GAVILAN COLLEGE
5055 Santa Teresa Blvd
Gilroy, CA 95023

Course Outline

COURSE: PHYS 4B DIVISION: 10 ALSO LISTED AS:

TERM EFFECTIVE: Spring 2022 CURRICULUM APPROVAL DATE: 05/10/2022

SHORT TITLE: PHYS FOR SCI & ENG II

LONG TITLE: Physics for Scientists and Engineers - Electricity and Magnetism

Units	Number of Weeks	Type	Contact Hours/Week	Total Contact Hours
4	18	Lecture:	3	54
		Lab:	3	54
		Other:	0	0
		Total:	6	108

COURSE DESCRIPTION:

An introduction to the principles of physics using calculus. Topics include oscillations, charge, electric fields, Gauss' Law, electric potential, capacitance, current and resistance, circuit analysis, magnetic fields, Ampere's Law, Faraday's Law and Maxwell's equations (C-ID: PHYS 210) (C-ID: PHYS 200S: Phys 4A + Phys 4B + Phys 4C) PREREQUISITE: Completion of PHYS 4A and MATH 1B with grades of 'C' or better. PRE/CO-REQUISITE: MATH 1C.

PREREQUISITES:

Completion of PHYS 4A, as UG, with a grade of C or better.
AND Completion of MATH 1B, as UG, with a grade of C or better.
AND Completion of MATH 1C, as UG, with a grade of C or better., Concurrent OK

COREQUISITES:

CREDIT STATUS: D - Credit - Degree Applicable

GRADING MODES

L - Standard Letter Grade

REPEATABILITY: N - Course may not be repeated

SCHEDULE TYPES:

02 - Lecture and/or discussion
03 - Lecture/Laboratory
04 - Laboratory/Studio/Activity
047 - Laboratory - LEH 0.7
05 - Hybrid
71 - Dist. Ed Internet Simultaneous
72 - Dist. Ed Internet Delayed
73 - Dist. Ed Internet Delayed LAB
737 - Dist. Ed Internet LAB-LEH 0.7

STUDENT LEARNING OUTCOMES:

By the end of this course, a student should:

1. Identify, describe, compare and contrast the various units of numbers and their significance.
2. Identify, describe, compare and contrast charge, conservation of charge, insulators, conductors, and Coulomb's Law.
3. Identify, describe, compare and contrast electric field, Gauss' Law, electric potential, and conservation ofenergy for charged particles.
4. Identify, describe, compare and contrast capacitance, resistance, and current.
5. Identify, describe, compare and contrast capacitors and resistors in parallel, series, and mixed circuit configurations.
6. Identify, describe, compare and contrast Ohm's Law, conservation of charge, conservation of energy, and Kirchoff's Rules.
7. Identify, describe, compare and contrast magnetic fields, forces on moving charges and currents, and forces between currents.
8. Identify, describe, compare and contrast the Biot-Savart Law, Ampere's Law, and Faraday's Law.
9. Identify, describe, compare and contrast Inductance, LR, LC, and RLC circuits.

COURSE OBJECTIVES:

By the end of this course, a student should:

1. Analyze situations involving applications of Newtonian Mechanics: oscillations.
2. Analyze real-world experimental data, including appropriate use of units and significant figures, and relate the results of experimental data to the physical concepts discussed in the lecture portion of the class.
3. Analyze simple static charge distributions and calculate the resulting electric field and electric potential.
4. Analyze simple current distributions and calculate the resulting magnetic field.
5. Predict the trajectory of charged particles in uniform electric and magnetic fields.
6. Analyze DC and AC circuits in terms of current, potential difference, and power dissipation for each element.

CONTENT, STUDENT PERFORMANCE OBJECTIVES, OUT-OF-CLASS ASSIGNMENTS

Curriculum Approval Date: 05/10/2022

LECTURE CONTENT:

