

Math 374: Undergraduate Representation Theory

MWF 10:00am - 10:50am, HBH 453. See Syllabus for details
Instructor: Dr. Chelsea Walton. notlaw@rice.edu

Last Updated: August 30, 2025

| Lecture # | Date | Topic (Notes in Dropbox folder) | Section of James & Liebeck | Instructor lectures | Student Speaker 1 Mode (10:00a-10:20a) | Student Speaker 2 Mode (10:25a-10:45a) | Other references | Homework Due Date |
|---------------|--|---|----------------------------------|------------------------|---|---|---|-------------------|
| 1 | M 8/25/2025 | Introduction to Course Review of Groups | Chapter 1 | ✓ | — | — | Walton's 2021 NAM-JMM talk + accomp. article | |
| 2 | W 8/27/2025 | Review of Groups | Chapter 1 | ✓ | — | — | | |
| 3 | F 8/29/2025 | Linear Algebra Review | Chapter 2 | ✓ | — | — | | HW #0 Due |
| 4 | W 9/3/2025 (after Labor Day) | Linear Algebra Review | Chapter 2 | ✓ | — | — | | |
| 5 | F 9/5/2025 | Group Representations | Chapter 3 | — | Thomas M. Chalk Talk p. 30-31 on representations | Teddy A. Chalk Talk p. 32-34 on equivalent repns | Instructor Notes #5 p.1-2 #5 p.3-4 | |
| 6 | M 9/8/2025 | Group Representations FG-modules | Chapter 3 Chapter 4 | — | Oscar P. Chalk Talk p. 34-35 on kernels of repns | (Instructor) Chalk Talk p. 38-40, ending with Defn 4.3 | Instructor Notes #5 p.5-7 #6 p.1-2, 3(top) | |
| 7 | W 9/10/2025 | FG-modules | Chapter 4 | — | Dasha D. Chalk Talk p. 40-41 on Theorem 4.4 with one example | Sungwon C. Chalk Talk p. 42-44 on Skip Prop 4.6, do a recap + Defn 4.8 | Instructor Notes #6 p.3-4 #6 p.5, #7 p.1-2 | |
| 8 | F 9/12/2025 | FG-modules | Chapter 4 | — | Luke S. Chalk Talk p. 44-45 on perm'n mods | Riley K. Chalk Talk p. 45-47 on FG- mods + equiv repns | Instructor Notes #7 p.2-4 #7 p.5-7 | |
| 9 | M 9/15/2025 | FG-submodules Irreducible FG- modules | Chapter 5 | — | Benjamin S. Chalk Talk p. 49-50 on FG-submods | Peter B. Chalk Talk p.50-51 on irred FG-mods | Instructor Notes #8 p.1-2 #8 p.3-4 (+5 as time allows) | |
| 10 | W 9/17/2025 | Group Algebras | Chapter 6 | — | Matthew B. Chalk Talk p. 53-55 on group alg of G, Prop 6.4 briefly | Eric S. Chalk Talk p. 56-58 on regular FG-mod, Prop 6.10 briefly | Instructor Notes #9 p.2-4 (just to examples) #9 p.4(bottom)-p.6 | HW #1 Due |
| 11 | F 9/19/2025 | FG-homomorphisms | Chapter 7 | — | Viktor M. Chalk Talk p. 61-62 on FG-homoms | Dasha S. Chalk Talk p. 63-66 on Isom FG-mods (sketch Thm 7.6) | Instructor Notes #10 p.1(bottom)-p.3 #10 p.4-6 (but could opt for Example 7.8) | |
| 12 | M 9/22/2025 (ONLINE) | Direct sum of FG- modules Maschke's Theorem | Chapter 7 Chapter 8 | ✓ | — | — | | |
| 13 | W 9/24/2025 (ONLINE) | Maschke's Theorem | Chapter 8 | ✓ | — | — | | |
| 14 | F 9/26/2025 (ONLINE) | Schur's Lemma | Chapter 9 | — | ? Slides Online p. 78-80 on Schur's Lemma | ? Slides Online p. 81-83 on fin abl grp reps +diag'n | (Will receive instructor notes after the talks. Please give it your best go on developing the slides on your own.) | |
| 15 | M 9/29/2025 (ONLINE) | Schur's Lemma | Chapter 9 | — | ? Slides Online p. 83-85, just Defns 9.12, 9.15 w/ examples (see ** →>) | ? Slides Online p. 84-86 be sure to cover Propositions 9.14, 9.16, 9.18 | (See above) ** Start with recapping the major theorems covered: Maschke's Thm (w/ Thm 8.7), and Schur's Lem (w/ Prop 9.5) | |
| 16 | W 10/1/2025 (ONLINE) | Irreducible modules and the group algebra More on the group alg | Chapter 10 Chapter 11 | — | ? Slides Online p. 89-91 on irred submods of CG | ? Slides Online p. 92-93 exams, + p. 95-96 thru Prop 11.2 | (See above) | HW #2 Due |
| 17 | F 10/3/2025 (ONLINE) | More on the group algebra | Chapter 11 | — | ? Slides Online p. 96-99 on Prop 11.3 thru Example 11.7 | ? Slides Online p. 99-102 Prop 11.8 thru Thm 11.12 + examples | (See above) | |
| 18 | M 10/6/2025 | Interlude: ADE classification/ McKay Correspondence | | ✓ | — | — | | |
| 19 | W 10/8/2025 | Conjugacy Classes | Chapter 12 | — | ? Slides In-Person p. 104-107 on conj classes and sizes (skip pf of Theorem 12.8) | ? Slides In-Person p. 107-111 on conjugacy classes of D_4 and S_n | (See above) | |
