PHYS 42 Course Outline as of Fall 2006

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	17.5	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:
This is a course intended for scientists and engineers and will include electricity and magnetism.

Prerequisites/Corequisites:
Completion of PHYS 40 or higher (V5) and Course Completion or Current Enrollment in MATH 2A OR MATH 1C

Recommended Preparation:

Limits on Enrollment:

Schedule of Classes Information:
Description: This is a course intended for scientists and engineers and will include electricity & magnetism. (Grade Only)
Prerequisites/Corequisites: Completion of PHYS 40 or higher (V5) and Course Completion or Current Enrollment in MATH 2A OR MATH 1C
Recommended:
Limits on Enrollment:
Transfer Credit: CSU;UC. (CAN PHYS12)(PHYS 4A+PHYS 42+PHYS 41=PHYS SEQ

B)(PHYS 43+PHYS 4A+PHYS 42+PHYS 41=PHYS SEQ C)
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

Outcomes and Objectives:
Upon completion of the course, the student should be able to:
1. Define the properties of electric charges and electric fields.
2. Solve problems involving Coulomb's Law for point charges and simple continuous charge distributions.
3. Calculate electric fields due to point charges and due to simple continuous charge distributions.
4. Describe and explain the motion of charged particles in a uniform electric field and in the oscilloscope.
5. Define electric flux, state Gauss' Law and apply Gauss' Law in determining electric fields for various charge distributions.
6. Describe the difference between an electrical insulator and an electrical conductor and list properties of a conductor in electrostatic equilibrium.
7. Define electric potential and potential difference.
8. Determine the potential difference and electric potential in uniform electric fields due to point charges and uniform charge distributions.
9. Obtain E (the electric field vector) from the electric potential.
10. Define capacitance and calculate the capacitance of capacitors with simple geometries.
11. Solve problems involving calculations of capacitors for various combinations of capacitors, and for capacitors with and without

dielectrics.
12. Define electric dipole moment and determine the torque on and potential energy of electroic dipole moments in electric fields.
13. Define the concepts of current, current density, drift velocity, resistance, and resistivity; describe the temperature dependence of resistivity; and state Ohm's Law.
14. Solve problems involving resistance, current, voltage and power.
15. Determine the equivalent resistance of resistors in series and parallel to simplify various combinations of resistors.
16. State Kirchhoff's rules and use them to calculate potential and current in various DC circuits.
17. Apply Kirchhoff's rules to RC circuits and describe how the charge and current vary with time.
18. Define the properties of the magnetic field.
19. Calculate the magnetic force on moving charged particles and current carrying conductors in a magnetic field.
20. Describe the motions of charged particles moving in a magnetic field.
21. Use the Biot-Savart Law to calculate the magnetic field produced by a current.
22. State Ampere's Law and apply it in determining magnetic fields.
23. Explain magnetic flux and Gauss' Law for magnetism.
24. Use Faraday's Law of induction to calculate motional emf.
25. State Lenz's Law and apply it to induced currents.
26. State Maxwell's equations.
27. Explain self inductance.
28. Solve problems involving RL circuits, energy in a magnetic field, oscillations in an LC circuit and RLC circuits.
29. Describe the behavior of resistors, inductors and capacitors in AC circuits, and define capacitive reactance, inductive reactance and impedance.
30. Solve for current, voltage, the phase angle between current and voltage, and resonant frequencies in series RLC AC circuits.
31. Explain the operation of a transformer, how a transformer can be either a step-up or step-down transformer, and the role of transformers in AC power transmission.
32. Discuss Maxwell's equations and the discovery of electromagnetic waves.
33. Use Poynting's vector to calculate the electric field, the magnetic field, the energy, pressure, and momentum associated with electromagnetic waves.
34. Explain the production of electromagnetic waves by an infinite current sheet and by an antenna.

Topics and Scope:

Topics covered include:
1. Coulomb's Law and electric fields.
2. Gauss' Law.
3. The electric potential.
4. Capacitance and dielectrics.
5. Current, resistance, and Ohm's Law.
6. Direct current circuits and RC circuits using Kirchhoff's rules.

7. Magnetic fields and the forces on moving charges.
8. Sources of magnetic fields Biot-Savart Law and Ampere's Law.
9. Faraday's Law of induction.
10. Self inductance, RL circuits, oscillations in LC circuits and RLC circuits.
11. Alternating current circuits including RLC series and parallel circuits and resonance.
12. Maxwell's equations, electromagnetic waves and Poynting's vector.

Lab work includes:

1. Constructing DC and AC circuits with various combinations of resistance, capacitance and inductance and using DC power supplies and AC signal generators.
2. Learning to use and using digital electronic multimeters and oscilloscopes to make measurements in electrical systems.
3. Using computers with current, voltage and magnetic field probes to observe/make measurements in electrical circuits and magnetic fields.
4. Using spreadsheets to record data and to calculate experimental results.
5. Constructing graphs using computer graphing programs.
6. Error analysis
7. Numerical and graphical analysis of data.

Assignment:

1. No less than twelve sets of homework problems.
2. Five to fifteen quizzes.
3. No less than twelve laboratory experiments.
4. No less than three mid-term exams.
5. Final exam.
6. Lab Reports.

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.

None, This is a degree applicable course but assessment tools based on writing are not included because problem solving assessments are more appropriate for this course.	Writing 0 - 0%

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

Homework problems, 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.

Multiple choice, Physics problems to solve, quizzes and exams.	Exams 50 - 70%

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

LAB REPORTS	Other Category 20 - 30%

Representative Textbooks and Materials:
PHYSICS FOR SCIENTISTS AND ENGINEERS by Serway & Beichner, 6th edition, Saunders, 2003