GAVILAN COLLEGE
5055 Santa Teresa Blvd
Gilroy, CA 95023

Course Outline

COURSE: PHYS 4B DIVISION: 20 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

Out of Class Hrs:	108.00
Total Learning Hrs:	216.00

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. 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.

COURSE CONTENT:
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

COURSE CONTENT (CONTINUED):
LECTURE CONTENT (CONTINUED):
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

COURSE CONTENT (CONTINUED):
LECTURE CONTENT (CONTINUED):
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.

COURSE CONTENT (CONTINUED):

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
- Not Transferable

UC TRANSFER:
- Transferable UC, effective 201270
- Not Transferable

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