CREDIT COURSE OUTLINE

I. COVER PAGE

(1) PHYS 4B	(2) PHYSICS FOR SCIENTISTS AND ENGINEERS	(3) 4
Number	Title	Units

(4)	Lecture / Lab Hours:			
	Total Course Hours			
		Total Lec hours:		70.00
		Total Lab hours:		34.00
		Total Contact hours:		104.00
	Lec will generate 0 hour(s) outside work.			
	Lab will generate 0 hour(s) outside work.			
(5)	Grading Basis:	Grading Scale Only		
		Pass/No Pass option		X
		Pass/No Pass only		
(6)	Advisories: ENGL 1A - READING AND COMPOSITION			
(7)	Pre-requisites(requires C grade or better): PHYS 4A MATH 4A MATH 6			
	Corequisites: MATH 6			
	ENGL 1A Eligibility for			

(8)Classification:			
		Degree applicable:	X
		Non-degree applicable:	
		Basic skills:	
(9)RC	Fulfills AS/AA degree requirement: (area)		
	General education category:		
	Major:		
	Certificate of:		
	Certificate in:		
(10)CSU		Baccalaureate:	X
(11)Repeatable: (A course may be repeated three times)			0

(12) Catalog Description:
Mechanical waves, Thermodynamics, electricity, magnetism.

II. COURSE OUTCOMES:

(Specify the learning skills the student demonstrates through completing the course and link critical thinking skills to specific course content and objectives.)

Upon completion of this course, students will be able to:

I. understand basic concepts and fundamental laws in thermodynamics, electricity, and magnetism.
II. solve problems in thermal expansion.
III. differentiate the heat transfer mechanisms of conduction, convection, and radiation.
IV. apply the First Law of Thermodynamics.
V. understand the relationship between temperature and molecular kinetic energy.
VI. understand basic concepts and fundamental laws in electricity and magnetism.
VII. calculate the electric potential of various charge configurations.
VIII. relate electric field and electric potential.
IX. determine the capacitance of various electrical systems.
X. work basic problems involving electrical circuits.

III. COURSE OBJECTIVES:

(Specify major objectives in terms of the observable knowledge and/or skills to be attained.)

In the process of completing this course, students will:

I. complete assignments and lab reports outside of class requiring the application of concepts studied in class.
II. use the scientific method for experiments illustrating basic ideas in physics, producing results which must be compared and/or correlated with what has been presented in class lectures.
III. develop new ideas using previously held knowledge as their foundation.
IV. use the appropriate language of physics and mathematics in order to solve problems in physics.
V. use problem solving processes developed in this course requiring sound reasoning skills that enhance responsible decision-making.

IV. COURSE OUTLINE:

Lecture Content:

Week 1: The principle of superposition; phase difference and the conditions for constructive and destructive interference; standing waves on strings with demonstration; resonance; beats (Serway, Ch 18);
Week 2: How temperature scales are defined; deriving linear equations to convert between temperature scales; thermometers and the Zeroth Law of Thermodynamics; absolute zero and the Kelvin scale (Serway, Ch 19).
Week 3: Thermal expansion; equations of state and the ideal gas law (Serway, Ch 19); specific heat and calorimetry; phase transitions and latent heat; thermodynamic work; the First Law of Thermodynamics; energy transfer mechanisms (conduction (Newton's Law of Cooling), convection, and radiation (Stefan's Law)) (Serway, Ch 20).
Week 4: Kinetic model of a monatomic ideal gas; experimental check: predictions of kinetic model vs. measured values for molar specific heats; the equipartition theorem; specialized equation of state for adiabatic processes; probability distributions; the Maxwell-Boltzman distribution of molecular speeds (Serway, Ch 21).
Week 5: Heat engines: real, perfect and ideal; energy conservation and engine efficiency; refrigerators: real, perfect and ideal; the Second Law of Thermodynamics (Claussius and Kelvin Planck statements of); models of gasoline and diesel engines; Entropy and the modern form of the Second Law of Thermodynamics (Serway, Ch 22).
Week 6: the simple electroscope and Coulomb's Law (demonstration); conservation of charge; the fundamental charge "e"; electrical "ground" and charging by induction (demonstration with electroscope); definition of the E field; finding E fields: discrete vs. continuous distributions of charge; motion of a charged particle in a uniform E field (Serway, Ch 23).
Week 7: Definition of E flux; Gauss's Law for Electricity: finding the flux through arbitrary closed surfaces; MT exam review: waves, thermo, electrostatics; midterm exam #1.
Week 8: Gauss's Law: finding E (spherical, cylindrical, and planar symmetries); properties of a charged, isolated conductor in electrostatic equilibrium (Serway, Ch 24).
Week 9: Review of the relation between work and potential energy (Phy 4A); electrostatic potential and potential energy; examples of finding V(r) from E using integration; finding E from V(r) by differentiation; equipotential surfaces; potential on or inside a charged conductor in equilibrium (Serway, Ch 25).
Week 10: Charge storage and the definition of capacitance; calculating "C": parallel plate capacitors, cylindrical and spherical capacitors; networks of capacitors (parallel and series); energy storage in capacitors; electric energy density; the effect of dielectrics; dielectric strength and sparking; electric dipoles: torque and PE in an external E (Serway, Ch 26).
Week 11: Definition of electric current; charge-carrier drift speed; definition of resistance; ohmic vs. non-ohmic materials; resistance and temperature; electrical power (Serway, Ch 27); EMF's: real vs. ideal models of; networks of resistors: series and parallel (Serway, Ch 28).
Week 12: Kirchoff's Rules and DC circuits; RC circuits; electrical instruments: ammeter, voltmeter, ohmmeter; household wiring and electrical safety (circuit breakers, GFIs, and the "case ground.") (Serway, Ch 28); Oersted's experiment and the Relation between electric current and magnetism; the defining equation for the B field (Serway, Ch 29).

