I. CATALOG INFORMATION

A. Discipline: PHYSICS

B. Subject Code and Number: PHYS M20B

C. Course Title: Thermodynamics, Electricity and Magnetism

D. Credit Course units:

Units: 4

Lecture Hours per week: 4

Lab Hours per week : 0

Variable Units : No

E. Student Learning Hours:

Lecture Hours:

Classroom hours: 70 - 70

Laboratory/Activity Hours:

Laboratory/Activity Hours 0 - 0

Total Combined Hours in a 17.5 week term: 70 - 70

F. Non-Credit Course hours per week

G. May be taken a total of: [X] 1 [ ] 2 [ ] 3 [ ] 4 time(s) for credit

H. Is the course co-designated (same as) another course: No [X] Yes [ ]
If YES, designate course Subject Code & Number:

I. Course Description:

Introduces the basic principles of thermodynamics and electromagnetism. Uses calculus to develop the subject matter. Includes the following topics: temperature, heat, the laws of thermodynamics, electrostatics, capacitance, DC circuits, magnetic forces and fields, electromagnetic induction, AC circuits, Maxwell's equations, and electromagnetic waves.

J. Entrance Skills

*Prerequisite: No [ ] Yes [X] Course(s)
MATH M25B and PHYS M20A

*Corequisite: No [X] Yes [ ] Course(s)

Limitation on Enrollment: No [X] Yes [ ]

Recommended Preparation: No [ ] Yes [X] Course(s)
MATH M25Cshould be completed or be taken concurrently.

Other: No [X] Yes [ ]

K. Other Catalog Information:

Course Credit Limitation:

UC - PHYS M10A, PHYS M10B and PHYS M20A, PHYS M20B, PHYS M20C combined: maximum credit, one series.

II. COURSE OBJECTIVES

Upon successful completion of the course, a student will be able to:

		Methods of evaluation will be consistent with, but not limited by, the following types or examples.
1	analyze simple static charge distributions and calculate the resulting electric field and electric potential.	Written assignments and in-class discussions
2	analyze simple current distributions and calculate the resulting magnetic field.	Written assignments and in-class discussions
3	predict the trajectory of charged particles in uniform electric and magnetic fields.	Written assignments and in-class discussions
4	analyze DC and AC circuits in terms of current, potential difference, and power dissipation for each element.	Written assignments and in-class discussions
5	recognize, recall, and apply the equations that describe physical phenomena involving thermodynamics and electromagnetism.	Written midterm and final exams
6	demonstrate ability to analyze and solve physics problems of greater than average difficulty using calculus.	Written homework assignments
7	demonstrate ability to analyze and synthesize physics problems of greater than average complexity and evaluate and judge the results of the solutions to these problems.	Written assignments and in-class discussions

III. COURSE CONTENT

Estimated %	**Topic**	**Learning Outcomes**
Lecture (must total 100%)		
	Thermodynamics Temperature, temperature scales Ideal gas law Kinetic theory of gases Heat capacity, specific heat, internal energy First law of thermodynamics	1, 2, 5, 6,

