Northampton
Community College

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General Education
Foundational Course Categories

Intellectual & Practical Skills
___ Communication
___ Computer Literacy (C)
___ Information Literacy
___ Quantitative Literacy (QL)
___ Writing Intensive (WI)
___ Critical Thinking and Problem Solving

Knowledge of Arts, Cultures and the Natural World
___ AH Arts & Humanities
__X__ SCI Science
___ SIT Societies & Institutions over Time
___ SSHB Scientific Study of Human Behavior
___ D Diversity and Global Awareness

Honors Section Available
___ Yes
__X__ No

COURSE OUTLINE

Course Number: **PHYS 101**

Course Title: **Physics I**

CATALOG DESCRIPTION:

This is an introductory, algebra-based, problem-solving physics course with a lab component. Topics covered are one and two-dimensional motion, forces, Newton's laws, work, power, energy, momentum, rotation, equilibrium, fluids, temperature, and heat.

PREREQUISITES: Prereq. - MATH 140 (College Algebra) with C or better

TOTAL CREDITS 4 **LECTURE HOURS** 3 **LAB HOURS** 2

Prepared by Instructor: W. Doney **Date:** Spring 2020

Date of Original Course: Fall 1967 **Division Dean:** _____
Denise François-Seeney, Ph.D

Date Outline Updated: Spring 2020

1. ***What are the student learning outcomes of this course?*** **(List 3 to 8 course outcomes.)**

Upon completion of this course the student will:

1. Learn basic measurement, estimation, and data collection and analysis
2. Solve 1 & 2-dimensional translational, circular, and rotational motion problems
3. Solve problems involving forces
4. Solve problems applying energy, work, and conservation of energy and momentum
5. Solve problems involving fluids
6. Solve problems involving heat and temperature
7. Perform various group and individual experiments to further investigate topics covered

2. Link the learning outcomes to course content and learning experiences

(1) Using the table below, present a recommended sequenced topical (content) outline. (2) Link the content areas to the course learning outcomes. (3) List suggested learning experiences for students. Feel free to expand the table to accommodate the course.

Student Learning Outcome(s)	Topics to cover	Suggested learning experiences/assignments/activities
1, 7	**Introduction, Measurement, Estimation** 1. Length, Mass, Time, and Force 2. Systems of Units (Metric (SI) & U.S. Customary) 3. Conversion Factors 4. Significant Factors 5. Error	Lecture, homework, quizzes, test, collaborative group lab activities (in class or out of class)
1, 2, 7	**Motion: Kinematics in 1-D** 1. Position, Velocity, Acceleration, and Time 2. Motion at constant acceleration 3. Acceleration due to gravity	Lecture, homework, quizzes, test, collaborative group lab activities (in class or out of class)
1, 2, 7	**Motion: Kinematics in 2-D** 1. Kinematic Equations for 2-D motion with Constant Acceleration 2. Scalar and Vector Quantities 3. Scalar Components of a Vector 4. Vector Addition/Subtraction with Triangle, Polygon, Component Methods 5. Projectile Motion	Lecture, homework, quizzes, test, collaborative group lab activities (in class or out of class)
1, 2, 3, 7	**Newton's Laws of Motion** 1. Newton's First Law 2. Newton's Second law 3. Newton's Third Law 4. Free-body diagrams 5. Friction (Static and Kinetic)	Lecture, homework, quizzes, test, collaborative group lab activities (in class or out of class)
1, 2, 3, 7	**Circular Motion** 1. Angular Position, Angular Velocity, Angular Acceleration, and Time 2. Kinematic Equations for Circular Motion with Constant Angular Acceleration 3. Centripetal Force and Centripetal	Lecture, homework, quizzes, test, collaborative group lab activities (in class or out of class)

