Montgomery County Community College
PHY 151
Principles of Physics I
(Calculus-based)
4-3-3

COURSE DESCRIPTION:
This calculus-based course, designed for physical science majors, presents in depth an experimental and analytical study of Newtonian mechanics and thermal physics, emphasizing one- and two-dimensional kinematics, dynamics, work and energy, conservation theorems, linear and angular momentum, collisions, rotational dynamics, statics, fluid mechanics, thermal properties of materials, laws of thermodynamics, kinetic theory of ideal gases, calorimetry, Carnot cycle, heat engines, and heat pumps. 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
None

Previous or Concurrent Course Requirements
MAT 189 Calculus with a Review of Functions II OR MAT 190 Calculus and Analytic Geometry I

LEARNING OUTCOMES Upon successful completion of this course, the student will be able to:	LEARNING ACTIVITIES	EVALUATION METHODS
1. Recognize basic physical quantities and the units associated with them.	Lecture Small Group Discussions Laboratory Experiments Demonstrations AV/Multimedia Materials Daily Reading Problem-Solving Assignments	Homework/Quiz Laboratory Report Section Examinations Final Exam
2. Explain how various physical quantities are related to each other.	Lecture Small Group Discussions Laboratory Experiments Demonstrations AV/Multimedia Materials Daily Reading Problem-Solving Assignments	Homework/Quiz Laboratory Report Section Examinations Final Exam

LEARNING OUTCOMES	LEARNING ACTIVITIES	EVALUATION METHODS
3. Describe and use the scientific method as applied to problems in classical physics.	Lecture Small Group Discussions Laboratory Experiments Demonstrations AV/Multimedia Materials Daily Reading Problem-Solving Assignments	Homework/Quiz Laboratory Report Section Examinations Final Exam
4. Use the basic physical principles to solve practical problems.	Lecture Small Group Discussions Laboratory Experiments Demonstrations AV/Multimedia Materials Daily Reading and Problem-Solving Assignments	Homework/Quiz Laboratory Report Section Examinations Final Exam
5. Solve physics-related problems in a rigorous and orderly manner.	Lecture Small Group Discussions Laboratory Experiments Demonstrations AV/Multimedia Materials Daily Reading Problem-Solving Assignments	Homework/Quiz Laboratory Report Section Examinations Final Exam
6. Recognize the basic physical principles behind the operation of current technologies.	Lecture Small Group Discussions Laboratory Experiments Demonstrations AV/Multimedia Materials Daily Reading Problem-Solving Assignments	Homework/Quiz Laboratory Report Section Examinations Final Exam
7. Devise, perform, and analyze properly controlled experiments to test hypotheses.	Lecture Small Group Discussions Laboratory Experiments Demonstrations AV/Multimedia Materials Daily Reading Problem-Solving Assignments	Homework/Quiz Laboratory Report Section Examinations Final Exam

LEARNING OUTCOMES	LEARNING ACTIVITIES	EVALUATION METHODS
8. Use experimental evidence to form tentative interpretations and conclusions.	Lecture Small Group Discussions Laboratory Experiments Demonstrations AV/Multimedia Materials Daily Reading Problem-Solving Assignments	Homework/Quiz Laboratory Report Section Examinations Final Exam
9. Assign meaningful measurement uncertainties and identify reasonable sources of experimental error.	Lecture Small Group Discussions Laboratory Experiments Demonstrations AV/Multimedia Materials Daily Reading Problem-Solving Assignments	Homework/Quiz Laboratory Report Section Examinations Final Exam
10. Communicate experimental results through written lab reports.	Lecture Small Group Discussions Laboratory Experiments Demonstrations AV/Multimedia Materials Daily Reading Problem-Solving Assignments	Homework/Quiz Laboratory Report Section Examinations Final Exam
11. Use basic laboratory equipment in a safe and appropriate manner.	Lecture Small Group Discussions Laboratory Experiments Demonstrations AV/Multimedia Materials Daily Reading Problem-Solving Assignments	Homework/Quiz Laboratory Report Section Examinations Final Exam
12. Interpret the graphical representation of various physical quantities.	Lecture Small Group Discussions Laboratory Experiments Demonstrations AV/Multimedia Materials Daily Reading Problem-Solving Assignments	Homework/Quiz Laboratory Report Section Examinations 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. Describing Motion
2. Freely Falling Bodies
3. Vectors
4. 2-Dimensional Motion
5. Newton's Laws of Motion
6. Friction
7. Work and Energy
8. Work-Energy Theorem
9. Conservation of Energy
10. Linear momentum
11. 1- and 2-Dimensional Collisions
12. Rotational Motion
13. Newton’s Law of Gravitation, and Kepler’s Laws
14. Circular Motion
15. Static Equilibrium
16. Rotational Dynamics
17. Mechanical Properties of Solids
18. Fluid Mechanics
19. Temperature and Thermal Expansion
20. Ideal Gas Law
21. Calorimetry
22. Heat Engines

SEQUENCE OF EXPERIMENTS:

1. Measurement
2. Acceleration Due to Gravity
3. Vector Addition
4. Projectile Motion
5. Newton's 2nd Law
6. Friction
7. Work-Energy Theorem
8. Conservation of Energy
9. 1-Dimensional Collisions
10. 2-Dimensional Collisions
11. Centripetal Force
12. Statics
13. Thermal Expansion
14. Latent Heat of Liquid Nitrogen

LEARNING MATERIALS:

Textbook:

Serway & Jewett. (2010). *Physics for Scientists and Engineers* (9th ed.).
Brooks/Cole CENGAGE Learning
PHY151 Laboratory Manual
Physics Computer Lab (Science Center 216)
Tutorial Services
Scientific calculator (logarithms, exponential, powers, roots, etc.)

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: 4/11/2006
Revised by: Thomas French, Assistant Professor of Physics Date: 2/6/2009
VPAA/Provost Compliance Verification: Dr. John C. Flynn, Jr. Date: 9/11/2009

Revised by: Thomas French, Assistant Professor of Physics Date: 6/13/2012
VPAA/Provost or designee Compliance Verification:
Victoria L. Bastecki-Perez, Ed.D. Date: 7/26/2012

Revised by: Xingshu Zhu, Assistant Professor of Physics Date: 2/6/2013
VPAA/Provost or designee Compliance Verification:
Victoria L. Bastecki-Perez, Ed.D. Date: 4/5/2013

Revised by: Evon Martins, Assistant Professor of Chemistry Date: 5/2/2013
VPAA/Provost or designee Compliance Verification:
Victoria L. Bastecki-Perez, Ed.D. Date: 6/17/2013

Revised by: Debbie Dalrymple Date: 6/27/2016
VPAA/Provost or designee Compliance Verification:
Victoria L. Bastecki-Perez, Ed.D. Date: 6/27/2016

Revised by: Thomas French, Assistant Professor of Physics Date: 11/20/2017
VPAA/Provost or designee Compliance Verification: Date: 11/20/2017

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.