

Modern Physics
MESSIAH COLLEGE
Spring 2010

Catalogue Course #: PHYS 251

Credit: 4 hours

Prerequisite: PHYS212 or equivalent

Instructor: Dr. Abaz Kryemadhi
Assistant Professor of Physics
329 Frey Hall Phone: 2384
e-mail: akryemadhi@messiah.edu

Class Sessions:	<u>Time</u>	<u>Location</u>
Lect. Section	TR 8:00-9:30 am	Frey 143
Lab Section:	R 2:05-5:05 pm	Frey 350

Office Hours:

M 1:00 - 3PM; T 10:30-12:30 PM; W 1:00-2:00 PM

Text: Modern Physics (5th ed) by Paul A. Tipler and Ralph A. Llewellyn, W. H. Freeman and Company, 2008. (ISBN: 0716775506)

Website: http://home.messiah.edu/~akryemadhi/PHYS251_2010/phys251.html

HW, labs, and updates will be posted here. Visit this website frequently, especially if you are missing a class. The website is password protected. Username and Password will be provided in class.

Description Topics in Modern Physics: special theory of relativity, quantization of charge and energy, wavelike properties of particles, Schrodinger Equation, spectra of the atoms, molecular structures and spectra, nuclear and particle physics, astrophysics and cosmology. Three hours of lectures and three hours of laboratory per week.

Objectives:

1. *Gain an understanding of the limitations of classical physics and the key experiments that lead to the development of quantum mechanics. Develop an understanding of foundations of quantum mechanical principles.*
2. *You will demonstrate a mastery of the course content at a suitable level for a modern physics course, by the end of it.*

3. *Develop the capacity to apply abstract ideas to tangible problems. This will enhance your critical thinking skills.*
4. *Develop the capacity to think scientifically, and that sometimes means accepting something based on experimental evidence, even when it is counterintuitive and become aware of God's glory in that revelation.*

Attendance: *Excessive absence from class will have a detrimental effect on assigned grades. The instructor will decide on a case-by-case basis whether tests can be made-up.*

Homeworks: *Problem Sets will be posted on the website and are to be turned in by 5:00pm on the due date.
Late homework will be accepted only for emergency cases.*

Labs: Lab Write-ups will be provided in the website for the course. There are four weekly regular labs and two-two week project labs.

- 1) Electron Diffraction (one week)
- 2) Frank Hertz Experiment (one week)
- 3) Photoelectric Effect (one week)
- 4) Particle in a box (one week)
- 5) Nuclear Magnetic Resonance and Electron Spin Resonance, Part I, and Part II (two week project)
- 6) Nuclear and particle physics, Part I and Part II (two week project)

Reading: *You will be expected to keep up with the assigned textbook reading from the course syllabus.*

Tests: *There will be 3 one and half hour tests on approximately the dates given below. There will also be a final exam. Make-up tests will be given only in very unusual circumstances.*

Test	Date	Chapters Covered*
Unit 1	Tuesday, Feb. 23	1 - 3
Unit 2	Thursday, March 25	4 - 6
Unit 3	Tuesday, April 20	7,11
*Note: only the sections indicated in the syllabus will be tested.		

Final Exam: The final examination will be comprehensive. No deviations from the college stated time for the final examination will be allowed, except for dire emergencies. Travel arrangements do not qualify as

emergencies.

**Final Exam Date: Thursday May 6, 10:30 AM-12:30 PM
in F143.**

Grades: The final grade will represent a weighted average of the homeworks, the labs, the tests, and the final exam. The weighting factors are shown:

Assignment	<i>Percent of grade</i>
Homework	20%
Labs	20%
3 Unit Tests	45%
Final Examination	15%
TOTAL	100%

Grade Scale:

A	93-100%	B	83-86%	C	73-76%	D	50-66%
A-	90-92%	B-	80-82%	C-	70-72%	F	0-49%
B+	87-89%	C+	77-79%	D+	67-69%		

Mission of Department of Mathematical Sciences and General Education

The mission of the Department of Mathematical Sciences is:

to educate students in excellent problem solving skills and the quantitative analysis of Mathematics, Statistics, Physics, and Computer Science

and to challenge students to live out their faith in their vocation as they become servant leaders in society, church, and the world.