	Acceleration 4. Newton's Law of Universal Gravitation 5. Gravity near Earth's surface	
1, 2, 3, 4, 7	**Work and Energy** 1. Work done by constant force 2. Mechanical Energy (Potential and Kinetic) 3. Work-energy Principle 4. Conservation of Mechanical Energy	Lecture, homework, quizzes, test, collaborative group lab activities (in class or out of class)
1, 2, 4, 7	**Linear Momentum** 1. Momentum and relation to force 2. Conservation of Momentum 3. Collisions (one-dimensional, elastic and inelastic)	Lecture, homework, quizzes, test, collaborative group lab activities (in class or out of class)
1, 2, 3, 4, 7	**Rotational Motion** 1. Angular quantities 2. Torque or Moment of a force 3. Rotational dynamics – torque and rotational inertia 4. Rotational Kinetic Energy	Lecture, homework, quizzes, test, collaborative group lab activities (in class or out of class)
1, 3, 7	**Static Equilibrium** 1. Statics 2. Conditions for equilibrium 3. Stability and balance 4. Elasticity; stress and strain	Lecture, homework, quizzes, test, collaborative group lab activities (in class or out of class)
1, 3, 5, 7	**Fluids** 1. Density and specific gravity 2. Pressure in fluids 3. Atmospheric and gauge pressure 4. Pascal's principle 5. Buoyancy and Archimedes' principle 6. Fluids in motion 7. Bernoulli's equation	Lecture, homework, quizzes, test, collaborative group lab activities (in class or out of class)
1, 5, 6, 7	**Temperature** 1. Temperature and thermometers 2. Zeroth Law of Thermodynamics 3. Gas laws and absolute temperature 4. Ideal Gas Law	Lecture, homework, quizzes, test, collaborative group lab activities (in class or out of class)
1, 5, 6, 7	**Heat** 1. Heat as energy transfer 2. Internal Energy 3. Specific Heat 4. Latent Heat 5. Heat Transfer: conduction / convection / radiation	Lecture, homework, quizzes, test, collaborative group lab activities (in class or out of class)
1, 6, 7	**Thermodynamics** 1. First Law of Thermodynamics 2. Second Law of Thermodynamics 3. Carnot's Equations & Carnot's Theorem	Lecture, homework, quizzes, test, collaborative group lab activities (in class or out of class)

Provide a brief (1-2 paragraphs) narrative explanation that elaborates on the content of this table. *Feel free to attach a recommended course schedule/weekly agenda as an appendix.*

See Appendix A.

2. cont. How will each learning outcome be assessed? Link the learning outcomes to assessment.

Using the table below, explain what types of major assignments will demonstrate how and to what extent the students have achieved the learning outcomes. This section should indicate the specific types of student work that will be assessed. Feel free to include both formative and summative assessment methods. Attach any examples of assessments or rubrics as an appendix, if available.

Student Learning Outcome	Suggested Assessment Methods
1, 2, 3, 4, 5, 6, 7	Tests and Quizzes
1, 2, 3, 4, 5, 6, 7	Collaborative group lab activities
1, 2, 3, 4, 5, 6, 7	Individual activities
1, 2, 3, 4, 5, 6	Homework assignments
1, 2, 3, 4, 5, 6, 7	Final Exam

Please include a brief (1-2 paragraphs) narrative explanation that elaborates on the content of the table above. Include which assessments would be included in the student's final grade and the recommended percentages.

Each test and/or quiz will contain problems related to the lecture and/or lab component of the class, assessing the student's knowledge and problem-solving ability. Lab projects and activities require the students to work individually or in small groups (3 max) to use the scientific method to define problems, determine approach to analyzing the problem, analyze the problem through testing and data collection, evaluate the results, and report on the results. Numerous textbook and instructor-created homework problems are assigned that require students to apply what is discussed in lecture in solving these problems.

In all cases, students are assessed on their approach and the process, not just the solution. They are graded on each phase of the process.

The course should have content dispersed into at least four major tests/exams (including the final), quizzes, numerous lab activities, and assigned homework.

EXAM GRADES (75%)

- 4 Exams - cover both in-class and lab work, scheduled approx. every 3-4 Chapters
- Quizzes – may be unannounced
- Homework, as assigned

GROUP/INDIVIDUAL LAB ACTIVITIES (25%)

- lab reports & quizzes, *12 activities minimum*

The following grading system can be used for all graded assignments

A 94 -100	B+ 87 - 89	C+ 77 - 79	D 60 - 69
A- 90 - 93	B 83 - 86	C 70 - 76	F < 60
	B- 80 - 82		

3. Describe and explain recommended classroom methods or teaching approaches an instructor could use to facilitate student learning in this course.

Lecture can be used to introduce, develop, and/or discuss a topic. Guided exercises and problems solved as a class can be used to learn problem solving techniques. Individual and collaborative problem solving and/or lab exercises allow time for students to apply the scientific method to solving problems. It should not be sufficient for students to "just get the answer," but able to explain their solution approach, and interpret the answers in the context of the problems they are solving. Real-life examples and applications should be discussed so that students can appreciate the applications of scientific and mathematical methods/models, and understand why this course is important outside of the classroom. Technology should be used to model, collect data, analyze results, and make decisions about problems, as well as provide additional online resources to support the classroom.

4. Link the course learning outcomes to the student's larger educational experience at NCC.

Do the student learning outcomes for this course link to (select all that apply):

X (A) General Education outcomes (complete section A below);

☐ (B) Program outcomes (complete section B below);

☐ *or* (C) they can stand alone and do not relate to A or B (go on to #6).