15.00%	Equipartition theorem Second law of thermodynamics Carnot engine Entropy Thermal expansion Van der Waal's equation, phase diagrams	7
20.00%	Electrostatics Electric charge, Coulomb's Law Electric field: discrete and continuous charge distributions Electric flux and Gauss's Law Electric dipoles, electric field lines Motion of point charges in electric fields Electric potential of discrete and continuous charge distributions Electric potential gradient Equipotential lines and surfaces Electrostatic energy Capacitance and capacitors Energy stored in capacitors Dielectrics, induced charge densities, polarization	2, 3, 5, 6, 7
10.00%	Direct current circuits Voltage, current, and resistance, Ohm's Law Electromotive force, batteries Combinations of resistors Kirchhoff's rules, multiloop circuits Ammeters and voltmeters RC (resistor capacitor) circuits Microscopic theory of conduction	3, 4, 5, 6, 7
25.00%	Magnetic fields Magnetic forces, motion of a point charge in a magnetic field Force on a current carrying loop, torque on a current carrying loop Sources of magnetic fields The Biot-Savart Law, magnetic fields due to current carrying wires Gauss's Law for magnetism Ampere's Law Magnetism in matter	2, 3, 5, 6, 7
20.00%	Magnetic induction and AC circuits Magnetic flux, Faraday's Law and Lenz's Law Motional emf (electromotive force), eddy currents Self-inductance, mutual inductance Magnetic energy RL (resistor inductor) circuits Alternating current in resistors, capacitors, and inductors Phasors LC (inductor capacitor), RC, RLC (inductor resistor capacitor), series and parallel circuits Resonance, quality, and bandwidth Circuit analysis using complex numbers Transformers	3, 4, 5, 6, 7
10.00%	Maxwell's equations and electromagnetic waves Displacement current, the Maxwell-Ampere Law Maxwell's equations integral and differential forms Electromagnetic waves, the wave equation Point sources, dipole radiation Electromagnetic spectrum Energy and momentum in an electromagnetic wave Radiation pressure	1, 2, 3, 4, 5, 6, 7

IV. TYPICAL ASSIGNMENTS

A. Writing assignments

Writing assignments are required. Possible assignments may include, but are not limited to:	
1	solve electromagnetics problem sets.
2	write a short report on Gauss's Law.
3	solve conservation of electromagnetic energy problem sets.

B. Appropriate outside assignments

Appropriate outside assignments are required. Possible assignments may include, but are not limited to:	
1	field trips to local engineering and science companies.
2	complete homework assignments that consists of solving physics problems that correspond to the lecture topics in class. For each topic listed in the course content section, the assignment will include at least three problems, one of which will be of greater than average difficulty.

C. Critical thinking assignments

Critical thinking assignments are required. Possible assignments may include, but are not limited to:	
1	perform data set analysis of charge particles.
2	distinguish the various forces in a free body diagram.
3	analyze the efficiencies of various circuits.

V. METHODS OF INSTRUCTION

Methods of instruction may include, but are not limited to:

- [ ] Distance Education – When any portion of class contact hours is replaced by distance education delivery mode (Complete DE Addendum, Section XV)
- [X] Lecture/Discussion
- [ ] Laboratory/Activity
- [X] Other (Specify) In-class demonstrations.
- [X] Optional Field Trips
- [ ] Required Field Trips

VI. METHODS OF EVALUATION

Methods of evaluation may include, but are not limited to:

[ ] Essay Exam	[ ] Classroom Discussion	[X] Skill Demonstration
[X] Problem Solving Exam	[X] Reports/Papers/ Journals	[X] Participation
[X] Objective Exams	[X] Projects	[X] Other (specify)

Short answers on homework problems.

VII. REPRESENTATIVE TEXTS AND OTHER COURSE MATERIALS

Giancoli, Douglas C. Physics for Scientists and Engineers with Modern Physics. 4th ed. Addison-Wesley, 2008.

Serway, Raymond A., and John W. Jewett. Physics for Scientists and Engineers with Modern Physics. 9th ed. Cengage Learning, 2013.

Thorton, Stephen T., and Andrew Rex. Modern Physics for Scientists and Engineers. 4th ed. Cengage Learning, 2012.

VIII. STUDENT MATERIALS FEES

[X] No [ ] Yes

IX. PARALLEL COURSES

College	*Course Number*	*Course Title*	*Units*
CSU, Northridge	PHYS 220B	Electricity and Magnetism	3
UC, Los Angeles	PHYSICS 1B	Physics for Scientists and Engineers: Oscillations, Waves, Electric and Magnetic Fields	5
UC Santa Barbara	PHYS 3	Basic Physics	3
San Francisco State	PHYS 230	General Physics with Calculus II	3
San Diego State Univ.	PHYS 196	Principles of Physics	3
Cal Poly Pomona	PHYS 133	General Physics	3
CSU Fullerton	PHYS 226	Fundamental Physics: Elect + Magnetism	3

X. MINIMUM QUALIFICATIONS

Courses Requiring a Masters Degree:
Master's in physics, astronomy, or astrophysics OR Bachelor's in physics or astronomy AND Master's in engineering, mathematics, meteorology, or geophysics OR the equivalent.

