Mt. San Jacinto College
Integrated Course Outline of Record

Form B

Submitted by: Anthony DiMauro **Date:** 05/14/2020

Department	Subject	Course Number	Title
Physics	Physics PHY	100	Physical Science in Modern Society (formerly Conceptual 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	Total Units
3.00	3.00
Lecture Contact Hours	**Total Contact Hours**
48.00 - 54.00	48.00 - 54.00
Lecture Homework Hours	
96.00 - 108.00	

Stand Alone:

Program Applicable

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

A NATURAL AND PHYSICAL SCIENCES

General Education Justification:

Physics 100 examines and analyzes the properties of the physical universe and their interactions (GELO 1,3). To do this it must examine the intereactions of energy, matter, and motion, on scales from the atomic level to the size of the observable universe, and ranging from everyday siutations to theoretical scientific settings (GELO 1,3). The study of physics enables our understanding of natural phenomena, and is the basis for the fields of biology, chemistry, geology, and astronomy (GELO 5). Emphasis is placed on understanding and use of the scientific method which involves proposing and testing hypotheses to establish an understanding of the physical universe and our place in it (GELO 2,3,5). The content of this course, as outlined above, is consistent with the intent of General Education Area A: Natural and Physical Sciences.

Maximum Enrollment: 40

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 provides a conceptual introduction to the basic physics and chemistry in the Modern World. Effects of technology on individuals and human society. Examines natural phenomena and human-directed technology encountered in daily life from a physical science perspective. Topics may include: mechanics, electricity and magnetism, optics, sound, quantum and nuclear physics, properties of matter, chemical reactions, atomic theory.

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 provides a conceptual introduction to the basic physics and chemistry of in the Modern World

Need for the course:

This course is an introduction to the science of physics and chemistry at a conceptual level integrated with larger ideas and satisfies an elective in the area of science for students transferring to four-year universities or colleges.

Prerequisite(s):

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

-none-

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 and interpret data, apply standards to solve problems, seek and discriminate relevant information, use logical reasoning, make predictions, collaborate and communicate ideas, and transform knowledge necessary for scientific inquiry.
2. Demonstrate the Problem-solving process (diagram, analyze, use mathematical reasoning, explain, and solve) for simple physical science problems from the core physical science concepts.
3. Analyze natural and human created phenomena and technology encountered in daily life from a physical science perspective.
4. Analyze the physics and chemistry of energy resources (thermal, kinetic, potential, chemical, nuclear, its storage and use, primary sources of energy (fossil fuel, nuclear, wind and solar) and their relative effects on the environment.
5. Analyze the effects of physical science and technology on individuals and human society.
6. Utilize computer software and electronic probes to acquire and analyze digital data and assess error.
7. Utilize technology to create short reports that integrate and explain the basic physics and chemistry principles with modern technology on individuals and human society.

Course Content:

(please number the outline of main topics and subtopics)

1. **What is Science**
    1. Mathematics, the language of science - A conceptual approach
    2. Scientific Measurements - The importance of Accuracy, Precision and Error.
    3. Scientific Method - How science is performed by scientists. Research, Collaboration and Communication.
2. **Integrated Physics Concepts**
    1. Newtonian Classical Mechanics
        1. Linear Motion
            1. Displacement, Velocity, Acceleration v=d/t, a=v/t
            2. Basic Linear Motion in one dimension.
        2. Forces and Momentum
            1. F=ma
            2. Net Forces on an object
            3. Momentum and Conservation of Momentum
        3. Energy
            1. Kinetic and Potential Energy
            2. Conservation of Energy
        4. Wave Motion
            1. Sound and Harmonics
            2. Transverse and Longitudinal Waves
            3. The Doppler Effect
    2. Thermodynamics
        1. Heat Transfer Mechanisms
            1. Conduction, Convection and Radiation
    3. Fluid Mechanics
        1. Pascall's Principle
        2. Archimedes's Principle
        3. Bernoullis's Principle
    4. Gravitation
    5. Electricity and Magnetism
        1. Electric Charges, Forces and Fields
        2. Simple DC Circuits
        3. Magnetism
        4. Magnetic Induction
    6. Light and Optics

