# PHY 4523: Statistical Physics Spring 2014 Professor Mark W. Meisel

**“*in vivo*”** schedule (**black text: projected and tentative**; **purple text: past**; **blue text: hotlinks**;

**red text important announcements**; **green text: fixed final exam**)

**Note:** Schedule is “projection” and revisions will be announced in class and subsequently posted online.

Week 1 Jan 06 Class Starts, Introduction to the Course. Some helpful formula handouts.

Chapter 1. **Ch. 1 Problems: 3, 4, 5, 9, 10, 11, 12.**

Jan 08 Syllabus typos corrected. “Yesteryear” links added to webpage.

Finish Chapter 1, and start Chapter 2.

**Ch. 2 Problems: 4, 6, 8, 9, 13, 19.**

Begin Kinetic Theory Discussion.

Jan 10 Finish discussion on Kinetic Theory and Equipartition of Energy.

Distribute playing card.

**Quiz 1 focusing on Ch. 1.**

Week 2 Jan 13 Return and review Quiz 1.

Start Ch. 3. **Problems for Chapter 3: 6, 7, 9, 10, 11, 14, 16, 20, 21.**

Percolation “handout” is online in PDF format at:

http://iopscience.iop.org/0031-9120/37/3/406/pdf/0031-9120\_37\_3\_406.pdf

An overview is available at:

<http://www2.imperial.ac.uk/~mgastner/percolation/percolation.html>

**Describe Homework 1 (**[**PDF sheet**](http://www.phys.ufl.edu/~meisel/sm-hw1-14.pdf)**).**

Jan 15 Continue Ch. 3. Aside on “autocorrelation” function and Brownian motion.

Jan 17 Complete Ch. 3.

**Quiz 2 focusing on Ch. 2.**

Week 3 Jan 20 No class, King Holiday.

Jan 22 Return and review Quiz 2. Finish “autocorrelation”/Brownian motion.

Start Ch. 4. **Problems for Chapter 4: 1, 2, 4, 6, 7, 8, 10, 12, 14.**

**Homework 1 due at start of class.**

**HITT Points start to accumulate on this date.**

Jan 24 Discuss Homework 1 and Percolation Results (available as [Powerpoint](http://www.phys.ufl.edu/~meisel/PHY4523-Hole-Punching-Results-2014.pptx)).

**Scale-free Networks**, A.-L. Barabasi and E. Bonabeau, *Scientific American*

May 2003, pp 60-69 and PDF available from UF library as:

<http://www.nature.com/scientificamerican/journal/v288/n5/pdf/scientificamerican0503-60.pdf>

Continue Ch. 4.

**Quiz 3 focusing on Ch. 3.**

Week 4 Jan 27 Return and review Quiz 3.

Return and discuss Homework 1.

Ch. 4, continued, Do 2D Ising model. Rubber band experiment/demo.

Jan 29 Ch. 4, continued. Negative temperature. 2D rubber band model.

Jan 30 Finish Ch. 4.

**Quiz 4 on material up to, and including, Sec. 4.4.**

Week 5 Feb 03 Return and review Quiz 4.

NOTE: “grace period” for HITT registration ends today.

Start Chapter 5. **Problems Ch. 5: 2, 4, 6, 8, 10, 12, 14, 17, 20, 22, 23, 26.**

Boltzmann Distribution: nice worked example here in [PDF](http://www.phys.ufl.edu/~meisel/Boltzmann.pdf).

<http://bcs.whfreeman.com/tiplermodernphysics6e/#735797__762197__>

[**Distribute Extra Problem sheet.**](http://www.phys.ufl.edu/~meisel/Extra-HW1-sm2014.pdf) Start 2-level systems.

Feb 05 Continue with 2 level systems and Ch. 5.

Feb 07 Announce that MTE 1 will cover all material up to section 5.13, inclusive.

Continue Ch. 5. Extra HW 1 done. Problem 5.6 sketched.

**Quiz 5 on all material in Ch. 4.**

Week 6 Feb 10 Return and review Quiz 5. Finish Problem 5.6. Negative temperature 2.

Continue Ch. 5. Material to the end of the lecture is fair for MTE 1.

Feb 12 **Email Questions by NOON today** for Review for MTE 1.

Feb 14 **MTE 1. Material from Ch. 1 to Ch. 5, section 5.13, inclusive.**

Week 7 Feb 17 Review MTE 1. Continue Ch. 5.

Feb 19 Ch. 5 continued, 1D and 3D particle(s) in a box.

**Homework Problem #2 announced and described (see 21 Feb)**

**“Element” assignments made for Homework Problem #2.**

Feb 21 Typo-corrected [Homework Problem #2 as PDF](http://www.phys.ufl.edu/~meisel/sm-hw2-14.pdf).