| 20 | F 10/10/2025 | Conjugacy Classes | Chapter 12 | — | ? Slides In-Person p. 111-113 on a recap of conj classes, and those of A_n | ? Slides In-Person p. 113-115 on normal subgroups | (See above) | |
| 21 | W 10/15/2025 (after Midterm Recess) | Characters | Chapter 13 | ✓ | — | — | | HW #3 Due |
| 22 | F 10/17/2025 | Characters | Chapter 13 | ✓ | — | — | | |
| 23 | M 10/20/2025 | Inner Product of Characters | Chapter 14 | — | ? Chalk Talk p. 133-135 on inner products | ? Chalk Talk p. 135-137 on inner prod of chars thru Hyp 14.7 | (Will receive instructor notes after the talks. Please give it your best go on developing the talk notes on your own.) | |
| 24 | W 10/22/2025 | Inner Product of Characters | Chapter 14 | — | ? Chalk Talk p. 137-139 on recall Hyp 14.7 thru Prop 14.10 | ? Chalk Talk p. 139-141 on Cor 14.11 and Thm 14.12 | (See above) | |
| 25 | F 10/24/2025 | Inner Product of Characters | Chapter 14 | — | ? Chalk Talk p. 141-143 on Thm 14.17 thru Defn 14.19 | ? Chalk Talk on p. 143-145 on Thm 14.20 thru Example 14.22 | (See above) | |
| 26 | M 10/27/2025 | Inner Product of Characters | Chapter 14 | — | ? Chalk Talk p. 145-146 on Theorems 14.23 and 14.24 | ? Chalk Talk p. 146-149 decomp CG-mods with one example | (See above) | |
| 27 | W 10/29/2025 | The Number of Irreducible Characters Character Tables | Chapter 15 Chapter 16 | — | ? Chalk Talk p. 152-154 thru Corollary 15.4 | ? Chalk Talk p. 154, 159-160 on Prp 15.5, Cor 15.6, Defn 16.1, and Example 16.3(2) | (See above) | HW #4 Due |
| 28 | F 10/31/2025 | Character Table and Orthogonality Relations | Chapter 16 | — | ? Chalk Talk p. 159-161 on Def 16.1 and Prop 16.2, w/ Exam 16.3(1,3) | ? Chalk Talk p. 161-163 on Theorem 16.4 and Example 16.5(1) | (See above) | |
| 29 | M 11/3/2025 | Character Table and Orthogonality Relations | Chapter 16 | ✓ | — | — | (See above) | |
| 30 | W 11/5/2025 | Tensor Products | Chapter 19 | ✓ | — | — | | |
| 31 | F 11/7/2025 | Tensor Products | Chapter 19 | — | ? Speaker's choice: Chalk or Slides p. 194-196, skip pf of (19.9), cover Thm 19.10, and examples | ? Speaker's choice: Chalk or Slides p. 196-198 on decomp χ^2 thru Prop 19.13 | | |
| 32 | M 11/10/2025 | Tensor Products | Chapter 19 | — | ? Speaker's choice: Chalk or Slides p. 198-201, start w/ χ, S, χ_A , Prop 19.14 (skim proof), Example 19.15, skim Exam 19.16 as time permits | ? Speaker's choice: Chalk or Slides p. 205-208 on direct products (skim pfs, focus on Example 19.19) | | |
| 33 | W 11/12/2025 | Restriction to a Subgroup | Chapter 20 | — | ? Speaker's choice: Chalk or Slides p. 210-212 on restriction | ? Speaker's choice: Chalk or Slides p. 212-214 on consts, Def 20.3 thru Prop 20.5 | | HW #5 Due |
| 34 | F 11/14/2025 | Restriction to a Subgroup Clifford's Theorem | Chapter 20 | — | ? Speaker's choice: Chalk or Slides p. 215-216 on Prop 20.7 and Clifford's Thm | ? Speaker's choice: Chalk or Slides p. 215-216 on Props 20.9-20.11 | | |
| 35 | M 11/17/2025 | Restriction Induced Modules | Chapter 20 Chapter 21 | — | ? Speaker's choice: Chalk or Slides p. 219 on Prop 20.12, and do Exercise 20.5 | ? Speaker's choice: Chalk or Slides p. 224-226, thru Def 21.4, compare defn of induction with restriction | | |
| 36 | W 11/19/2025 | Induced Modules and Characters | Chapter 21 | — | ? Speaker's choice: Chalk or Slides p. 226-227 on Def 21.4 thru Prop 21.6 | ? Speaker's choice: Chalk or Slides p. 227-230 on Prop 21.7 thru Thm 21.11 (skim pfs as you choose) | | |
| 37 | F 11/21/2025 | Induction and The Frobenius Reciprocity Theorem | Chapter 21 | ✓ | — | — | | |
| 38 | M 11/24/2025 | The Frobenius Reciprocity Theorem Applications | Chapter 21 | ✓ | — | — | | |
| 39 | M 12/1/2025 (after Thanksgiving) | Representations of Symmetric Groups | (Instructor's notes) | ✓ | — | — | | |
| 40 | W 12/3/2025 | Representations of Symmetric Groups | (Instructor's notes) | ✓ | — | — | | HW #6 Due |
| 41 | F 12/5/2025 | Representations of Symmetric Groups | (Instructor's notes) | ✓ | — | — | | |
| — | — | | | | | | | |
| Study Days | Sa 12/6/2025 - T 12/9/2025 | | | | | | | |
| | No Final Exam for this course | | | | | | | |