



# Course Specifications

<b>Course Title:</b>	Group Theory
<b>Course Code:</b>	30113403-3
<b>Program:</b>	BSc. Mathematics 301100
<b>Department:</b>	Mathematics
<b>College:</b>	Al Leith University College
<b>Institution:</b>	Umm Al-Qura, University

## Table of Contents

<b>A. Course Identification</b> .....	<b>3</b>
6. Mode of Instruction (mark all that apply).....	3
<b>B. Course Objectives and Learning Outcomes</b> .....	<b>3</b>
1. Course Description.....	خطأ!
الإشارة المرجعية غير معرّفة.	
2. Course Main Objective.....	4
3. Course Learning Outcomes.....	4
<b>C. Course Content</b> .....	<b>4</b>
<b>D. Teaching and Assessment</b> .....	<b>5</b>
1. Alignment of Course Learning Outcomes with Teaching Strategies and Assessment Methods.....	5
2. Assessment Tasks for Students.....	5
<b>E. Student Academic Counseling and Support</b> .....	<b>6</b>
<b>F. Learning Resources and Facilities</b> .....	<b>6</b>
1. Learning Resources.....	6
2. Facilities Required.....	6
<b>G. Course Quality Evaluation</b> .....	<b>7</b>
<b>H. Specification Approval Data</b> .....	<b>7</b>

## A. Course Identification

<b>1. Credit hours:3 hours</b>			
<b>2. Course type</b>			
a.	University <input type="checkbox"/>	College <input type="checkbox"/>	Department <input checked="" type="checkbox"/>
b.	Required <input checked="" type="checkbox"/>	Elective <input type="checkbox"/>	Others <input type="checkbox"/>
<b>3. Level/year at which this course is offered: Fifth Level / Third Year</b>			
<b>4. Pre-requisites for this course (if any):</b>			
Sets and Algebraic structures.30112401-4			
<b>5. Co-requisites for this course (if any):</b>			
Does not exist.			

## 6. Mode of Instruction (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	3 hours / week	100%
2	Blended	0	0%
3	E-learning	0	0%
4	Correspondence	0	0%
5	Other	0	0%

## 7. Actual Learning Hours (based on academic semester)

No	Activity	Learning Hours
<b>Contact Hours</b>		
1	Lecture	(3 hours)×(15 weeks)
2	Laboratory/Studio	
3	Tutorial	
4	Others (specify)	8 hours
	<b>Total</b>	<b>53 hours</b>
<b>Other Learning Hours*</b>		
1	Study	(2 hour)×(15 weeks)
2	Assignments	(2 hour)×(15 weeks)
3	Library	(2 hour)×(15 weeks)
4	Projects/Research Essays/Theses	10 hours
5	Others(specify)	
	<b>Total</b>	<b>100 hours</b>

\*The length of time that a learner takes to complete learning activities that lead to achievement of course learning outcomes, such as study time, homework assignments, projects, preparing presentations, library times

## B. Course Objectives and Learning Outcomes

<b>Course Description</b>
This course provides the introduction to group theory, including groups, subgroups, cyclic groups, generating sets, Homomorphisms between groups and the Sylow theorem.

## 2. Course Main Objective

The main purpose of this course is learning basic facts of group theory, permutation groups, alternating groups, groups of symmetries, homomorphisms between groups, substructure of group theory, group action on sets, orbits, stabilizers, conjugacy classes, class equations, isomorphism theorems and Sylow theorems of finite groups.

## 3. Course Learning Outcomes

CLOs		Aligned PLOs
<b>1</b>	<b>Knowledge:</b>	
1.1	Define groups, subgroups, cyclic groups, generating sets and Caley Diagrams.	K1
1.2	List the different groups of symmetries.	K1
1.3	Recognize homomorphisms between groups, factor groups and automorphisms of groups.	K3
1.4	Define group action on a set, conjugacy classes and class equations.	K1
1.5	Memorize Sylow theorems of finite groups.	K4
<b>2</b>	<b>Skills:</b>	
2.1	Calculate the direct product of two groups	S5
2.2	Find homomorphisms between groups.	S3
2.3	Evaluate conjugacy classes and class equations.	S2
2.4	Prove Sylow theorems of finite groups.	S9
<b>3</b>	<b>Competence:</b>	
3.1	Use the definitions, methods and theorems of the course to study the properties complex groups.	C2
3.2	Justify the choice of different steps in problem resolution procedure.	C5
3.3	Communicate effectively in both written and oral form.	C1

## C. Course Content

No	List of Topics	Contact Hours
1	<ul style="list-style-type: none"><li>- Introduction and examples:</li><li>- Definition of a group</li><li>- Subgroups</li><li>- Examples</li></ul>	6
2	<ul style="list-style-type: none"><li>- Cyclic groups, generating sets and Caley Diagrams</li></ul>	6
3	<ul style="list-style-type: none"><li>- Permutations, groups of symmetries (triangle, rectangle, square)</li><li>- Co-sets</li><li>- Direct Products of groups.</li></ul>	6
4	<ul style="list-style-type: none"><li>- Homomorphisms between groups normal subgroups and factor groups, automorphisms of groups</li></ul>	6
5	<ul style="list-style-type: none"><li>- Group Action on a set (Orbit Stabilizer Theorem)</li><li>- Fixed points</li><li>- P-groups, examples</li></ul>	9
6	<ul style="list-style-type: none"><li>- Conjugacy classes</li><li>- Class equations</li></ul>	6
7	<ul style="list-style-type: none"><li>- Sylow theorems of finite groups</li></ul>	6
<b>Total</b>		<b>45</b>