6 HOURS

1. Oscillations:

Springs

Simple Harmonic Motion

Energy in Simple Harmonic Motion

Ideal Pendulum and Physical Pendulum

Damping

Forced Oscillations

6 HOURS

2. Electric Charges and Fields

Electric Charge

Conductors, Insulators, and Charging by Induction

Coulomb's Law

Electric Field

Calculating Electric Fields of Charge Distributions

Electric Field Lines

Electric Dipoles

3 HOURS

3. Gauss's Law

Electric Flux

Explaining Gauss’s Law

Applying Gauss’s Law

Conductors in Electrostatic

3 HOURS

4. Electric Potential

Electric Potential Energy

Electric Potential and Potential Difference

Calculations of Electric Potential

Determining Field from Potential

Equipotential Surfaces and Conductors

3 HOURS

5. Capacitance

Capacitors and Capacitance

Capacitors in Series and in Parallel

Energy Stored in a Capacitor

Capacitor with a Dielectric

Molecular Model of a Dielectric

3 HOURS

6. Current and Resistance

Electrical Current

Model of Conduction in Metals

Resistivity and Resistance

Ohm's Law

Electrical Energy and Power

Superconductors

3 HOURS
7. Direct-Current Circuits
Electromotive Force
Resistors in Series and Parallel
Kirchhoff's Rules
Electrical Measuring Instruments
Circuits
Household Wiring and Electrical Safety
6 HOURS
8. Magnetic Forces and Fields
Magnetism and Its Historical Discoveries
Magnetic Fields and Lines
Motion of a Charged Particle in a Magnetic Field
Magnetic Force on a Current-Carrying Conductor
Force and Torque on a Current Loop
The Hall Effect
Applications of Magnetic Forces and Fields
6 HOURS
9. Sources of Magnetic Fields
The Biot-Savart Law
Magnetic Field Due to a Thin Straight Wire
Magnetic Force between Two Parallel Currents
Magnetic Field of a Current Loop
Ampere’s Law
Solenoids and Toroids
Magnetism in Matter
6 HOURS
10. Electromagnetic Induction
Faraday’s Law
Lenz's Law
Motional Emf
Induced Electric Fields
Eddy Currents
Electric Generators and Back Emf
Applications of Electromagnetic Induction
3 HOURS
11. Inductance
Mutual Inductance
Self-Inductance and Inductors
Energy in a Magnetic Field
Circuits
Oscillations in an LC Circuit
RLC Series Circuits

3 HOURS
12. Alternating-Current Circuits
AC Sources
Simple AC Circuits
RLC Series Circuits with AC
Power in an AC Circuit
Resonance in an AC Circuit
Transformers
1 HOUR
13. Maxwell’s Equations
2 HOURS
Final Exam
Total 54 hours.
LAB CONTENT:
The Lab activities for the course will be divided as:
(a) Experimental activities or educational simulations (50%)
(b) Problem-Solving activities using computational tools and programming (50%)
6 HOURS
LAB: Basic Introduction to a high order programming language such as MATLAB or Octave.
3 HOURS
LAB: SHM and Damping Motion
3 HOURS
LAB: Electrostatics - Coulomb's Law.
3 HOURS
LAB: Electrostatics - Faraday's Ice Pail.
3 HOURS
LAB: Electric field.
3 HOURS
LAB: Ohms Law.
3 HOURS
LAB: DC Circuits with resistors (Parallel and Series)
3 HOURS
LAB: RC Circuits
3 HOURS
LAB: Capacitors
3 HOURS
LAB: DC motor design and construction.
3 HOURS
LAB: Determine the ratio of the electric charge to the mass of the electron (e/m).
3 HOURS
LAB: The magnetic force and field (Earth’s magnetic field)
3 HOURS
LAB: Amperes law
3 HOURS
LAB: AC circuits and impedance
3 HOURS
LAB: Inductors

3 HOURS
LAB: LRC circuits
3 HOURS
LAB: Generators
Total 54 hours.

METHODS OF INSTRUCTION:
Lecture/discussion. Laboratory exercises. Group projects.

OUT OF CLASS ASSIGNMENTS:
Required Outside Hours 54
Assignment Description
Regularly assigned homework that requires students to analyze and study pertinent text material, solved examples and lecture notes.

Required Outside Hours 54
Assignment Description
Regularly assigned homework that requires students to apply the principles and skills covered in class by solving related problems using analytical and computational methods.

METHODS OF EVALUATION:
Writing assignments
Evaluation Percent 20
Evaluation Description
Lab Reports.

Problem-solving assignments
Evaluation Percent 20
Evaluation Description
Homework, quizzes, projects.

Objective examinations
Evaluation Percent 60
Evaluation Description
In-class written exams.

REPRESENTATIVE TEXTBOOKS:

University Physics Volume 2, Ling, Moebs and Sanny, OPENSTAX, 2021.
ISBN: ISBN-10: 1-947172-21-2
Rationale: Open Source Textbook.
12 Grade Verified by: David Argudo

University Physics Volume 1, Ling, Moebs and Sanny, OPENSTAX, 2021.
ISBN: ISBN-10: 1-947172-20-4
Rationale: Open Source Textbook
12 Grade Verified by: David Argudo

University Physics Volume 3, Ling, Moebs and Sanny, OPENSTAX, 2021.
ISBN: ISBN-10: 1-947172-22-0
Rationale: Open Source textbook.
12 Grade Verified by: David Argudo

Loyd, David. Physics Lab Manual 4th Edition, Cengage Learning (ISBN: 9781285650043)

RECOMMENDED TEXTBOOKS OR OTHER MATERIALS:

UCD: Physics 9C ? Electricity and Magnetism by Tom Weideman: https://phys.libretexts.org/Courses/University_of_California_Davis/UCD%3A_Physics_9C__Electricity_and_Magnetism

ARTICULATION and CERTIFICATE INFORMATION

Associate Degree:

GAV B1, effective 201270

GAV B3, effective 201270

CSU GE:

CSU B1, effective 201270

CSU B3, effective 201270

IGETC:

IGETC 5A, effective 201270

IGETC 5C, effective 201270

CSU TRANSFER:

Transferable CSU, effective 201270

UC TRANSFER:

Transferable UC, effective 201270

SUPPLEMENTAL DATA:

Basic Skills: N
Classification: Y
Noncredit Category: Y
Cooperative Education:
Program Status: 1 Program Applicable
Special Class Status: N
CAN: XXXXXX
CAN Sequence: PHYS SEQ B
CSU Crosswalk Course Department: PHYS
CSU Crosswalk Course Number: 210
Prior to College Level: Y
Non Credit Enhanced Funding: N
Funding Agency Code: Y
In-Service: N
Occupational Course: E
Maximum Hours:
Minimum Hours:
Course Control Number: CCC000213812
Sports/Physical Education Course: N
Taxonomy of Program: 190200