COURSE DATA

Data Subject	
Code	34175
Name	Group theory
Cycle	Grade
ECTS Credits	6.0
Academic year	2019 - 2020

Study (s)

Degree	Center	Acad. year	Period
1107 - Degree in Mathematics	Faculty of Mathematics	4	First term

Subject-matter

Degree	Subject-matter	Character
1107 - Degree in Mathematics	16 - Seminar on Algebra	Optional

Coordination

Name	Department
BALLESTER BOLINCHES, ADOLFO	5 - Algebra
ESTEBAN ROMERO, RAMON	363 - Mathematics

SUMMARY

English

Whether one wants to study groups because of its applications or to do research in the theory, the concept of action is implicit in the nature of the groups, initially as permutation groups but also as transformations or actions on objects and structures of various kinds. It is thus necessary to study actions on groups and its application to the construction of the semidirect product. It is related and of great interest the Schur-Zassenhaus theorem. The idea of solvability appears at the origin of the theory of groups linked to the solvability by radicals of algebraic equations. Its influence affects the arithmetic structure and its normal structure of groups. Burnside's theorem on the solvability of groups whose order is divisible only by two primes is a key example of this. Also in this context of arithmetic Hall theorems are quite relevant. Another important focus of group theory is the study of finite simple groups. Here we will study the

simple groups PSL (n, q).

PREVIOUS KNOWLEDGE

Relationship to other subjects of the same degree

There are no specified enrollment restrictions with other subjects of the curriculum.

Other requirements

Knowledge of the course on Algebraic Structures

OUTCOMES

1107 - Degree in Mathematics

- Capacity for analysis and synthesis.
- Solve problems that require the use of mathematical tools.
- Learn autonomously.
- Possess and understand the mathematical knowledge.
- Apply the knowledge in the professional world.
- Expressing mathematically in a rigorous and clear manner.
- Knowing the time and the historical context in which occurred the great contributions of women and men in the development of mathematics.
- Visualize and interpret the solutions obtained.

LEARNING OUTCOMES

Students should develop those learning skills necessary to undertake further studies with autonomy.

Students should know how to use search tools library resources.

Students should learn how to do presentations and expose their work in public.

Students should be able to be familiar with topics of current interest of recent research in group theory.

DESCRIPTION OF CONTENTS

1. Revision and Preliminaries.

1. We review previous knowledge about permutation groups,
Solvable groups, and Sylow theory.

2. Nilpotent Groups. Fitting and Frattini subgroups.

2. The properties of the p-groups, the center of a nontrivial p-group is nontrivial, every proper subgroup is contained in its normalizer itself serve as a basis for introducing nilpotent groups by the central series. The product of nilpotent normal subgroups of a finite group is a nilpotent normal subgroup.

3. Subnormality. Baer´s Theorem.

3. We shall prove Baer theorem by using Zippers Lemma.

4. The Jordan-Hölder Theorem. Minimal Normals.

4. We prove the Jordan-Holder theorem and introduce minimal normal subgroups.

5. Primitive Groups. Galois Theorem. Iwasawa Criterium.

5. We introduce the concept of primitive group, and the Iwasawa criterium necessary for the final chapter.

6. Semidirect Product. Schur-Zassenhaus Theorem

6. We introduce the concept of semidirect group, so necessary for the examples. We prove the theorem of Schur-Zassenhaus.

7. Solvable Groups. Theorems of Hall and Carter.

7. With the techniques already developed, we are able to prove the fundamental theorems of Hall and Carter.

8. Simplicity of the groups PSL (n,q).

8. We prove the simplicity of the groups PSL (n, q), thus giving the student a family of examples of simple groups of Lie type (they only knew alternating groups).

WORKLOAD

ACTIVITY	Hours	% To be attended
Theory classes	37,50	100
Classroom practices	15,00	100
Other activities	7,50	100
Study and independent work	16,50	0
Readings supplementary material	8,00	0
Preparation of evaluation activities	16,50	0
Preparing lectures	24,80	0
Resolution of case studies	8,50	0
TOTAL	134,30	

TEACHING METHODOLOGY

English version is not available

EVALUATION

The mark obtained in the exam will count 80 % of the final grade. The seminar will note the 10 % and 10 % participation.

To pass you must obtain a minimum grade of 4 out of 10 on the exam.

In the second call, the assessment system will be the same. **The scores of the seminars and the participation cannot be recovered in the second call.**

REFERENCES

Basic

- Referencia b1: Isaacs, I. M. Finite Group Theory, AMS 2008
- Referencia b2: Kurzweil, H., Stelmacher, B. The Theory of Finite Groups, Springer-Verlag, 2004

- Referencia b3: Rose, J.S., A Course on Group Theory, Cambridge U.P., 1978

Additional

- Rerencia c1: Doerk, K., Hawkes, T.O., Finite Soluble Groups, Walter de Gruyter, 1992.
- Referencia c2: Huppert, B., Endlichen Gruppen I, Springer-Verlag, 1967
- Referencia c3: Gorenstein, D., Finite Groups, Chelsea, 1980

ADDENDUM COVID-19

This addendum will only be activated if the health situation requires so and with the prior agreement of the Governing Council

English version is not available