Course Specification

— (Postgraduate Programs)

Course Title: Groups and Fields	
Course Code: MAT 7121	
Program: Doctor of Philosophy in Mathematics	
Department: Mathematics and Statistics	
College: Science	
Institution: Imam Mohammad Ibn Saud Islamic University	
Version: V1	
Last Revision Date: None	

Table of Contents

A. General information about the course:

1. Course Identification:

1. Credit hours:
4 (4 Lectures, 0 Lab, 0 Tutorial)

2. Course type

A.	☐ University	☐ College	☒ Program	☐ Track	☐ Others
B.	☒ Required			☐ Elective	

3. Level/year at which this course is offered: (Level 1 / Year 1)

4. Course General Description:

This course describes the most important ideas, studying finite groups fundamental theory of studying finite groups such as: Direct and Semi-direct Products, Sylow's Theorems, Free Group, Presentation, p-Groups, Finitely Generated Abelian Groups, Nilpotent and soluble Groups, simple groups. Basics of field theory will be studied such as splitting fields, algebraic closure, field extensions, and the fundamental theory of Galois.

5. Pre-requirements for this course (if any):

None

6. Pre-requirements for this course (if any):

None

7. Course Main Objective(s):

The objective of this course is to give a detailed knowledge and methods for classification of finite groups through p-groups, Sylow's subgroups, nilpotent and soluble groups. An important class of simple groups is presented by alternating groups. Moreover, the course provides the basics of field theory, and notions such as splitting fields, algebraic closure, field extensions, and the fundamental theory of Galois.

2. Teaching Mode: (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	60	100%
2	E-learning	0	0
3	Hybrid	0	0

No	Mode of Instruction	Contact Hours	Percentage
	• Traditional classroom • E-learning		
4	Distance learning	**0**	**0**

3. Contact Hours: (based on the academic semester)

No	Activity	Contact Hours
1.	**Lectures**	**60**
2.	**Laboratory/Studio**	**0**
3.	**Field**	**0**
4.	**Tutorial**	**0**
5.	**Others (specify)……**	**0**
	Total	60

B. Course Learning Outcomes (CLOs), Teaching Strategies and Assessment Methods:

Code	Course Learning Outcomes	Code of PLOs aligned with the program	Teaching Strategies	Assessment Methods
1.0	**Knowledge and understanding**			
1.1	**To list new tools which give answers to deep questions in finite group theory.**	**K1, K2**	**4 lecture hours\week**	**Direct: Regular Exams**
1.2	**To outline complex problems that require making decisions in situations regarding the type of groups or fields studied.**	**K1, K2**	**4 lecture hours\week Self-study**	**Direct: Short Quizzes**
…				
2.0	**Skills**			
2.1	**To develop techniques of proof in Groups and fields**	**S1, S2**	**Self-study**	**Direct:** • **Participations Short Quizzes**

4

Code	Course Learning Outcomes	Code of PLOs aligned with the program	Teaching Strategies	Assessment Methods
2.2	To develop oral communication and technical writing skills through writing and oral presentation.	S3	Real-life problems	Direct: Homework and Mini projects
2.3	To use Internet in searching for p-Groups	S4	Real-life problems	Direct: Short Quizzes
2.4	To carry out deep and not short proofs in Fields and Field extension	S1, S2	Self-study	Direct: Participations
3.0	**Values, autonomy, and responsibility**			
3.1	To execute works independently	V1, V3	Personal questions	Direct: Participation
3.2	To cooperate with team work	V1, V2	Teamwork and class discussions.	Direct: Homework and Mini projects

C. Course Content:

No	List of Topics	Contact Hours
1.	**Groups:** The Fundamental Theorem of Finitely Generated Abelian Groups, Direct and Semi-direct Products.	10
2.	**Group Action and Class Equation:** Sylow Theorems, Chain Conditions and Krull-Schmidt Theorem, Free Group, Group Presentation.	10
3.	**p-Groups:** Nilpotent Groups, Normal Series and Jordan-Holders Theorem, Solvable Groups, Simple Groups, and Simplicity of Alternating Groups.	10
4.	**Fields:** Review of Basics, Splitting Extension Fields, Algebraic Closure, Separable and Normal Field Extensions.	10
5.	**The Fundamental Theorem of Galois:** The Galois Group of a Polynomial, Cyclic and Cyclotomic Field Extensions.	10
6.	**Radical Field Extension:** Insolubility of The Quintic, The Symmetric Polynomials and Insolubility of The General Polynomial.	10
Total		**60**

D. Students Assessment Activities:

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
1.	**Homeworks, Quizzes, Mini-projects**	**During the semester**	**30%**
2.	**Midterm**	**Week 8-9**	**30%**
3.	**Final Exam**	**Week 15**	**40%**

*Assessment Activities (i.e., Written test, oral test, oral presentation, group project, essay, etc.)

E. Learning Resources and Facilities:

1. References and Learning Resources:

Essential References	• **T. Hungerford, *Algebra*, GTM, Springer-Verlag 1974. (Main Reference)**
Supportive References	• **D. Dummit & R. Foote, *Abstract Algebra*, John Wiley 2004.**
Electronic Materials	
Other Learning Materials	

2. Educational and Research Facilities and Equipment Required:

Items	Resources
facilities (Classrooms, laboratories, exhibition rooms, simulation rooms, etc.)	▪ **Each class room should be equipped with a whiteboard and a projector.** ▪ **Laboratories should be equipped with computers and an internet connection.**
Technology equipment (Projector, smart board, software)	▪ **The rooms are equipped with data show and Smart Board.**
Other equipment (Depending on the nature of the specialty)	▪ **None.**

F. Assessment of Course Quality:

Assessment Areas/Issues	Assessor	Assessment Methods
Effectiveness of teaching	Students Course Responsible	**Direct:** Questionnaire. **Direct:** Course e-Portfolio. **Indirect:** Second examiner checklist-Course report. **Direct:** Questionnaire.

Assessment Areas/Issues	Assessor	Assessment Methods
	Peer Reviewer	**Indirect:** External assessor report.
Effectiveness of students' assessment	Program Leaders	**Direct:** Course e-Portfolio. **Indirect:** Course report.
Quality of learning resources	Course Responsible	**Direct:** Exams - Course e-Portfolio. **Indirect:** Second examiner checklist-Course report.
The extent to which CLOs have been achieved	• Students • Faculty (Academic Advisory- GCC) • Program Leaders • Course Responsible	**Direct:** course Entrance/Exit. **Indirect:** Observations - Accreditation review. **Direct:** Course e-Portfolio. **Indirect:** Course evaluation survey- Observations- Syllabus review- Accreditation review.
Other		

Assessor (Students, Faculty, Program Leaders, Peer Reviewer, Others (specify)

Assessment Methods (Direct, Indirect)

G. Specification Approval Data:

COUNCIL /COMMITTEE	MATHEMATICS AND STATISTICS DEPARTMENT COUNCIL
REFERENCE NO.	8/1446
DATE	05/04/1446 (08/10/2024)