



SYLLABUS

Course Code	Course Num.	Course Name	Credit Hours	Lec.	Lab.	Tut.	Private study	Pre-requisites	Course Level	Teaching Language
MAT	628	Group Representation	4	3	0	1	8	MAT 623	3-4	English

A. Course Description

This course describes the most important ideas, theoretical results in Representations Theory. The course includes the essential fundamentals of Representations, modules and Characters. It covers classical topics as Maschke's theorem, Schür's Lemma and Tensor Product of representations and their characters. The emphasis is on theoretical results with provably good performance. Applications and heuristics are mentioned only occasionally.

B. Course Outcomes

At the end of this course the student will be able to:

1. Introduce in depth the following basic topics in Group Representations Theory: Representations, Regular representation, Permutation Representation, Irreducible modules and completely reducible modules, Module homomorphism and isomorphic modules,
2. Know Maschke's theorem, Schür's Lemma and applications. Characters, Irreducible, regular and faithful Characters, Inner Products of Characters, Character tables, Orthogonality relations of characters, Lifting characters, Tensor Product of representations and their characters, Characters of finite direct product of groups.

C. References

Representations and Characters of Groups, D.G. James, M.W. Liebeck, 2nd Ed., Cambridge, 2011.

Required Textbook

1. *Representation Theory of Finite Groups*, M. Burrow, Dover Publications 2011.
2. *Group Representation theory - Part A*, D. L. Dornhoff, Marcel Dekker 1971.

Course Website: Google Classroom Webpage: <http://www.imamm.org/>



D. Topics Outline

Group Representation: Definitions and Examples, Equivalent Representations, Group Algebras, Group Algebras Modules and Submodules, Regular Representation, Permutation Representation, Irreducible Modules and Completely Reducible Modules, Module, Homomorphisms, and Isomorphic Modules, Maschke's Theorem, Schur's Lemma and Applications.

Group Characters: The Conjugacy Class Equation, Center of Group Algebra, Characters, Irreducible, Regular and Faithful Characters, Inner Products of Characters, The Number of Irreducible Characters, Character Tables, Row and Column Orthogonality Relations of Characters, Computing Characters Tables of Small Orders Groups, Lifted Characters, Finding Linear Characters by Lifting, Tensor Product of Representations and their Characters, Characters of Finite Direct Product of Groups.

E. Office Hours

Office hours give students the opportunity to ask in-depth questions and to explore points of confusion or interest that cannot be fully addressed in class.

F. Exams & Grading System

The semi-official dates of the exams for this course are:

- **Midterm:** 8th or 9th week.
- **Quizzes & Homework:** During the semester.
- **Final Exam:** 16th week.

Your course grade will be based on your semester work as follows:

Midterm : 30 %	Final Exam: 40 %
4 Quizzes + 4 Homeworks, Attendance & Participation: 30 %	

The grading distribution:

A ⁺	A	B ⁺	B	C ⁺	C	F
[95, 100]	[90, 95)	[85, 90)	[80, 85)	[75, 80)	[70, 75)	[0, 70)



D. Student Workload:

#	Teaching/learning activities	Contact Hours	Frequency	Total Contact hours	Self-study hours	Total self-study hours	Student Learning Time
1	Lecture	3	15	45	1.5	22.5	67.5
2	Tutorial	1	15	15	3	45	60
3	Lab\Practical	0	0	0	0	0	0
4	Homework	0	4	0	1.5	22.5	22.5
5	Quiz	0.25	4	1	1	4	5
6	Test (Midterm)	2	1	2	12	12	14
7	Final Exam	2	1	2	12	12	14
Total				65		118	183

Independent self-study = $118/15 \cong 8$ hrs per week

G. Student Attendance/Absence

Only three situations will be considered as possible excused absences:

- Occurrence of a birth or death in the immediate family will be excused. (“Immediate family” is defined by the University as spouse, grandparents, parents, brother, or sister).
- Severe illness in which a student is under the care of a doctor and physically unable to attend class will be excused. Students are not excused for a doctor's appointment. Do not make appointments that conflict with rehearsals. Notes from the University Health Center will be accepted.

[Executive Rules for Study Regulations and Examsgoo.gl/ykm7t3](https://www.Examsgoo.gl/ykm7t3)