The General Education program at Messiah College encourages the development of knowledge, skills, and attitudes of intellect, character, and faith that Christians use in lives of service, leadership and reconciliation.

Americans with Disabilities Act (ADA):

Messiah College welcomes students with disabilities. If you have a documented disability and wish to discuss academic accommodations for this specific course, please contact the professor as soon as possible. All disability accommodations must be pre-approved through the Office of Disability Services, 342 Old Main (5358).

Course Schedule:

This schedule is subject to change at the instructor's discretion based on time limitations and the actual pace of the class

- | | | |
|------------------------|------------|---|
| 1. Tuesday, Feb. 2 | Topic: | Relativity, Einstein's Postulates, and Lorentz Transformation |
| 2. Thursday, Feb. 4 | Topic: | Time Dilation, Length Contraction, and The Doppler Effect |
| | Have Read: | Sections 1.1 – 1.5 |
| 3. Tuesday, Feb. 9 | Topic: | Momentum, Energy, and Binding Energy |
| | Have Read: | Sections 2.1 – 2.3 |
| | Due: | HW#1 |
| 4. Thursday, Feb. 11 | Topic: | Invariant Mass and General Relativity |
| | Have Read: | Sections 2.4 – 2.5 |
| 5. Tuesday, Feb. 16 | Topic: | Electric Charge and Blackbody Radiation |
| | Have Read: | Sections 3.1 – 3.2 |
| | Due: | HW#2 |
| 6. Thursday, Feb. 18 | Topic: | Photoelectric and Compton Effects |
| | Have Read: | Sections 3.3 – 3.4 |
| 7. Tuesday, Feb. 23 | Test#1: | Chapters 1 - 3 |
| 8. Thursday, Feb. 25 | Topic: | Atoms, Nuclei and Hydrogen |
| | Have Read: | 4.1 – 4.3 |
| | Due: | HW#3 |
| 9. Tuesday, March 2 | Topic: | Hydrogen and X-rays and Frank Hertz |
| | Have Read: | Sections 4.3 – 4.5 |
| 10. Thursday, March 4 | Topic: | Particles, Waves and Wave packets |
| | Have Read: | Sections 5.1 – 5.3 |
| | Due: | HW#4 |
| 11. Tuesday, March. 9 | Topic: | Probability Functions, Uncertainty Principle and Wave Particle Duality |
| | Have Read: | Sections 5.4 – 5.7 |
| 12. Thursday, March 11 | Topic: | 1-D Schrödinger Equation and Square Well |
| | Have Read: | Sections 6.1 – 6.3 |
| | Due: | HW#5 |

13. Tuesday, March 23	Topic: Have Read:	Expectation, Harmonic Oscillator, and Waves Sections 6.4 – 6.6
14. Thursday, March 25	Test #2:	Chapters 4 – 6
15. Tuesday, March 30	Topic: Have Read: Due:	3-D Schrödinger and Hydrogen Sections 7.1 – 7.3 HW#6
16. Thursday, April 1	Topic: Have Read:	Electron Spin, Angular Momentum, and more Schrodinger Sections 7.4 – 7.6
17. Tuesday, April 6	Topic: Have Read:	Atomic States Sections 7.7 – 7.8
18. Thursday, April 8	Topic: Have Read: Due:	Nuclei, Radioactivity and Alpha, Beta, Gamma Decay Sections 11.1-11.4 HW#7
19. Tuesday, April 13	Topic: Have Read:	Nuclear Force, Shell Model and Nuclear Reactions Sections 11.5 – 11.8
20. Tuesday, April 20	Test#3	Chapter 7 and 11
21. Thursday, April 22	Topic: Have Read: Due:	Particle Physics, Concepts, Forces, Conservation Laws and Symmetries Sections 12.1 – 12.3 HW#8
22. Tuesday, April 27	Topic: Have Read:	The Standard Model and Beyond Standard Model Sections 12.4 – 12.5
23. Thursday, April 29	Topic: Have Read: Due:	The Sun, Stars, Evolution of Stars and Cataclysmic Events Sections 13.1 – 13.5 HW#9
24. Tuesday, May 4	Topic: Have Read:	Galaxies and Cosmology Sections 13.6 – 13.8