Mt. San Jacinto College
Integrated Course Outline of Record

Form B

Submitted by: Mark Maier **Date:** 11/14/2019

Department	Subject	Course Number	Title
Physics	Physics PHY	102	Basic Electricity and Modern Physics

Units/Hours

Each lecture unit requires 1 hour per week of class time, and 2 hours per week of study outside of class.
Each laboratory unit requires 3 hours per week of class time.
Each activity unit requires 2 hours per week of class time and 1 hour per week of study outside of class.

Lecture Units	Lab Units	Total Units
3.00	1.00	4.00
Lecture Contact Hours	**Lab Contact Hours**	**Total Contact Hours**
48.00 - 54.00	48.00 - 54.00	96.00 - 108.00
Lecture Homework Hours	**Lab Homework Hours**	
96.00 - 108.00	0	

Stand Alone:

Program Applicable

AA/AS Degree General Ed Breadth Area(s):

A NATURAL AND PHYSICAL SCIENCES

General Education Justification:

This course is the second semester of a year long algebra based physics sequence. The course satisfies the GELO 4 (The student will analyze and explain issues in quantitative terms using college-level mathematical concepts and methods, where appropriate). A typical example: One of the topics covered in Physics 102 is series and parallel circuits. Students have to be able to recognize what kind of circuit they are dealing with, they have to produce the proper equations used to analyze the circuits, and they have to be able to solve those equations using all the problem solving techniques they learned in algebra. Additional GELO's that apply to the class include: GELO 1: Students examine complex issues and discover the connections and correlations among ideas to advance toward a valid independent conclusion (Examples include how relativistic concepts revert back to Newtonian mechanics at low velocity). GELO 2: Analyze real or potential problems and develop, evaluate, and test possible solutions and hypotheses using the scientific method where appropriate (The physics laboratory is an example of how this GELO is applied). GELO 5: Apply their knowledge and skills to new and varied situations (Students do this by solving new problems). GELO 6: Apply technology competently, selecting and using tools appropriate to the task(Students need to select the appropriate tools when completing labs).

Maximum Enrollment: 32

Maximum Enrollment Justification: Justification:

Grading Method: Letter Grade or P/NP

TOP code: 1902.00

Can be Taken 1 **time(s) for credit** (max 4)

- Visual or Performing Arts course that is required to meet major requirements for UC/CSU
- Intercollegiate athletics course
- Academic/vocational competition course

Catalog Description:

(Please do not refer to transferability or degree, certificate, or employment concentration applicability. Please only describe the course).
(**75 words** or less in gray box below).

This course facilitates the study of various topics in physics including thermodynamics, electromagnetism, DC circuits, optics and modern physics while focusing on the student's development of technical problem solving skills, vocabulary and the ability to read and understand scientific literature.

Schedule Description:

(Please do not refer to transferability or degree, certificate, or employment concentration applicability. Please only describe the course).
(**25 words** or less in gray box below).

This course covers thermodynamics, electromagnetism, DC circuits, optics and modern physics.

Need for the course:

This course is an introduction to the physics of thermodynamics, electromagnetism, optics and modern physics at a level not requiring calculus. It satisfies the science requirement for students seeking a general education transfer to a 4-year college or university.

Prerequisite(s):

Prerequisites go through a separate approval process. See Forms E1-E6 for details.
(For further clarification, contact the Prerequisite Subcommittee)

- PHY 101 with a Grade of C or better.

Corequisite(s):

Corequisites go through a separate approval process. See Forms E1-E6 for details.

-none-

Recommend Preparation:

Recommended Preparation goes through a separate approval process. See Forms E1-E6 for details.

-none-

Other Enrollment Criteria:

-none-

Learning Objectives:

(please number each objective and express in behavioral terms)

Upon the completion of the course the student will be able to do the following:

1. Analyze physical systems by employing the fundamental laws governing electricity and magnetism.
2. Analyze and solve a variety of problems relating to thermodynamics and electromagnetism.
3. Make precise measurements using simple laboratory instruments including but not limited to pressure gauges, VOM meters, electric power supplies and oscilloscopes.
4. Operate computer based data acquisition systems.
5. Analyze and interpret laboratory data using calculator and computer based analytic and graphing applications as needed.
6. Write clear and comprehensive laboratory reports.
7. Examine and utilize physics terminology effectively and correctly.
8. Analyze the concept of special relativity and its impact on modern society.
9. Analyze the concepts behind quantum physics and understand how these have contributed to business and major technological developments.
10. Relate the practical knowledge learned in the course to the writing of a scientific article.