Finish 3D particles in box and connection to van der Waals Equation.

READ Appendix F (small typo in Eq. F.9?)

Start Ch. 6. **Chapter 6 Problems: 2, 4, 6, 8, 9.**

**Quiz 6 on Ch. 5 up to section 5.13, inclusive.**

Week 8 Feb 24 Return and review Quiz 6. Finish Ch. 6.

Feb 26 Start Chapter 7. **Chapter 7 Problems: 2, 4, 5, 10, 13, 16.**

Feb 28 Continue k-space Density of States discussion.

Start Chapter 8. **Chapter 8 Problems: 1, 2, 3, 5, 7, 9, 12.**

Generate Planck distribution function.

Week 9 Mar 03,05,07 No classes, Spring Break

Week 10 Mar 10 Continue Chapter 8. **Chapter 8 Problems: 1, 2, 3, 5, 7, 9, 12.**

Einstein and Debye models of vibrations in a solid.

Announce “make-up” excused work day rules.

Mar 12 **Homework 2 due at start of class.**

Finish Chapter 8.

Mar 14 **Email Questions by NOON today for Review for MTE 2.**

Week 11 Mar 17 **MTE 2 focuses on Ch. 5 (parts not on MTE1), 6, 7 and material since MTE1.**

Mar 19 Review MTE 2. Review Chapter 8.

Mar 21 “Make-up Day” (must email instructor BY NOON on 19 March) about

intention to participate and provide list of material(s) to be made-up.

Attendance for students making up material missed by excused absences.

No “make-up” for you? The “reading day” for you.

Week 12 Mar 24 Start Chapter 9. **Chapter 9 Problems 1, 3, 4, 5, 9.**

“Top 10 Things You Should Know about the Chemical Potential”

By Peter N. Saeta, Harvey Mudd College

<http://www.physics.hmc.edu/~saeta/courses/p117/ChemPot.pdf>

Mar 26 Continue discussion of chemical potential and Ch. 9.

Mar 28 Finish Chapter 9.

**Quiz 7 on material in Ch. 8.**

Week 13 Mar 31 Review and return Quiz 7. Start Chapter 10.

Parallel discussion to contrast Fermi-Dirac and Bose-Einstein Statistics.

**Chapter 10 Problems: 1, 2, 4, 8, 9, 10, 12, 13, 15.**

Apr 02 Start discussion of Fermi gas.

Apr 04 Finish discussion on Fermi gas. Motivate BEC and watch movies.

[BEC Homepage at University of Colorado](http://www.colorado.edu/physics/2000/bec/)

**Quiz 8 on material in Ch. 9.**

Week 14 Apr 07 Review and return Quiz 8.

“Spintronics: A Spin-Based Electronics Vision of the Future”, by S.A. Wolf, D.D. Awschalom,

R.A. Buhrman, J.M. Daughton, S. von Molnar, M.L. Roukes, A.Y. Chtchelkanova, D.M. Treger,

*Science* 294 (2001) 1488, <http://www.sciencemag.org/content/294/5546/1488> and [Fig. 3](http://www.phys.ufl.edu/~meisel/Spintronics.pptx)

BEC: supersolid?

Apr 09 Finish Chapter 10. **Quiz 9 on material up to end of Monday, 04 April.**

Apr 11 **Guest Lecture by Professor Hagen** (<http://www.phys.ufl.edu/~hagen/>)

“The inside story of the Stat. Mech. needed by a budding biological physicist” or

“The Stat. Mech. needed to *Understand* the UF Condensed Matter Seminar on

Monday, 14 April”, <http://www.phys.ufl.edu/cmseminar/>

Week 15 Apr 14 Information Theory: finish discussion. Highlights on Chapter 11 and 12.

**OH on Apr 15? See Meisel after class.**

Apr 16 **Email Questions by NOON today for Review for MTE 3 and Final Exam.**

**No OH on Apr 17.**

Apr 18 “Small Group Problem Solving Lab” and two 2/1 HITT questions,

last of the HITT points to make 60.

Week 16 Apr 21 **MTE 3.**

Apr 23 Review MTE 3. Review course.

Apr 25 No Class, Reading Day

**Apr 12** **Course Evaluations**, “GatorRater” (?), <https://evaluations.ufl.edu/evals/>

**to** open now and until last day of “reading days”.

**Apr 25**  **Extra Credit** of 5 pts to everyone in class if more than 80% of the students respond.

**Office Hours during Exam Week:**

By appointment, contact Instructor by email to arrange.

Final Exam (Group 30D): Wednesday, 30 April, 3:00 pm to 5:00 pm, NPB 1002

Final Exam covers material from the entire course.