## D. Teaching and Assessment

### 1. Alignment of Course Learning Outcomes with Teaching Strategies and Assessment Methods

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
<b>1.0</b>	<b>Knowledge</b>		
1.1	Define groups, subgroups, cyclic groups, generating sets and Cayley Diagrams.	Lecture Tutorials	Exams (Midterm and Final). Quizzes.
1.2	List the different groups of symmetries.	Lecture Tutorials	
1.3	Recognize homomorphisms between groups, factor groups and automorphisms of groups.	Lecture Tutorials	
1.4	Define group action on a set, conjugacy classes and class equations.	Lecture Tutorials	
1.5	Memorize Sylow theorems of finite groups.	Lecture Tutorials	
<b>2.0</b>	<b>Skills</b>		
2.1	Calculate the direct product of two groups	Lecture Individual or group work	Exams (Quizzes, Midterm and Final). Homework
2.2	Find homomorphisms between groups.	Lecture Individual or group work	
2.3	Evaluate conjugacy classes and class equations.	Lecture Individual or group work	
2.4	Prove Sylow theorems of finite groups.	Lecture Individual or group work	
<b>3.0</b>	<b>Competence</b>		
3.1	Use the definitions, methods and theorems of the course to study the properties complex groups.	Lecture Individual or group work	Exams (Quizzes, Midterm and Final). Research Homework
3.2	Justify the choice of different steps in problem resolution procedure.	Lecture Individual or group work	
3.3	Communicate effectively in both written and oral form.	Lecture Individual or group work	

### 2. Assessment Tasks for Students

#	Assessment task*	Week Due	Percentage of Total Assessment Score
1	Midterm Test (1)	6 <sup>th</sup> week	20%
2	Midterm Test (2)	12 <sup>th</sup> week	20%

#	Assessment task*	Week Due	Percentage of Total Assessment Score
3	Homework and Quizzes	During the semester	10%
4	Final Examination	End of semester	50%

\*Assessment task (i.e., written test, oral test, oral presentation, group project, essay, etc.)

## E. Student Academic Counseling and Support

**Arrangements for availability of faculty and teaching staff for individual student consultations and academic advice:**

Each group of students is assigned to a faculty member where he or she will provide academic advising. All faculty members are required to be in their offices outside teaching hours. Each faculty member allocates at least 4 hours per week to give academic advice and to answer to the questions of students about concepts studied during the lectures.

## F. Learning Resources and Facilities

### 1. Learning Resources

<b>Required Textbooks</b>	A First Course in Abstract Algebra, (7th Edition), John B. Fraleigh, Pearson (2002).
<b>Essential References Materials</b>	Notes on Algebraic Structures, Peter J. Cameron.
<b>Electronic Materials</b>	<ul style="list-style-type: none"> <li>- <a href="https://en.wikipedia.org/wiki/group_theory">https://en.wikipedia.org/wiki/group_theory</a></li> <li>- <a href="https://en.wikipedia.org/wiki/Algebraic_structure">https://en.wikipedia.org/wiki/Algebraic_structure</a></li> <li>- <a href="http://mathworld.wolfram.com/GroupTheory.html">http://mathworld.wolfram.com/GroupTheory.html</a></li> <li>- <a href="http://mathworld.wolfram.com/topics/GroupTheory.html">http://mathworld.wolfram.com/topics/GroupTheory.html</a></li> </ul>
<b>Other Learning Materials</b>	None.

### 2. Facilities Required

Item	Resources
<b>Accommodation</b> (Classrooms, laboratories, demonstration rooms/labs, etc.)	Large classrooms that can accommodate more than 50 students.
<b>Technology Resources</b> (AV, data show, Smart Board, software, etc.)	Data Show.
<b>Other Resources</b> (Specify, e.g. if specific laboratory equipment is required, list requirements or attach a list)	None.

## G. Course Quality Evaluation

Evaluation Areas/Issues	Evaluators	Evaluation Methods
Effectiveness of teaching and assessment.	Students	Direct
Quality of learning resources.	Students	Direct
Extent of achievement of course learning outcomes.	Faculty member	Direct

**Evaluation areas** (e.g., Effectiveness of teaching and assessment, Extent of achievement of course learning outcomes, Quality of learning resources, etc.)

**Evaluators** (Students, Faculty, Program Leaders, Peer Reviewer, Others (specify))

**Assessment Methods** (Direct, Indirect)

## H. Specification Approval Data

Council / Committee	Council of the Mathematics Department
Reference No.	
Date	

Council / Committee	Council of the Mathematics Department	The mathematical sciences (college of applied sciences) and the mathematics (Al Leith university college) department's first meeting of the coordinative committee
Reference No.	4101050782	First meeting
Date	Sunday, 17 November 2019	Thursday, 17 October 2019

Department Head

Dr. Ali Hassani