subgroups, cyclic groups, normal subgroup, quotient groups, simple groups, etc.
 - 2- Give examples of these algebraic structures
 - 3- Differentiate between abelian and non abelian groups
 - 4- Differentiate between primary and non primary groups
 - 5- Differentiate between simple and non simple groups
 - 6- Prove and apply some theorems and results in group theory
 - 7- Verify group homomorphism, isomorphism, automorphism
 - 8- Compute the group action on a set
 - 9- Compute the direct product
 - 10- Characterize groups with small order according to isomorphisms.

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

Developing the course material to keep up with the new scientific and technological knowledge by

1. Advising students to use new references.
2. Advising the students to use the Internet.
3. Adding / deleting some of the course syllabus.
4. Updating mathematical methods to prove some mathematical issues.

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 | | |
|--|-------------|---------------|
| Topic | No of Weeks | Contact hours |
| Definition of groups and some examples | 1 | 5 |
| Subgroups/ Cyclic groups | 1 | 5 |
| Cosets and Lagrange's theorem. | 1.5 | 7.5 |
| Normal subgroups, quotient groups, and simple groups | 2.5 | 12.5 |
| Group homomorphism/ isomorphism, automorphosim | 1.5 | 7.5 |
| Isomorphism theorems. | 2 | 10 |
| Cayley's theorem and its generalization | 1 | 5 |
| Symmetric groups | 1 | 5 |
| Group action on a set and Sylow's theorems | 2.5 | 12.5 |

| | | |
|----------------|---|---|
| Direct product | 1 | 5 |
|----------------|---|---|

| | | | |
|--|-----------------|--------------------------------------|-------------|
| 2. Course components (total contact hours per semester): | | | |
| Lecture: 45 | Tutorial: 30 | Practical/Fieldwork/Internship: None | Other: None |

3. Additional private study/learning hours expected for students per week. (This should be an average for the semester not a specific requirement in each week)

6 hours per a week for reviewing and doing homework.

4. Development of Learning Outcomes in Domains of Learning

For each of the domains of learning shown below indicate:

- (i) A brief summary of the knowledge or skill the course is intended to develop;
- (ii) description of the teaching strategies to be used in the course to develop that knowledge or skill;
- (iii) The methods of student assessment to be used in the course to evaluate learning outcomes in the domain concerned.

a. Knowledge

(i) Description of the knowledge to be acquired

In this course the student will acquire the following knowledge:

- 1- Definition of some basic algebraic structures: groups, subgroups, cyclic groups, normal subgroup, quotient groups, simple groups, etc.
- 2- Proofs and applications of some basic theorems and results in group theory: Lagrange's theorem, Cayley's theorem and its generalization, Cauchy theorem, Sylow theorems.
- 3- Concepts of group homomorphism, isomorphism, automorphism, and its applications
- 4- Action of a group on a set

- 5- The concept of the direct product
- 6- Groups with small order according to isomorphisms.

(ii) Teaching strategies to be used to develop that knowledge

1. Lectures: every lecture includes some questions that attract students' attentions, and attempts are made to encourage the students to involve themselves in solving some arising questions.

2. Trying to show the connection between the subjects of the course by employing some theorems; for example, the generalization of Cayley's theorem and Sylow's theorem to determine simple groups.

(iii) Methods of assessment of knowledge acquired

Questions during lectures. , Quizzes,. Two mid terms,. Final Exams, Homework.

b. Cognitive Skills

(i) Cognitive skills to be developed

- Ability to prove the mathematical case in a logic way.
- Developing the students' ability to abstract.
- Developing the students' ability to think logically.
- Ability to apply some theorem to determine if a group is simple or not.
- Ability to differentiate between the hypotheses and the results.
- Ability to differentiate between different btypes of groups.

(ii) Teaching strategies to be used to develop these cognitive skills

Oral questions, quizzes, homework, and then discussions of students' answers and explaining the right and wrong answers.

(iii) Methods of assessment of students cognitive skills

Quizzes, homework, two mid terms, and a final exam.

c. Interpersonal Skills and Responsibility

(i) Description of the interpersonal skills and capacity to carry responsibility to be developed

1. Students are put in groups to help each other in solving some problems that have been given as homework.
2. Students are encouraged to take serious initiatives and not get scared.
3. Respecting others opinion.
4. Dealing with others in trust and good manners.

(ii) Teaching strategies to be used to develop these skills and abilities

1. Encouraging competition between students.
2. Encouraging brilliant students to help their fellows.
3. Encouraging students to search right answers from different sources.

(iii) Methods of assessment of students interpersonal skills and capacity to carry responsibility

1. Achieving their homework as individuals or as groups.
2. Self trust and satisfaction.
3. Interest in learning more about the current course.

d. Communication, Information Technology and Numerical Skills

(i) Description of the skills to be developed in this domain.

