PHYS 42 Course Outline as of Fall 2023

CATALOG INFORMATION

Dept and Nbr: PHYS 42 Title: ELECTRICITY & MAGNETISM
Full Title: Electricity and Magnetism for Scientists and Engineers
Last Reviewed: 9/26/2022

Units		Course Hours per Week		Nbr of Weeks	Course Hours Total	
Maximum	4.00	Lecture Scheduled	3.00	17.5	Lecture Scheduled	52.50
Minimum	4.00	Lab Scheduled	3.00	8	Lab Scheduled	52.50
		Contact DHR	0		Contact DHR	0
		Contact Total	6.00		Contact Total	105.00
		Non-contact DHR	0		Non-contact DHR	0

Total Out of Class Hours: 105.00 Total Student Learning Hours: 210.00

Title 5 Category:	AA Degree Applicable
Grading:	Grade Only
Repeatability:	00 - Two Repeats if Grade was D, F, NC, or NP
Also Listed As:	
Formerly:	PHYS 4C

Catalog Description:
In this course, students will be introduced to electromagnetic phenomena; they will use calculus, algebra, and trigonometry to apply physics laws and principles into solving problems involving electromagnetism and circuits.

Prerequisites/Corequisites:
Completion of PHYS 40 or higher (V5) and Course Completion or Current Enrollment in MATH 1C

Recommended Preparation:

Limits on Enrollment:

Schedule of Classes Information:
Description: In this course, students will be introduced to electromagnetic phenomena; they will use calculus, algebra, and trigonometry to apply physics laws and principles into solving problems involving electromagnetism and circuits. (Grade Only)
Prerequisites/Corequisites: Completion of PHYS 40 or higher (V5) and Course Completion or Current Enrollment in MATH 1C

Recommended:
Limits on Enrollment:
Transfer Credit: CSU;UC.
Repeatability: Two Repeats if Grade was D, F, NC, or NP

ARTICULATION, MAJOR, and CERTIFICATION INFORMATION:

AS Degree:	**Area**		Effective:	Inactive:
	C	Natural Sciences	Fall 1983	
CSU GE:	**Transfer Area**		Effective:	Inactive:
	B1	Physical Science	Fall 1983	
	B3	Laboratory Activity		
IGETC:	**Transfer Area**		Effective:	Inactive:
	5A	Physical Sciences	Fall 1983	
	5C	Fulfills Lab Requirement		

CSU Transfer:	Transferable	Effective:	Fall 1983	Inactive:
UC Transfer:	Transferable	Effective:	Fall 1983	Inactive:

CID:

CID Descriptor:	PHYS 200S Calculus-Based Physics for Scientists and Engineers: ABC
SRJC Equivalent Course(s):	PHYS40 AND PHYS41 AND PHYS42 AND PHYS43
CID Descriptor:	PHYS 210 Calculus-Based Physics for Scientists and Engineers: B
SRJC Equivalent Course(s):	PHYS42

Certificate/Major Applicable:
Major Applicable Course

COURSE CONTENT

Student Learning Outcomes:
At the conclusion of this course, the student should be able to:
1. Apply laws of physics to analyze and solve problems related to electromagnetism and circuits.
2. Design and assemble apparatuses to measure electromagnetic phenomena.
3. Analyze and make meaningful comparisons between experiment and theory.
4. Effectively communicate principles and processes of electromagnetism and circuits.

Objectives:
At the conclusion of this course, the student should be able to:
1. Define and solve problems related to static electric fields and forces.
2. Use Gauss's law to solve problems involving charged conductors and insulators.
3. Define and calculate the electric potential for point charges and charged conductors and insulators.
4. Obtain the electric field from an electric potential.
5. Calculate the capacitance of capacitors with and without dielectrics.
6. Solve problems related to current, resistance, electrical power, and Ohm's law.
7. Use Kirchhoff's rules to analyze direct current (DC) circuits.
8. Define and solve problems related to the properties of magnetic fields and forces.
9. Use the Biot-Savart and Ampere’s laws to calculate the magnetic field produced by currents.
10. Use Faraday's law of induction to calculate motional emf.

11. Analyze resistors, inductors and capacitors in alternating current (AC) circuits using equations and phasors.
12. Solve problems related to the design of transformers and power transmission.
13. Describe Maxwell's equations and the properties of electromagnetic waves.
14. Solve problems related to electromagnetic waves.