1. Electromagnetic Spectrum
2. Light Waves and Photons
3. Image formation on and in Mirrors and Lenses

1. Atomic and Nuclear Physics
    1. Atomic Interactions (Electron transitions)
    2. Nuclear Physics
        1. The Atomic Nucleus and the Strong Force
        2. Environmental Radiation
        3. Nuclear Fission and Fusion
2. Modern Aspects of Quantum Physics
    1. Ultraviolet Catastrophe
    2. Photoelectic Effect

1. **Integrated Chemistry Principles**

    1. **Structure of Matter**
        1. Atoms and Molecules
        2. Elements and Compounds
        3. Phases of Matter
    2. Atomic Theory
        1. Protons, Neutrons and Electrons
        2. Electron Transitions
        3. Line Spectra

1. **Integration of Physics and Chemistry Concepts in Modern Technology and Human Society (Instructor chooses relevant topics below associated with their instruction and integrate the physics and chemistry principles above involved in the topic.)**

    1. **Human Body**
        1. Hearing - Vibrations, Waves, Sound, Harmonics, Transverse and Longitudinal Waves, Wave Speed
        2. Seeing - Light, Color, Optics, Lenses, Ray Diagrams, Refraction, Diffraction, Dispersion
        3. Nervous System- The Action Potential, Charged Ions, Electric Charges, Forces and Fields, Capacitors, Gases
        4. Respiration - Atoms, Molecules, Chemical Reactions, Motion (Blood Flow), Velocity
        5. Muscle Movement - Forces, Force Diagrams, Power, Momentum,
        6. Digestion - Chemical Bonding, Chemical Reactions, Acids and Bases
    2. **The Environment**
        1. Weather - The Water Cycle, Rain, Phases of Matter, Condensation, Heat, Gases, Heat Transfer, Convection, Radiation
        2. Climate Change - Global Warming, Atmosphere, Gases, Molecules, Chemical Bonding, Chemical Reactions, Greenland Ice Core Drilling,
        3. Urban Pollution, Chemical Reactions, Gases, Carbon Capture,
        4. Oceans - Thermolhaline Circulation, Wave motion, Tides,
        5. Power Generation - Coal, Gas, Solar, Wind, Hydropower, Biomass,
    3. **Modern Society**
        1. Transportation - Mass transit, personal transport (autos, e-bikes, electric cars, hydrogen power)
        2. Telecommunications - Internet
        3. Computers -
        4. Home Appliances - Coffee Maker power rating, Microwave vs Convection Oven, Modem and WiFi -electromagnetic signals
        5. Medical Technologies - Ultrasound Therapy and Diagnosis, Radiation Therapy and Diagnosis, PET Sca, X-rays Machine, CAT Scans, Dental Technologies,
        6. Entertainment -

7. Energy Sources - Power generation from: Nuclear, Coal, Natural Gas, Wind, Solar, Hydro, Biomass
8. Telecommunications - GPS, Satellite, WiFi, bluetooth signals, Fiber Optics
9. Sports Science - Weight lifting, running, yoga,
10. Urban Architecture
11. City Planning and Development

4. **Space and Space Exploration**
    1. Rocketry - Fuel systems
    2. Space Probes
    3. Solar System Dynamics

Methods of Instruction:

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

- **Method:** Lecture
  Integration: Lecture with visual aids will be used illustrate how to perform topics such as how to use the problem solving process.
- **Method:** Discussion
  Integration: Discussion of Physics principles that directly effect their everyday lives; i.e. the physics involved in hearing or feeling.
- **Method:** Homework
  Integration: Homework: exercises and problems at the end of each textbook chapter designed to reinforce learning concepts. Or instructor selected questions and problems that are relevant to modern society and technology.
- **Method:** Physics Demonstrations
  Integration: Physical Demonstrate of the physical principles such as wave motion through the use of wave propagation machines and computer animations.
- **Method:** Film/video Viewing and Discussion
  Integration: Films/videos emphasizing the relevance of physics to society and everyday activities.
- **Method:** Group Projects
  Integration: Students get in small groups, select a debate topic and debate another group. Students use physics and chemistry concepts to argue their points.
- **Method:** Lab Activities
  Integration: Lab Activities will be utilized allowing students to to students to perform activities with digital probes to acquire data and analyze that data in informal lab exercises.