Week 13: B force on a current-carrying wire; electric motors; motion of a charged particle in a uniform B field (spectrometers and accelerators); the Hall Effect and the sign of the mobile charge carrier (Serway, Ch 29); calculating B fields with the Biot-Savart Law; calculating B fields with Ampere's Law (Serway, Ch 30);
Week 14: Gauss's Law for B; displacement current and Maxwell's correction to Ampere's Law (Serway, Ch 30); MT exam review: electrostatics, capacitance, DC circuits, magnetism; midterm exam #2.
Week 15: magnetic properties of materials: paramagnetism, diamagnetism, and ferromagnetism (Serway, Ch 30); Faraday's Law with demonstration; Lenz's Law; motional EMF, magnetically-induced E fields; the AC generator (Serway, Ch 31).
Week 16: Maxwell's Equations (Serway, Ch 31); self-inductance; RL circuits; magnetic energy and energy density; mutual inductance; LC oscillations; LRC circuits: under-damped, over-damped, critically-damped (Serway, Ch 32).
Week 17: Resistors in an AC circuit; phasor diagrams; capacitors in an AC circuit; inductors in an AC circuit; series RLC AC circuits; power and resonance in an AC circuit; Final Exam review.

Lab Content:

A. Thermal expansion

B. Calorimetery

C. Kinetic gas theory simulations
D. Electric charge simulations
E. Electric field mapping
F. Electric potential simulations
G. Build your own capacitors
H. Measure and calculate the RC time constant
I. Resistive circuits
J. Magnetic field simulations

V. APPROPRIATE READINGS

Reading assignments may include but are not limited to the following:

I. Sample Text Title:
1. Recommended - Serway, R. and Jewett, J *Physics for Scientists and Engineers,* ed. 8 Thomson Brooks/Cole, 2009,
   or
2. Recommended - Giancoli, D *Physics for Scientists and Engineers,* ed. 4 Pearson, 2008,
   and/or
3. Recommended - Appel, K. , Gasineau, J., Bakken, C *Physics with Vernier,* ed. 4 Pearson, 2009,

II. Other Readings
1. Recommended - *Instructor-supplied handouts and supplements, especially for labs.*

___ Global or international materials or concepts are appropriately included in this course
___ Multicultural materials and concepts are appropriately included in this course

If either line is checked, write a paragraph indicating specifically how global/international and/or multicultural materials and concepts relate to content outline and/or readings.

VI. METHODS TO MEASURE STUDENT ACHIEVEMENT AND DETERMINE GRADES:

Students in this course will be graded in at least one of the following four categories. Please check those appropriate. A degree applicable course must have a minimum of one response in category A, B, or C.

A. Writing Check either 1 or 2 below			
X	***1. Substantial writing assignments are required. Check the appropriate boxes below and provide a written description in the space provided.***		
	2. Substantial writing assignments are NOT required. If this box is checked leave this section blank. For degree applicable courses you must complete category B and/or C.		
X	a) essay exam(s)	X	d) written homework
	b) term or other paper(s)		e) reading reports
X	c) laboratory report(s)		f) other (specify)

Required assignments may include but are not limited to the following:
Written laboratory reports which describe, explain, and interpret the data collected, provide analysis, and present final results.

B. Problem Solving Computational or non-computational problem-solving demonstrations, including:			
X	a) exam(s)	X	d) laboratory reports
X	b) quizzes		e) field work
X	c) homework problems		f) other (specify):

Required assignments may include but are not limited to the following:
Weekly homework assignments and lab reports.

