Course Outline

Course: Modern Physics II PHYS-214
Semester: Fall 2023 (Term 2231)
Lecture: MWF 10:00-10:50 AM, GOS-A300
Instructor: Dr. Seth M. Hubbard
Professor of Physics and Microsystems Engineering
Office: ENG-2115, Phone: (585) 475-4214, Email: smhsps@rit.edu
Teaching Asst.: Jacob Wurm, jmw8672@g.rit.edu
Office Hours: Wed 4-5PM and Friday 5-6PM, by appointment via email or stop by anytime, I will help if I am free. TA will also hold office hours Tu and Th from 6-7PM.
Website: http://mycourses.rit.edu

Slack: https://rit-phys-214-01-2231.slack.com/

Required Textbook:

- *Modern Physics*, by Kenneth Krane, 4th Edition, Wiley
    - You can use an older edition, but make sure you are in sync with what is discussed in class and note that homework problems are from 4th Edition.

Reference text, but not required:

- *Modular Series on Solid State Devices Vol. I, Semiconductor Fundamental,* by Robert Pierret, 2nd Ed.
- *Modular Series on Solid State Devices Vol. II, The PN Junction Diode,* by Gerold W. Neudeck, 2nd Ed.

Course Description: This course is a continuation of a survey of modern physics beyond the topics introduced in Modern Physics I. Central topics include the physics of multi-electron atoms, molecular structure, fundamentals of statistical physics applied to systems of particles, elementary solid-state physics, applications to semiconductor materials and simple devices, and basic elements of nuclear physics.

Prerequisite: Modern Physics I (PHYS-213)

Grading:

Breakdown:

Exam #1	20%
Exam #2	20%
Final Exam	25%
Homework	35%

Approx. Grading scale cut-offs:

94%	A		77%	C+
90%	A-		73%	C
87%	B+		68%	C-
83%	B		60%	D
80%	B-		<60%	F

Homework: There will be ~10-11 written homework assignments. Homework will include problems from book and additional problems assigned by the instructor. Homework assignments and solutions will be posted on the **myCourses** website.

Homework grading scale:

0 points: nothing or very little
1 point: substantial errors
2 points: quite a few errors, right approach
3 points: minor errors
4 points: perfect or nearly perfect

Tips:

- Make your solutions clear and neat.
- Number your questions and submit your homework with the questions in the assigned order
- Box or somehow otherwise clearly mark your final answer.
- Your homework should include all valid or required steps so that you or someone else could follow your method for a similar question.
- You are welcome to consult and discuss homework problems with others, however the assignment you turn in must be your own work and expressed in your own words to receive credit. If there is reasonable evidence of copying, either from another student or from a book/online source, it will be deemed an act of plagiarism, and lead to a failing grade on that assignment.
- Doing a good job on homework benefits everyone. You'll do better on the tests, and your homework scores will be higher.
- Contact me or the TA if you are having trouble, I am here to help.

Exams: Two one-hour exams will tentatively be held in-class on October 2nd and November 13th. A comprehensive final exam will be held Monday December 18th, from 10:45AM to 1:15PM in GOS-A300. All exams are closed book. Formula sheets will be allowed for all exams, you may bring a double-sided 8.5" x 11" sheet of paper with equations only. Exams will have both problem-solving and conceptual questions.

Academic honesty: Students are expected to exhibit the same level of professionalism and integrity that will distinguish them in their future careers. **Your signature** should be placed on all examination papers. Your signature attests to your completion of the work in an ethical and professional manner. Violations of the RITs academic honor code will result in a grade of F.

Dates I will be away: I will be on business travel September 20. I will find an appropriate replacement instructor or just run the class over Zoom. There may be other travel dates to be determined.

Attendance

Regular attendance is expected, barring any unforeseen issues such as illness, quarantine, etc. Attending and engaging in class time with me and your peers is important for your learning the materials. That said, if you're feeling unwell, don't come to class. I will post my PowerPoint notes on MyCourses and you can always ask a classmate for notes.