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:** Exams/Tests
  Integration: Exams/tests requiring student analysis of physical situations and utilization of appropriate mathematical operations to evaluate student mastery of course objectives such as demonstrating the problem-solving technique and analyzing the effects of physical science and technology on individuals and society. Exam/tests designed to produce results conducive to evaluation. Evaluation outcomes dependent on accuracy of student responses. Emphasis placed on multi-chapter content (as opposed to quizzes which focus on single chapter material).
- **Method:** Quizzes
  Integration: Quizzes requiring student analysis of physical situations and utilization of appropriate mathematical operations to evaluate student mastery of course objectives 1-10. Quizzes designed to produce results conducive to evaluation. Evaluation outcomes dependent on accuracy of student responses. Emphasis placed on single-chapter content (as opposed to exams/tests which focus on multi-chapter material).
- **Method:** Papers
  Integration: A term paper focusing on a topic from course objectives 8-9 in which students demonstrate the

ability to synthesize related lecture and chapter materials. Term papers produce measurable results by demonstrating student achievement of course objectives. Evaluation based on accurate and original content.

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. **Reading Assignments** from the text and related material from the web.
    1. Students should read the appropriate material about the physical science concepts from the required reading each session.
    2. Students will also be given or must search for related material that includes integrating the physical science concept with 'everyday' uses or larger ideas.

2. **Homework Assignments**
    1. Students will be given basic assignments to relate the physics and chemistry principles to everyday appliances, modern technologies or concepts.
        1. What are the physcial science princilas in a total body workout?
        2. What are the physical science principles that a sonographer must know to provide a patient with the best care?
        3. What are the problems associated with heating a home efficiently?
        4. Utilizing the appropriate physcial principles, how does one explain to an 8 year-old that there are certain foods that are useless to them nutritionally?
    2. Sample numerical problems
        1. A patient has a sore shoulder from ligfting weights. How much force is required to do 10 chest press reps? What power is deliverd to the weight via the chest and shoulder?
        2. What is the power rating of your coffee maker? How much energy is required to heat up your coffe to 200°F? Sample numerical problem-based assignment
        3. How many arm overhead movements must be made in a 100-meter freestyle swim? What is the speed of the arms each cycle?
        4. How fast and how long must the wind blow to turn a windmill to deliver power to homes in the area?
        5. How much light energy is necessary to deliver the required power to 10,000 homes daily?
    3. Sample Integration assignments
        1. How does an X-ray machine work? Describe the physics and chemistry associated with this Medical technology.
        2. What are the advantages and disadvantages of Nuclear Fission vs Coal-fired power plants.

3. **Essays on everyday physics phenomena (to develop critical thinking skills necessary for scientific inquiry, understanding the physics of everyday life)**
    1. Students must write a research paper on a 'larger idea' such as transportation techinology and incorporate as many physics and chemistry principles associated with this 'larger idea'.
    2. Students must choose a subject related to optics and write a short essay. For example, how does a telescope/microscope work? Explain the optics of the eye. Describe the physics of a rainbow.

4. **Research Paper** (to develop critical thinking skills necessary for scientific inquiry, understanding the physics of everyday life)
    1. What types of power plants are used to generate electricity in your area? Do they employ heat engines and if so, what are the sources of heat?
    2. How can a person, family, company, institution, city or state do their part to lower their carbon footprint? What are the common facets that are needed at every level for this to happen?
    3. Why can we listen to several different radio stations on the am and fm settings? How does your

radio work and what do am and fm stand for?

Textbooks:

- Hewitt, Paul, Suchocki,John A., (2017). *Conceptual Physical Science, 6th Edition* Pearson. ISBN: 978-0134082295
- Kevin Pyatt, Ph.D., Donald Calbreath, Ph.D. (2018). *Ck 12 Basic Chemistry* CK-12. ISBN: OER
- Parsons, Richard (2018). *CK-12 Physics Concepts - Intermediate* CK-12. ISBN: OER
- CK-12 (2018). *CK-12 21st Century Physics - A Compilation of Contemporary and Emerging Technologies* CK-12. ISBN: OER

Other Resources:

Minimum Qualification

- Physics/Astronomy (Masters Required)