1. Use of electronic journals and data basis
2. Web CT
3. Use of PowerPoint and laptop – projector systems
4. Introduction to blogging
5. Experience wiki/moodle to develop collaborative writing skills

(ii) Teaching strategies to be used to develop these skills

1. Encourage students to make extensive use of material on the web
2. Encourage students to consult the specialist in the computer lab for help on web-based material
3. Demand the use of PowerPoint when giving presentations
4. Demonstrate and give blogging and wiki / moodle assignments and coach students in how to carry them out

(iii) Methods of assessment of students numerical and communication skills

1. Allot marks for the use of web-based material in students' presentations.
2. Distribute rubric at beginning of assignment so students know what they will be

| |
|---|
| evaluated on |
| e. Psychomotor Skills (if applicable) |
| (i) Description of the psychomotor skills to be developed and the level of performance required Not Applicable |
| (ii) Teaching strategies to be used to develop these skills Not Applicable |
| (iii) Methods of assessment of students psychomotor skills Not Applicable |

5. Schedule of Assessment Task for Students During the Semester

| Assessment | Assessment task (eg. essay, test, group project, examination etc.) | Week due | Proportion of Final Assessment |
|------------|--|----------|--------------------------------|
| 1 | First mid term | 7 | 20% |
| 2 | Second mid term | 12 | 20% |
| 3 | Quizzes and homework | weekly | 10% |
| 4 | Final examination | 16 | 50% |

D. Student Support

| |
|--|
| <p>1. Arrangements for availability of faculty for individual student consultations and academic advice. (include amount of time faculty are available each week)</p> <ol style="list-style-type: none"> 1. 10 office hours weekly. 2. Five minutes at the end of each lecture. 3. Encouraging students to get in touch with their teacher via e-mail or Department mail box. |
|--|

E. Learning Resources

| |
|---|
| <p>1. Required Text(s) Topics in Algebra Author: A.N Herstin. Translated by Dr. Althkair and Dr. Al Sehebanni. Publisher : king Saud University 20th edition, 1420. H</p> |
| <p>2. Essential References</p> <p>1. Group theory Author: Dr, Maroof Samhan and Fadwa Abu Moryaf a Publisher Dar Al Khraiji 1st edition 1427 H.</p> <p>2. A First Course in Abstract Algebra. Author: john B. Fraleigh Publisher: Addison & Wesley. 3rd edition, 1982</p> |
| <p>3- Recommended Books and Reference Material (Journals, Reports, etc) (Attach List)</p> |
| <p>4-.Electronic Materials, Web Sites etc</p> <ul style="list-style-type: none">- Internet sites related to the course- Teacher's site in MATH343. |
| <p>5- Other learning material such as computer-based programs/CD, professional standards/regulations</p> |

F. Facilities Required

| |
|---|
| <p>1. Accommodation (Lecture rooms, laboratories, etc.)</p> <ol style="list-style-type: none">1. Lecture room to accommodate at least 30 students.2. A big blackboard or two attached ones. |
| <p>2. Computing resources</p> <p>Laptop for every student/ or a computer lab.</p> |
| <p>3. Other resources (specify - eg. If specific laboratory equipment is required, list requirements or attach list)</p> <ol style="list-style-type: none">1. The availability of the assigned books in the university book store.2. The availability of references related to the course. |

G Course Evaluation and Improvement Processes

| |
|---|
| <p>1 Strategies for Obtaining Student Feedback on Effectiveness of Teaching</p> <ol style="list-style-type: none">1. An evaluation sheet for the course to be filled by the students at the end of each semester.2. Take the students' opinion about the course under consideration.3. Discussing the course with members of faculties who teach the same course. |
| <p>2 Other Strategies for Evaluation of Teaching by the Instructor or by the Department</p> <ol style="list-style-type: none">1. The level of the students in solving homework and quizzes2. Colleagues' opinions about students' performance in this course. |
| <p>3 Processes for Improvement of Teaching</p> <ol style="list-style-type: none">1. Encouraging students to get involved in the lecture.2. Getting the use of tutorial classes.3. Encouraging the students to read about the subject. |
| <p>4. Processes for Verifying Standards of Student Achievement (eg. check marking by an independent faculty member of a sample of student work, periodic exchange and remarking of a sample of assignments with a faculty member in another institution)</p> <ol style="list-style-type: none">1. Common books.2. Common Examination3. Team grading.4. Exchanging experience by comparing students' results in other departments. <p>2. Arrange with another institution to have two common test items included on an exam and compare marks given</p> <p>3. Students who believe they are under graded can have their papers checked by a second reader</p> |
| <p>5 Describe the planning arrangements for periodically reviewing course effectiveness and planning for improvement.</p> <ol style="list-style-type: none">1. Providing reviews to develop the assigned book content.2. Providing a discussion for the course subject by a specialized committee.3. View other math departments in well-known universities and getting help from them.4. Consulting some course specialists for course evaluation. |