C. Skill demonstrations, including:			
	a) class performance(s)		c) performance exams(s)
	b) field work		d) other (specify)

Required assignments may include but are not limited to the following:

D. Objective examinations including:			
X	a) multiple choice		d) completion
	b) true/false	X	e) other (specify): Written, step-by-step problem solutions to physics problems.
	c) matching items		

COURSE GRADE DETERMINATION:
Description/Explanation: Based on the categories checked in A-D, it is the recommendation of the department that the instructor's grading methods fall within the following departmental guidelines; however, the final method of grading is still at the discretion of the individual instructor. The instructor's syllabus must reflect the criteria by which the student's grade has been determined. (A minimum of five (5) grades must be recorded on the final roster.)

If several methods to measure student achievement are used, indicate here the approximate weight or percentage each has in determining student final grades.
homework = 20% labs = 20% midterm exam 1 = 15% midterm exam 2 = 15% final exam = 30%

VII. EDUCATIONAL MATERIALS

For degree applicable courses, the adopted texts, as listed in the college bookstore, or instructor-prepared materials have been certified to contain college-level materials.

Validation Language Level (check where applicable):	College-Level Criteria Met YES	NO
Textbook	X	
Reference materials		X
Instructor-prepared materials	X	
Audio-visual materials		X

Indicate Method of evaluation:

Used readability formulae (grade level 10 or higher)	____
Text is used in a college-level course	X
Used grading provided by publisher	____
Other: (please explain; relate to Skills Levels)	____

Computation Level (Eligible for MATH 101 level or higher where applicable)	X	____
Content		
Breadth of ideas covered clearly meets college-level learning objectives of this course	X	____
Presentation of content and/or exercises/projects:		
Requires a variety of problem-solving strategies including inductive and deductive reasoning.	X	____
Requires independent thought and study	X	____
Applies transferring knowledge and skills appropriately and efficiently to new situations or problems.	X	____

List of Reading/Educational Materials

Recommended - Serway, R. and Jewett, J *Physics for Scientists and Engineers,* ed. 8 Thomson Brooks/Cole, 2009, ISBN: 978-0-495-827

Recommended - Giancoli, D *Physics for Scientists and Engineers,* ed. 4 Pearson, 2008, ISBN: 9780131495081

Recommended - Appel, K. , Gasineau, J., Bakken, C *Physics with Vernier,* ed. 4 Pearson, 2009, ISBN: 978-1-9290755

Comments:

____ This course requires special or additional library materials (list attached).

X This course requires special facilities:
Physics laboratory classroom

Attached Files:

BASIC SKILLS ADVISORIES PAGE The skills listed are those needed for eligibility for English 125, 126, and Math 101. These skills are listed as the outcomes from English 252, 262, and Math 250. In the right hand column, list at least three major basic skills needed at the beginning of the target course and check off the corresponding basic skills listed at the left.

Check the appropriate spaces.

_____ Eligibility for Math 101 is advisory for the target course.
_____ Eligibility for English 126 is advisory for the target course.
_____ Eligibility for English 125 is advisory for the target course.

If the reviewers determine that an advisory or advisories in Basic Skills are all that are necessary for success in the target course, stop here, provide the required signatures, and forward this form to the department chair, the appropriate associate dean, and the curriculum committee.

REQUISITES

Subject Prerequisite -- MATH 4A TRIGONOMETRY

• Provide and analyze graphs of trigonometric functions.	• complete assignments and lab reports outside of class requiring the application of concepts studied in class.

Subject Prerequisite -- MATH 6 MATH ANALYSIS III

• Use vector methods to solve problems in three dimensional analytic geometry.	• complete assignments and lab reports outside of class requiring the application of concepts studied in class.

ESTABLISHING PREREQUISITES OR COREQUISITES

Every prerequisite or corequisite requires content review plus justification of at least one of the seven kinds below. Prerequisite courses in communication and math outside of their disciplines require justification through statistical evidence. Kinds of justification that may establish a prerequisite are listed below.

Check one of the following that apply. Documentation may be attached.

1. _____ The prerequisite/corequisite is required by law or government regulations.
   Explain or cite regulation numbers:
2. _____ The health or safety of the students in this course requires the prerequisite.
   Justification: Indicate how this is so.
3. _____ The safety or equipment operation skills learned in the prerequisite course are required for the successful or safe completion of this course.
   Justification: Indicate how this is so.
4. __X__ The prerequisite is required in order for the course to be accepted for transfer to the UC or CSU systems.
   Justification: Indicate how this is so.
   For articulation, our courses must have requisites equivalent to the requirements for corresponding physics courses taught at CSU and UC.
5. _____ Significant statistical evidence indicates that the absence of the prerequisite course is related to unsatisfactory performance in the target course.
   Justification: Cite the statistical evidence from the research.
6. _____ The prerequisite course is part of a sequence of courses within or across a discipline.
7. __X__ Three CSU/UC campuses require an equivalent prerequisite or corequisite for a course equivalent to the target course:
   UC Berkeley UC Davis Cal Poly SLO