Montgomery County Community College
PHY 153
Modern Physics
(For Science Major)
3-3-0

COURSE DESCRIPTION:
A one-semester course covering an introduction to the basic concepts underlying modem physics. Topics include the theories of Special Relativity and Quantum Mechanics with emphasis on the physical phenomena and experiments that led up to the origin of these theories. The course continues through a study of the applications of quantum mechanical theories to specialized areas of modem physics, such as atomic structure, lasers, physics of solids, and nuclear physics. In addition to lectures and problem solving, the course will make use of computer facilities and software to permit the student to observe and experience simulations of realistic numerical problems in the field of modem physics. This course is subject to a course fee. Refer to http://mc3.edu/adm-fin-aid/paying/tuition/course-fees for current rates.

REQUISITES:
Previous Course Requirements
- PHY 152 Principles of Physics II
- MAT 201 Calculus & Analytic Geometry II

Concurrent Course Requirements
None

LEARNING OUTCOMES Upon successful completion of this course, the student will be able to:	LEARNING ACTIVITIES	EVALUATION METHODS
1. Recognize the theoretical foundations and experimental observations that form the basis of modem physics.	Lecture Small Group Discussions Computer-Based Simulations Demonstrations AV/Multimedia Materials Daily Reading	Problem Solving Assignments Section Exams Comprehensive Final Exam

LEARNING OUTCOMES	LEARNING ACTIVITIES	EVALUATION METHODS
2. Describe the dichotomy between classical and modem physics and the reconciliation from a new theoretical perspective.	Lecture Small Group Discussions Computer-Based Simulations Demonstrations AV/Multimedia Materials Daily Reading Section Exams	Problem Solving Assignments Section Exams Comprehensive Final Exam
3. Explain how the process of theory formulation depends both on creative independent thought and building on earlier work.	Lecture Small Group Discussions Computer-Based Simulations Demonstrations AV/Multimedia Materials Daily Reading	Problem Solving Assignments Section Exams Comprehensive Final Exam
4. Apply Einstein's theory of special relativity to solve problems in relativistic mechanics.	Lecture Small Group Discussions Computer-Based Simulations Demonstrations AV/Multimedia Materials Daily Reading	Problem Solving Assignments Section Exams Comprehensive Final Exam
5. Recognize the basic physical principles behind the operation of current technologies.	Lecture Small Group Discussions Computer-Based Simulations Demonstrations AV/Multimedia Materials Daily Reading	Problem Solving Assignments Section Exams Comprehensive Final Exam
6. Describe phenomena associated with the structure of nuclei and radioactivity.	Lecture Small Group Discussions Computer-Based Simulations Demonstrations AV/Multimedia Materials Daily Reading	Problem Solving Assignments Section Exams Comprehensive Final Exam

LEARNING OUTCOMES	LEARNING ACTIVITIES	EVALUATION METHODS
7. Apply elements of quantum mechanics to solve problems involving wave functions, uncertainty principles and Schrodinger's Equation.	Lecture Small Group Discussions Computer-Based Simulations Demonstrations AV/Multimedia Materials Daily Reading	Problem Solving Assignments Section Exams Comprehensive Final Exam
8. Explain various models of the hydrogen atom and the quantization of atomic energy levels.	Lecture Small Group Discussions Computer-Based Simulations Demonstrations AV/Multimedia Materials Daily Reading	Problem Solving Assignments Section Exams Comprehensive Final Exam
9. Describe the nature of currently-known elementary particles and the experiments related to them.	Lecture Small Group Discussions Computer-Based Simulations Demonstrations AV/Multimedia Materials Daily Reading	Problem Solving Assignments Section Exams Comprehensive Final Exam

At the conclusion of each semester/session, assessment of the learning outcomes will be completed by course faculty using the listed evaluation method(s). Aggregated results will be submitted to the Associate Vice President of Academic Affairs. The benchmark for each learning outcome is that *70% of students will meet or exceed outcome criteria*.

SEQUENCE OF TOPICS:

1. Einstein's Principle of Relativity
2. Lorentz Transformations
3. Relativistic Quantities
4. Quantum Mechanics
5. Wave-Particle Duality of Light
6. Quantum Nature of Matter
7. de Broglie Hypothesis and Quantum Principles
8. Heisenberg Uncertainty Principle
9. Schrodinger Equation
10. One Dimensional Solutions to Schrodinger's Equation
11. Three Dimensional Solution to Schrodinger's Equation
12. Atomic Structure
13. Maxwell-Botzman Distribution (classical)
14. Quantum Statistics
15. Sold State and Nuclear Topics

LEARNING MATERIALS:
Required Textbook:
Serway, Moses, and Moyer (2004). Modern Physics, 3rd ed. Thomson Publishing (ISBN: 0534493394)
Recommended Reference:
Tipler and Llewellyn (2012). Modern Physics, 6th ed. W.H. Freeman and Company.
Physics Computer Lab (Science Center 216/217)
The Brendlinger Library (Central Campus)
Tutorial Services

Other learning materials may be required and made available directly to the student and/or via the College's Libraries and/or course management system.

Course Approval:

Prepared by: Thomas French, Assistant Professor of Physics	Date: 4/28/1998
Revised by: Thomas French, Assistant Professor of Physics	Date: 3/12/2013
VPAA/Provost or designee Compliance Verification:	
Victoria L. Bastecki-Perez, Ed.D.	Date: 4/14/2013
Revised by: Debbie Dalrymple	Date: 6/27/2016
VPAA/Provost or designee Compliance Verification:	
Victoria L. Bastecki-Perez, Ed.D.	Date: 6/27/2016

This course is consistent with Montgomery County Community College's mission. It was developed, approved and will be delivered in full compliance with the policies and procedures established by the College.