XI. ARTICULATION INFORMATION

A. Title V Course Classification:

1. This course is designed to be taken either:

   [ ] Pass/No Pass only (no letter grade possible); or
   [X] Letter grade (P/NP possible at student option)

2. Degree status:
   Either [X] Associate Degree Applicable; or [ ] Non-associate Degree Applicable

B. Moorpark College General Education:

1. Do you recommend this course for inclusion on the Associate Degree General Education list?
   Yes: [X] No: [ ] If YES, what section(s)?

   [ ] A1 - Natural Sciences - Biological Science
   [X] A2 - Natural Sciences - Physical Science
   [ ] B1 - Social and Behavioral Sciences - American History/Institutions

☐ B2 - Social and Behavioral Sciences - Other Social Behavioral Science
☐ C1 - Humanities - Fine or Performing Arts
☐ C2 - Humanities - Other Humanities
☐ D1 - Language and Rationality - English Composition
☐ D2 - Language and Rationality - Communication and Analytical Thinking
☐ E1 - Health/Physical Education
☐ E2 - PE or Dance
☐ F - Ethnic/Gender Studies

C. California State University(CSU) Articulation:

1. Do you recommend this course for transfer credit to CSU? Yes: ☒ No: ☐

2. If YES do you recommend this course for inclusion on the CSU General Education list?
Yes: ☒ No: ☐ If YES, which area(s)?

A1 ☐ A2 ☐ A3 ☐ B1 ☒ B2 ☐ B3 ☐ B4 ☐

C1 ☐ C2 ☐ D1 ☐ D2 ☐ D3 ☐ D4 ☐ D5 ☐

D6 ☐ D7 ☐ D8 ☐ D9 ☐ D10 ☐ E ☐

D. University of California (UC) Articulation:

1. Do you recommend this course for transfer to the UC? Yes: ☒ No: ☐

2. If YES do you recommend this course for the Intersegmental General Education Transfer Curriculum (IGETC)? Yes: ☒ No: ☐

IGETC Area 1: English Communication

☐ English Composition
☐ Critical Thinking-English Composition
☐ Oral Communication

IGETC Area 2: Mathematical Concepts and Quantitative Reasoning

☐ Mathematical Concepts

IGETC Area 3: Arts and Humanities

☐ Arts
☐ Humanities

IGETC Area 4: Social and Behavioral Sciences

☐ Anthropology and Archaeology
☐ Economics
☐ Ethnic Studies

- [ ] Gender Studies
- [ ] Geography
- [ ] History
- [ ] Interdisciplinary, Social & Behavioral Sciences
- [ ] Political Science, Government & Legal Institutions
- [ ] Psychology
- [ ] Sociology & Criminology

IGETC Area 5: Physical and Biological Sciences (mark all that apply)

- [ ] Physical Science Lab or Physical Science Lab only (none-sequence)
- [ ] Physical Science Lecture only (non-sequence)
- [ ] Biological Science
- [ ] Physical Science Courses
- [ ] Physical Science Lab or Biological Science Lab Only (non-sequence)
- [ ] Biological Science Courses
- [ ] Biological Science Lab course
- [ ] First Science course in a Special sequence
- [ ] Second Science course in a Special Sequence
- [ ] Laboratory Activity
- [X] Physical Sciences

IGETC Area 6: Language other than English

- [ ] Languages other than English (UC Requirement Only)
- [ ] U.S. History, Constitution, and American Ideals (CSU Requirement ONLY)
- [ ] U.S. History, Constitution, and American Ideals (CSU Requirement ONLY)

XII. REVIEW OF LIBRARY RESOURCES

A. What planned assignment(s) will require library resources and use?

The following assignments require library resources:
Research, using the Library's print and online resources, in preparing a short written report on a subject appropriate to the course.

B. Are the currently held library resources sufficient to support the course assignment?

YES: [X] NO: [ ]

If NO, please list additional library resources needed to support this course.