Note: Some courses meet both General Education (A) and Program Outcomes (B). If so, complete (A) & (B) below.

(A) General Education outcomes (Check all that apply to this course. Add course learning outcomes next to the appropriate GE outcome. A complete list of GE core outcomes can be found in the addendum attached and in the college catalog.)

	Knowledge of Arts, Cultures & the Natural World	**Student Learning Outcomes**
☐	**ARTS & HUMANITIES**	
	Students should understand both the creative process and how works of human imagination and thought from diverse cultures, places, and times express varieties of human experience.	
☐	**SOCIAL SCIENCE**	
	Students will demonstrate knowledge Societies and Institutions Over time (SIT) and the Scientific Study of Human Behavior (SSHB).	
X	**SCIENCE**	
	Students will demonstrate a working knowledge of scientific principles and concepts and be able to apply them to daily situations.	• Students will explain the scientific method, recognizing the potential for uncertainty in scientific inquiry. • Students will apply basic field and laboratory skills used for collecting and analyzing data according to the particular discipline.

☐	**DIVERSITY AND GLOBAL AWARENESS**	
	Students will demonstrate an understanding of human diversity and an awareness of global issues through analysis of arts, histories, cultures, geographies, economics, medicine, scientific data and/or institutions	
☐	**Intellectual and Practical Skills**	
☐	**COMMUNICATION**	
	Students will present and support ideas in an organized and coherent manner consistent with the intended audience and purpose in both speaking and writing.	• Students will identify, analyze, and choose supporting materials in written and spoken communication. • Students will organize information with a central idea or thesis. • Students will differentiate among various audience needs in word choice, level of explanation, and method of presentation.
☐	**COMPUTER LITERACY**	
	Students will use computer technology as a tool for communication and productivity both professionally and personally.	• Students will demonstrate knowledge of computer concepts and terminology. • Students will create, store, retrieve, and print formatted documents. • Students will evaluate ethical uses of technology.
☐	**INFORMATION LITERACY**	
	Students will demonstrate research skills in gathering, evaluating, and using information.	
☐	**QUANTITATIVE LITERACY**	
	Students will interpret and analyze quantitative data to solve problems.	• Students will interpret, analyze, and draw conclusions about data presented as words, abstract symbols, tables or graphs. • Students will use mathematics to model events and solve problems. • Students will communicate using mathematical language, symbols, data, and graphs.
☐	**CRITICAL THINKING AND PROBLEM SOLVING**	
	Students will think critically and propose solutions to open-ended problems.	• Students will analyze and evaluate information, ideas and arguments in order to form conclusions. • Students will design and evaluate a plan that addresses an open-ended problem.

(B) Program outcomes – please list as printed in the current college catalog

If this course fulfills the requirements for a particular major or area of study, then indicate how each course outcome directly links with the program-level outcomes presented in the college catalog. Using the table below, list the specific program-level outcomes next to each course learning outcome. Expand the table to accommodate the number of learning outcomes for the course.

Course learning outcome	*Program level outcome*

5. If this course is designated as a writing intensive course, complete this section. If not, proceed to section 6.

To be granted a writing-intensive designation, a course must have the following characteristics:

- the course must have as one of its central stated outcomes the development of a student's ability to communicate in writing within the course's discipline;
- the majority of all assessed work should be in the form of a series of written assignments (not a collection of short-answer paragraphs) that produce at least twelve pages (three thousand words) of finished student work;
- at least half of the writing assessed should require the use and incorporation of appropriate source materials appropriately retrieved and documented;
- the writing in the course should show evidence of critical reading and critical thinking skills in sustained discourse appropriate to the student's academic or professional field;
- the course plan or syllabus, statements of instructional method, and individual assignments should incorporate such writing development strategies as thesis development plans, office conferences, drafts and revisions to emphasize the process of writing as well as the product.

Describe the elements of the course that demonstrate how the characteristics listed above are going to be met.

6. ***What instructional resources will be used?***

Include texts, lab manuals, study guides, software and all other <u>required</u> materials and supplies or library sources.

Text: College Physics by OpenStax (Rice University).

Suggested Supplies: Scientific calculator, flash/thumb drive.

Lab Manual: PHYS 101 LAB MANUAL, Developed by NCC's Physics Department.

Tutoring: supplemental help and on-on-one tutoring is available in NCC's Learning Center.