Course Content:

(please number the outline of main topics and subtopics)

1. Thermodynamics
    1. The ideal gas law
    2. The kinetic theory of gases
    3. Temperature and the zeroth law of thermodynamics
    4. The first law of thermodynamics
    5. The second law of thermodynamics
    6. Heat engines
    7. Entropy
2. Electricity
    1. Statics, electric forces and fields, electrostatic potential.
    2. Kirchoff's Laws.
    3. Capacitance.
3. Magnetisim
    1. Fields and Dipoles.
    2. Induced currents and fields.
    3. Inductance.
    4. Transformers, alternating current theory.
4. Relativity
    1. Moving reference frames.
    2. Michelson-Morley Experiment.
    3. Time dilation, Lorentz contraction.
5. Quantum Mechanics
    1. Concept of quantization and reasons for it.
    2. Uncertainty principles.
6. Atomic structure and the Periodic Table.
    1. Historical developement.
    2. Atomic energy levels, Bohr orbits.
    3. Electronic spin.
7. Nuclear structure.
    1. Nuclear models.
    2. Radioactivity.
    3. Fission, Fusion
    4. Particle accelerators.
8. Optics

1. Nature and Propagation of Light, geometric optics, interference, diffraction

Lab Content:

(please number the outline of main topics and subtopics)

I. Measurments and uncertainty
    1. Significant figures
    2. Error analysis
II. Proper use of simple laboratory equipment
    1. Meter stick
    2. Scales
    3. Calipers
III. The computer based laboratory
    1. Opening data collection programs
    2. Setting up experimental equipment and sensors
    3. Calibrating sensors
    4. Taking data.
    5. Analyzing data with software programs such as Microsoft Excel
IV. The laboratory report

Methods of Instruction:

Methods of instruction may include, but are not limited to the following:

- **Method:** Observation and Demonstration
  Integration: The student will demonstrate and analyze problem solving strategies in physics (learning objective 2).
- **Method:** Lab Activities
  Integration: The student will perform laboratory experiments of selected physics phenomenon including error analysis and a written report (learning objectives 3, 4, 5 and 6).
- **Method:** Discussion
  Integration: The student will demonstrate and interactively discuss the fundamental laws of physics (learning objective 1).

Methods of Evaluation:

A student's grade shall be determined by the instructor using multiple measures of performance related to the course objectives. Methods of evaluation may include but are not limited to the following:

- **Method:** Homework
  Integration: Students will take quizzes on homework assignments involving similar analysis as in the examinations
- **Method:** Exams/Tests
  Integration: A minimum of 4 examinations will be given, requiring analysis of various physical systems, derivation of a mathematical description of each, solution of the resultant equations and physical interpretation of the result.
- **Method:** Lab work
  Integration: Students will prepare laboratory reports which demonstrate the student's ability to make precise measurements, analyze the collected data, interpret the results and perform appropriate error analysis in a concise and clear manner.

Examples of Assignments:

Students will be expected to understand and critique college level texts or the equivalent. Reading and writing, as well as out of class assignments are required. These assignments may include but are not limited to the following:

1. Complete physics related problems. Examples include but are not limited to:
    1. How much heat must be added to 0.45 kg of aluminum to change it from a solid at 130 ? to a liquid at 660 ? (its melting point)? The latent heat of fusion for aluminum is 4.0x105 J/kg.
    2. An electron and a proton are initially very far apart. They are then brought together to form a hydrogen atom, in which the electron orbits the proton at an average distance of 5.29x10-11 m. What is the change in the electric potential energy?
2. Complete comprehensive laboratory reports after analyzing a given physical system, such as determining the accelaration due to gravity.

Textbooks:

- John D. Cutnell; Kenneth W. Johnson; David Young; Shane Stadler (2018). *Physics* Wiley. ISBN: 9781119391883, 11193

Other Resources:

- Pasco Scientific. Lab Manual. PASCO Scientific , 01-01-2018.

Minimum Qualification

- Physics/Astronomy (Masters Required)