RIT policy on reasonable accommodations

RIT is committed to providing reasonable accommodations to students with disabilities. If you would like to request accommodations such as special seating or testing modifications due to a disability, please contact the Disability Services Office. It is located in the Student Alumni Union, Room 1150; the web site is https://www.rit.edu/disabilityservices/. After you receive accommodation approval, it is imperative that you see me during office hours so that we can work out whatever arrangement is necessary.

RIT policy on discrimination and harassment
RIT is committed to providing a safe learning environment, free of harassment and discrimination as articulated in our university policies located on our governance website. RIT's policies require faculty to share information about incidents of gender based discrimination and harassment with RIT's Title IX office, regardless whether the incidents are stated to them in person or shared by students as part of their coursework.

If you have a concern related to gender-based discrimination and/or harassment and prefer to have a confidential discussion, assistance is available from one of RIT's confidential resources on campus (listed below).

1. The Center for Women & Gender: Campus Center Room 1760; 585-475-7464; CARES (available 24 hours/7 days a week) Call or text 585-295-3533.
2. RIT Student Health Center – August Health Center/1st floor; 585-475-2255.
3. RIT Counseling Center - August Health Center/2nd floor - 2100; 585-475-2261.
4. The Ombuds Office – Student Auxiliary Union/Room 1114; 585-475-7200.
5. The Center for Religious Life – Schmitt Interfaith Center/Rm1400; 585-475-2137.
6. NTID Counseling & Academic Advising Services – Lyndon B. Johnson/2nd floor; 585-475-6468 (v), 585-286-4070 (vp).

Changes to the syllabus
I have provided this syllabus as guide to our course and have made every attempt to provide an accurate overview of the course. However, as instructor, I reserve the right to modify this document during the semester, if necessary, to ensure that we achieve course learning objectives. You will receive advance notice of any changes to the syllabus through myCourses/email.

Finally, I want for you to learn the material, enjoy the course, and succeed. If you have questions about your performance during the course, please contact me and we can discuss your progress.

Tentative Course Syllabus (1017-314)
The schedule below is only an approximate estimate of when we will be studying different topics

		M	**W**	**F**	**Materials to be covered**	**Reading**
1	Aug	28	30	1	Review Hydrogen Atom, bound states, quantum numbers, wave functions	Krane Ch. 7
2	Sept		6	8	Pauli Exclusion, energy levels in atoms, periodic table	Krane Ch. 8
3	Sept	11	13	15	Atomic bonding, types of bonds, primary vs secondary bonding.	Krane Ch. 9.1-9.3, Ch. 11.1
4	Sept	18	20	22	Molecular vibrations, rotation and spectra	Krane Ch. 9.4-9.6
5	Sept	25	27	29	Statistical Physics, density of states, Maxwell-Boltzmann, heat capacity	Krane Ch. 10.1-10.4
6	Oct	**2**	4	6	**Exam #1 October 2** Fermi-Dirac, Bose-Einstein, free electron in metal,	Krane Ch. 10.5-10.7.
7	Oct		11	13	crystal structure, band theory	Ch. 11.1-2,
8	Oct	16	18	20	Electrons in metal, heat capacity,	Ch. 11.3-6
9	Oct	23	25	27	Band theory, semiconductor and superconductors	Ch. 11.6-8
10	Oct	30	1	3	Semiconductor carriers, carrier distributions, carrier concentration	Pierret, Ch. 1-3
11	Nov	6	8	10	Drift and diffusion equations, recombination and generation, continuity equations	Neudeck, Ch. 2-3
12	Nov	**13**	15	17	**Exam #2 November 13** pn junctions, depletion, band bending at equilibrium and under bias, Ideal Diode Equation	Neudeck, Ch. 2-3
13	Nov	20			Ibid.	
14	Nov	27	28	1	Nuclear Structure and Radioactivity.	Krane, Ch. 12
15	Dec	4	6	8	Nuclear Reactions and Applications	Krane, Ch. 13
	Dec	11			Ibid.	
	Dec	**18**			**Final Exam:** GOS-A300, 10:45AM to 1:15PM	Comprehensive