# PHY 4523: Statistical Physics Spring 2015 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 07 Class Starts, Introduction to the Course. Some helpful formula handouts.

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

Jan 09 Finish Chapter 1, and start Chapter 2.

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

Begin Kinetic Theory Discussion.

Week 2 Jan 12 Finish discussion on Kinetic Theory and Equipartition of Energy.

Distribute playing card.

Jan 14 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-hw1-15.pdf)**). Due at start of class 21 Jan.**

Jan 16 Complete Ch. 3.

**Quiz 1 focusing on Ch. 1 and 2.**

Week 3 Jan 19 No class, King Holiday.

Jan 21 **Email questions about Ch. 3 by NOON.**

Return and review Quiz 1.

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 23 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 2 focusing on Ch. 3.**

Week 4 Jan 26 Return and review Quiz 2. Return Homework 1.

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

Ch. 4, continued, Do 2D Ising model.

Jan 28 Ch. 4, continued. Rubber band experiment/demo.

2D rubber band model. Negative Temperature (first mention).

Jan 30 Finish Ch. 4.

**Quiz 3 on material up to, and including, Sec. 4.4.**

Week 5 Feb 02 Return and review Quiz 3.

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__>

[**Extra Problem sheet.**](http://www.phys.ufl.edu/~meisel/Extra-HW1-sm2015.pdf)

Feb 04 Continue CH. 5 and 2-level systems.

Feb 06 Announce that MTE 1 will cover all material up to

Section 5.9, inclusive, & SHO.

Continue Ch. 5. Extra Problem sheet worked.

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

Week 6 Feb 09 Return and review Quiz 4. Finish Extra Problem sheet. Problem 5.6.

Continue Ch. 5 up to Sec. 5.9 and SHO.

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

Feb 11 **Email Questions by NOON today** for Review for MTE 1.

Feb 13 **MTE 1. Material from Ch. 1 to Ch. 5, Section 5.9, inclusive, and SHO,**

**And all Lecture material from start of course to Feb 09, inclusive.**

Week 7 Feb 16 Review MTE 1. Continue Ch. 5. Negative temperature 2.

Feb 18 Ch. 5 continued, 1D and 3D particle(s) in a box.

**Homework Problem #2 announced and described (see 20 Feb)**

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

Feb 20 [Homework Problem #2 as PDF](http://www.phys.ufl.edu/~meisel/sm-hw2-15.pdf). **Due at start of class on 11 Mar.**

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

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

**Quiz 5 on Ch. 5 up to section 5.9, inclusive.**

Week 8 Feb 23 Return and review Quiz 5. Finish Ch. 5.

Feb 25 Start Ch. 6. **Chapter 6 Problems: 2, 4, 6, 8, 9.**

Feb 27 Finish Ch. 6.

Week 9 Mar 02,04,06 No classes, Spring Break

**NOTE of 16 Feb: Projected and Tentative Schedule after the Spring Break to be revised by March 09.**

Week 10 Mar 09 Review where we are and where we are going.

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

Start k-space Density of States discussion.

Mar 11 **Homework 2 due at start of class.**

Finish k-space discussion. Finish Ch. 7.

Mar 13 Start Chapter 8. **Chapter 8 Problems: 1, 2, 3, 5, 7, 9, 12.**

Motivate Planck distribution function.

Week 11 Mar 16 Blackbody radiation. Return graded HW2 at end of class.

Mar 18 Einstein and Debye models of vibrations in a solid. Finish Chapter 8.

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 20 Finish Ch. 8. Continue discussion of chemical potential and Ch. 9.

**Quiz 6 on material in Ch. 7.**

Week 12 Mar 23 Review and return Quiz 6. Finish Ch. 9.

Catch-up Day on Material for MTE 2.

Mar 25 **Email Questions by NOON today for Review for MTE 2.**

**Review for MTE 2 based on email input.**

**Special Office Hour after class, 4 to 5 pm.**

**Mar 26 Thursday, NO Office Hour.**

Mar 27 **MTE 2 focuses on Ch. 5 (parts not on MTE1), 6-8 and material since MTE1.**

Week 13 Mar 30 **Announce “make-up” excused work day rules.**

Review MTE2. O2 and CO binding to red blood cells.

Apr 01 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.**

Start discussion of Fermi gas.

Apr 03 Finish discussion on Fermi gas.

“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)

**Quiz 7 on material in Ch. 9.**

Week 14 Apr 06 Review and return Quiz 7.

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

Apr 08 Liquid 4He versus BEC 87Rb. Finish Chapter 10. Work Problem 10.9.

**Quiz 8 on material up to end of Friday, 03 April.**

**Noon Deadline to notify Meisel, by email, about “Make-up Day” participation,**

**email must include list of material eligible for make-up.**

Apr 10 **“Make-up Day”** **(must email instructor BY NOON on 08 April) 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 15 Apr 13 Review and return Quiz 8.

Highlights on Chapters 11, 12, 13. Start Information Theory.

“A Mathematical Theory of Communication”, C. E. Shannon, The Bell System Technical Journal,

Vol. 27, pp. 379–423, 623–656, July, October, 1948,

<http://cm.bell-labs.com/cm/ms/what/shannonday/shannon1948.pdf>

“Entropy, information, and computation”, J. Machta, Am. J. Phys. 67, 1074 (1999),

[doi:10.1119/1.19085](http://scitation.aip.org/content/aapt/journal/ajp/67/12/10.1119/1.19085)

“Experimental demonstration of information-to-energy conversion and validation of the

generalized Jarzynski equality”, S. Toyabe, T. Sagawa, M. Ueda, E. Muneyuki, M. Sano,

Nature Physics 6, 988–992 (2010) [doi:10.1038/nphys1821](http://www.nature.com/nphys/journal/v6/n12/full/nphys1821.html)

“Thermodynamics of information: Bits for less or more for bits?”, C. Van den Broeck,

Nature Physics 6, 937–938 (2010) [doi:10.1038/nphys1834](http://www.nature.com/nphys/journal/v6/n12/full/nphys1834.html)

Apr 15 Catch-up day or start review early or lab tour or Broader Impacts?

Apr 17 **Email Questions by NOON today for Review for MTE 3 and Final Exam.**

Review for MTE3 and Final Exam.

Week 16 Apr 20 **MTE 3 covering material since MTE2 (Ch. 9-10 and lecture material).**

Apr 22 Review MTE 3. Review course.

Apr 24 No Class, Reading Day

**Apr 11** **Course Evaluations**, “GatorRater” (?), <https://evaluations.ufl.edu/evals/>

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

**Apr 24**  **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 29A): Wednesday, 29 April, 07:30 am to 09:30 am, NPB 1002

Final Exam covers material from the entire course.