PHYS 222 – Modern Physics
Spring 2013

Meeting Time:	**Lecture** MWF 8:55 - 10:05 am **Lab** M 1:15 – 4:15 pm
Classroom:	CHS 107
Instructor:	Dr. Paul A. Belony, Jr.
Office:	Room 112, Collier Hall of Science
Phone:	ext. 1440
e-mail:	belonyp@moravian.edu
Office Hours:	**M,W,F**: 10:30AM-12PM (Other hours by appointment)

Required Course Materials

- ✓ ***Modern Physics for Scientis and Engineers****, 4th ed., Thornton and Rex.*
- ✓ ***Introduction to Relativity****, Kogut*
- ✓ ***An Introduction to Error Analysis****, 2nd ed., John R. Taylor*

Course Description

This course, Physics 222, aims to provide students with a working knowledge of the concepts leading to the breakdown of classical physics and the emergence of modern quantum theory. In this course, students will develop substantial mathematical and physical techniques for solving problems. Students will be presented with in-class demonstrations engaging them in active learning. The course material contains a substantial experimental and writing component. In the laboratory portion of the course, students will learn about experimental design and gain experience using a variety of equipment for conducting physical measurements. This course satisfies the Writing Across the Curriculum requirement.

The areas of content are Relativity and Four-Vector Space-Time Physics, Scattering, Diffraction, Bohr Theory, Quantization, Wave-Particle Duality, Quantum Numbers, Elementary Particles Physics, Conservation Laws, Atomic Physics, Nuclear Physics, and Radioactivity.

Grading Policy

Grade	Percentage Equivalents
A	90 – 100
B	80 – 89
C	70 – 79
D	60 – 69
F	59 or lower

Assessment:	%Weight
Homework Problems	20
Lab Journal and Reports	20
Paper and Presentation	10
Exams	30
Final Exam	20

Homework Problems:

The aforementioned problem sets constitute a significant portion of your grade. Your work on these problem sets, as well as on lab reports and your paper, is subject to the Moravian College Policy on Academic Honesty. Refer to the Student Handbook or ask your instructor if you have any doubts or questions about any submitted work.

Due dates and late policy: Students are expected to submit their work by the due date. Work submitted after the due date will receive a zero.

Attendance Policy:
Students are expected to class. I will take attendance and will reserve the right to lower your grades accordingly should more than two unexcused absences accrue during the semester.

Paper and Presentation:
Students will be researching a topic in physics and will write a formal research paper. These assignments include: selecting a topic, producing a preliminary and final annotated bibliography, rough drafts, and writing the final draft of the paper. Students will also give a 10-15 minute presentation the last week of class. "The Writing Center is located in a building that is not accessible to persons with mobility impairments. If you need services of the Writing Center, please call 610-861-1392

Exams:
There will be at least three (in-class) one-hour exams during the semester. There will also be a final comprehensive exam. Makeup will not be given for the exams, and you cannot take an exam early or late.

Lab

This course has a laboratory component. Dr. Kelly Krieble will be your instructor for the lab. To augment your overall learning experience and provide an experimental aspect to the course, you will be required to perform a lab each week during the term. To instill good laboratory report writing skills, lab reports will be submitted throughout the semester according to a prescribed format that follows the style of popular physics journals, using LaTeX software. Students will also have the opportunity to peer review each other's work.

Disability:

Students who wish to request accommodations in this class for a disability should contact Elaine Mara, assistant director of learning services for academic and disability support at 1307 Main Street, or by calling 610-861-1510. Accommodations cannot be provided until authorization is received from the Academic Support Center.

Subject to Revision

	Date	Topic	Lab
M	Jan. 14	Introduction, Galilean Transformation	**Lab#1 - Interferometer**
W	Jan. 16	Chapter 1 (reading assignments)	
F	Jan. 18	Chapter 1(reading assignments)	
M	Jan. 21	*No Class (Martin Luther-King's Birthday)*	**Lab#2 – Radioisotopes, Shielding, MCAs**
W	Jan. 23	Michelson-Morley experiment, Einstein's postulates, simultaneity	
F	Jan. 25	Lorentz Transformation, Time Dilation, Length Contraction, Relative Velocity	
M	Jan. 28	Twin paradox, Space-time diagrams	**Lab#3 – Relativistic Energy**
W	Jan. 30	Relativistic momentum and mass-energy	
F	Feb. 01	Collisions (problems)	
M	Feb. 04	Threshold energy (problems)	**Lab#4 – Coincidence**
W	Feb. 06	Doppler effect, decay	
F	Feb. 08	Photoelectric effect, Photon interactions	
M	Feb. 11	**Exam#1 – Relativity**	**Lab#5 – Photoelectric Effect**
W	Feb. 13	Compton effect (problems)	
F	Feb. 15	Crystal structure, Bragg diffraction	
M	Feb. 18	Rutherford scattering	**Lab#6 – Compton Effect**
W	Feb. 20	Bohr Theory	
F	Feb. 22	Problem Session	
M	Feb. 25	Spectral lines and reduced mass	**Lab#7 – Balmer Series in H and D**
W	Feb. 27	Correspondence principle	
F	Mar. 01	X-rays and energy level quantization	
M	Mar. 04	*Spring Recess*	**Spring Break – no lab**
W	Mar. 06	*Spring Recess*	
F	Mar. 08	*Spring Recess*	
M	Mar. 11	Wilson-Sommerfeld quantization	**Lab#8 – X-ray diffraction**
W	Mar. 13	De Broglie Wavelength	
F	Mar. 15	Complimentary	
M	Mar. 18	Phase and group velocity	**Lab#9 – Electron Diffraction**
W	Mar. 20	Uncertainty Principle	
F	Mar. 22	Schröedinger equation	

M	Mar. 25	**Exam#2 – Particle/Wave Physics**	**Lab#10 – Photon Counting**
W	Mar. 27	*Easter Recess*	
F	Mar. 29	*Easter Recess*	
M	Apr. 01	*Easter Recess*	
W	Apr. 03	Infinite square well	
F	Apr. 05	Hydrogen Atom, Angular momentum & quantum numbers	
M	Apr. 08	Energy splitting and the g factor	**Lab#11 – X-ray diffraction**
W	Apr. 10	Zeeman effect	
F	Apr. 12	Anomalous Zeeman effect and Lande g	
M	Apr. 15	**Exam#3 – Quantum Physics**	**Lab#12 – TBD**
W	Apr. 17	Elementary Particles	
F	Apr. 19	Conservation Laws	
M	Apr. 22	Nuclear Physics, Radioactive Decay	**LAB – Paper presentation**
W	Apr. 24	Fission, Fusion	
F	Apr. 26	Semester Review	