XIII. PREREQUISITE AND/OR COREQUISITE JUSTIFICATION

Requisite Justification for MATH M25B

- [ ] A. Sequential course within a discipline.

[X] B. Standard Prerequisite or Corequisite required by universities.

CSU Northridge, UC Los Angeles, UC Santa Barbara

[ ] C. Corequisite is linked to companion lecture course.

[ ] D. Prerequisite or Corequisite is authorized by legal statute or regulation.
Code Section: _____

[ ] E. Prerequisite or Corequisite is necessary to protect the students' health and safety.

[ ] F. Computation or communication skill is needed.

[ ] G. Performance courses: Audition, portfolio, tryouts, etc. needed.

and

Requisite Justification for PHYS M20A

[X] A. Sequential course within a discipline.

1. demonstrate ability to analyze and solve physics problems of greater than average difficulty.

2. demonstrate ability to analyze, synthesize physics problems of reasonable complexity and evaluate and judge the results of the solutions to these problems.

3. recognize, recall, and apply the equations that describe physical phenomena involving the mechanics of solids and fluids; analyze and solve physics problems of at least average complexity appropriate for the course.

[ ] B. Standard Prerequisite or Corequisite required by universities.

[ ] C. Corequisite is linked to companion lecture course.

[ ] D. Prerequisite or Corequisite is authorized by legal statute or regulation.
Code Section: _____

[ ] E. Prerequisite or Corequisite is necessary to protect the students' health and safety.

[ ] F. Computation or communication skill is needed.

☐ G. Performance courses: Audition, portfolio, tryouts, etc. needed.

XIV. WORKPLACE PREPARATION

PHYS M20B: Not Applicable

XV. DISTANCE LEARNING COURSE OUTLINE ADDENDUM

PHYS M20B: Not Applicable

XVI. GENERAL EDUCATION COURSE OUTLINE ADDENDUM

General Education Division of Learning [check all applicable boxes]:

- ☒ Natural Sciences
  - ☐ Biological Science
  - ☒ Physical Science
- ☐ Social and Behavioral Sciences
  - ☐ American History/Institutions
  - ☐ Other Social Science
- ☐ Humanities
  - ☐ Fine or Performing Arts
  - ☐ Other Humanities
- ☐ Language and Rationality
  - ☐ English Composition
  - ☐ Communication and Analytical Thinking
- ☐ Health/Physical Education
- ☐ Ethnic/Women's Studies

Check either Option 1 or Option 2

☒ **OPTION #1:** Moorpark College has already received approval from the CSU and/or UC systems for this course to fulfill a GE requirement. Note: This option applies only to technical revisions and updated courses.

☐ **OPTION #2:** Moorpark College has not received approval from the CSU and/or UC systems for this course to fulfill a GE requirement. This option applies to all new and substantively revised courses.

XVII. STUDENT MATERIALS FEE ADDENDUM

PHYS M20B: Not Applicable

XVIII. REPEATABILITY JUSTIFICATION TITLE 5, SECTION 55041

PHYS M20B: Not Applicable

XIX. CURRICULUM APPROVAL

Course Information:

Discipline: PHYSICS

Discipline Code and Number: PHYS M20B

Course Revision Category: Outline Update

Course Proposed By:

Originating Faculty Ronald Wallingford 03/27/2013

Faculty Peer: Scarlet Relle 10/22/2013

Curriculum Rep: Robert Keil 04/01/2013

Department Chair: Ronald Wallingford 10/18/2013

Division Dean: Julius Sokenu 10/28/2013

Approved By:

Curriculum Chair: Jerry Mansfield 12/14/2013

Executive Vice President: Lori Bennett 12/18/2013

Articulation Officer: Letrisha Mai 10/31/2013

Librarian: Mary LaBarge 11/19/2013

Implementation Term and Year: Fall 2014

Approval Dates:

Approved by Moorpark College Curriculum Committee: 12/03/2013

Approved by Board of Trustees (if applicable): _____

Approved by State (if applicable): _____