Web Resources:

Instructor website: www.WilliamDoney.com/physics/index.htm
Publisher's website: www.PrenHall.com
Learning Management System: Blackboard course shell

APPENDIX A

Sample Course Schedule of Topics

(lab activities to be included to align with topics)

Week	Topics/Chapters Covered	Exam
1	Welcome & Ch 1 Introduction	**1**
2	Ch 2 Kinematics in One Dimension	
3	Ch 2 (cont.)	
4	Ch 3 Kinematics in Two Dimensions	
5	Ch 4 Motion and Force: Dynamics	**2**
6	Ch 4 (cont.)	
7	Ch 5 Circular Motion and Gravitation	
8	Ch 6 Work and Energy	
9	Ch 6 (cont.)	
10	Ch 7 Linear Momentum	**3**
11	Ch 8 Rotational Motion	
12	Ch 9 Bodies in Equilibrium	
13	Ch 10 Fluids	**4**
14	Ch 13 Temperature	
15	Ch 14 Heat	
16	Ch 15 Laws of Thermodynamics	
FINAL	**TBD**	

General Education Core Goals and Learning Outcomes (2011)

I. Knowledge of Arts, Cultures and the Natural World

ARTS & HUMANITIES

Goal: Students should understand both the creative process and how works of human imagination and thought from diverse cultures, places, and times express varieties of human experience.

Learning Outcomes:

- Students will discuss, analyze and interpret works that confront, express, and examine human experience.
- Students will describe and explain the ways that language, literature, philosophy, or the visual and performing arts challenge or reinforce specific cultural or historic values and conditions.

SOCIAL SCIENCE

Goal: Students will demonstrate knowledge of societies and institutions over time (SIT) and the scientific study of human behavior (SSHB).

Learning Outcomes:

- Students will identify and apply social science theories and concepts to behavioral or societal issues. (SIT & SSHB)
- Students will explain how a social science discipline describes and analyzes social change or human behavior.
- Students will describe how people's experiences and perspectives are shaped by sex, gender, ethnicity, class, age, race, culture and other factors.

Note: Social science courses must address the first outcome and one of the two remaining outcomes.

SCIENCE

Goal: Students will demonstrate a working knowledge of scientific principles and concepts and be able to apply them to daily situations.

Learning Outcomes:

- Students will explain the scientific method, recognizing the potential for uncertainty in scientific inquiry.
- Students will apply basic field and laboratory skills used for collecting and analyzing data according to the particular discipline.

DIVERSITY AND GLOBAL AWARENESS

Goal: Students will demonstrate an understanding of human diversity and an awareness of global issues through analysis of arts, histories, cultures, geographies, economics, medicine, scientific data and/or institutions.

Learning Outcomes:

- Students will discuss and explain how the diverse range of human differences influences the historical and current formation of artistic, economic, social, scientific, cultural or political institutions.
- Students will examine how the range of human differences influences each individual's experience of equality and inequality within a society, its institutions, or its cultures.

- Students will analyze how individuals and institutions have addressed persistent global challenges.

Note: to carry a diversity designation, the course needs to address at least one of the three outcomes.

II. Intellectual and Practical Skills

COMMUNICATION

Goal: Students will present and support ideas in an organized and coherent manner consistent with the intended audience and purpose in both speaking and writing.

Learning Outcomes:

- Students will identify, analyze, and choose supporting materials in written and spoken communication.
- Students will organize information with a central idea or thesis.
- Students will differentiate among various audience needs in word choice, level of explanation, and method of presentation.

COMPUTER LITERACY

Goal: Students will use computer technology as a tool for communication and productivity both professionally and personally.

Learning Outcomes:

- Students will demonstrate knowledge of computer concepts and terminology.
- Students will create, store, retrieve, and print formatted documents.
- Students will evaluate ethical uses of technology.

QUANTITATIVE LITERACY

Goal: Students will interpret and analyze quantitative data to solve problems.

Learning Outcomes

- Students will interpret, analyze, and draw conclusions about data presented as words, abstract symbols, tables or graphs.
- Students will use mathematics to model events and solve problems.
- Students will communicate using mathematical language, symbols, data, and graphs.

INFORMATION LITERACY

Goal: Students will demonstrate research skills in gathering, evaluating, and using information.

- Students will locate and identify information
- Students will evaluate source information and incorporate it into their work.
- Students will use source information in an ethical and legal fashion.

CRITICAL THINKING AND PROBLEM SOLVING

Goal: Students will think critically and propose solutions to open-ended problems.

Learning Outcomes:

- Students will analyze and evaluate information, ideas and arguments in order to form conclusions.
- Students will design and evaluate a plan that addresses an open-ended problem.

Note: To carry a critical thinking designation, the course must address at least one of the two outcomes.