Lab Objectives:
1. Develop and conduct experiments that apply the scientific method and error analysis to explore principles in static electricity, AC/DC circuits, electronic components, and magnetism.
2. Use manual and computerized data collection techniques to measure and analyze parameters related to electricity and magnetism.
3. Plot, curve fit, and interpret data using a spreadsheet or other analysis tools.

Topics and Scope:

1. Electric Field
   A. Electric charges and field lines
   B. Coulomb’s law
   C. Electric field of continuous charges
   D. Motion of charged particle in electric field
2. Gauss’s Law
   A. Electric flux
   B. Calculating electric field using the Gauss’s law
   C. Conductors in electrostatic fields
3. Electric Potential
   A. Potential difference in a uniform electric field
   B. Electric potential of point charge and charged conductor of various simple geometries
   C. Finding electric field from electric potential
4. Dielectrics
   A. Capacitances
   B. Combinations of capacitances
   C. Energy stored in capacitors
   D. Electric dipole
5. Current and Resistance
   A. Electric current and resistance
   B. Effect of temperature on resistivity
   C. Conductivity and resistivity
   D. Electrical power
6. DC Circuits
   A. Batteries and emf
   B. Resistors in series and parallel
   C. Kirchhoff’s rules
   D. RC circuits
7. Magnetic Field
   A. Magnetic force on a moving charge and its applications
   B. Magnetic force on a current carrying conductor
   C. Torque on a current loop in a uniform magnetic field
   D. Hall effect
8. Sources of Magnetic Field
   A. Biot-Savart law
   B. Ampere’s law
   C. Magnetic field of currents flowing in straight wires, solenoid, toroid, and sheets

D. Gauss's law in magnetism
E. Magnetic materials and magnetic field of the Earth
9. Faraday's Law
A. Motional emf
B. Lenz's law
C. Induced emf, generators and motors
D. Eddy current
10. Inductance
A. Self inductance, inductors, and mutual inductance
B. RL circuits
C. Stored energy in a magnetic field
D. Oscillation in LC and RLC circuits
11. AC Circuits
A. Resistors, inductors, and capacitors in AC circuits
B. Phasors
C. Series RLC circuit
D. Power in AC circuits
E. Transformers and power transmission
12. Electromagnetic Waves
A. Poynting's vector
B. Maxwell's equations
C. Plane electromagnetic waves
D. Polarization of light
E. Energy carried and pressure exerted by electromagnetic waves
F. Electromagnetic spectrum

All topics are covered in both the lecture and lab parts of the course.

Assignment:

Lecture-Related Assignments:
1. Homework problem sets (10-30)
2. Quizzes (5-15)
3. Exams (2-4)
4. Final exam

Lab- and Lecture-Related Assignments:
1. Laboratory experiments and reports (12-16)

Methods of Evaluation/Basis of Grade:

Writing: Assessment tools that demonstrate writing skills and/or require students to select, organize and explain ideas in writing.

Written lab reports	Writing 5 - 20%

Problem Solving: Assessment tools, other than exams, that demonstrate competence in computational or non-computational problem solving skills.

Homework problem sets; Laboratory experiments	Problem solving 10 - 30%

Skill Demonstrations: All skill-based and physical demonstrations used for assessment purposes including skill performance exams.

None	Skill Demonstrations 0 - 0%

Exams: All forms of formal testing, other than skill performance exams.

Quizzes, exams, final	Exams 40 - 70%

Other: Includes any assessment tools that do not logically fit into the above categories.

Participation and attendance	Other Category 0 - 10%

Representative Textbooks and Materials:
Representative Textbooks:
Physics For Scientists And Engineers. 10th ed. Serway, Raymond and Jewett, John. Cengage L. 2018.
Physics For Scientists and Engineers: A Strategic Approach With Modern Physics. 4th ed. Randall Knight. 2016. (classic)
University Physics Volume 2 by OpenStax, S. J. Ling, J. Sanny, and W. Moebs, 2016. (classic)

Online Educational Resources (OER):
University Physics, Volume 1, Moebs, William et al. https://openstax.org/details/books/university-physics-volume-1 Creative Commons Attribution License v4.0.
University Physics, Volume 2. Ling, Samuel J., et al. https://openstax.org/details/books/university-physics-volume-2 Creative Commons Attribution License v4.0.
University Physics Volume 3. Ling, Sameul J., et al. https://openstax.org/details/books/university-physics-volume-3 Creative Commons Attribution License v4.0.