

PHYS 152 Seminar / Laboratory - Syllabus Summer 2022

Electricity and Magnetism (calculus-based)

Course Number: **10239** (3 units, seminar), **10240** (1 unit, laboratory)

A. **Instructor:** Dr. Thomas Gredig

Office: CSU Long Beach

Phone: (562) 985-4922

Email: Thomas.Gredig@csulb.edu,

Office Hours: Online via Zoom Video Conferencing, MoFr 9-10am, Zoom ID: 815 7004 3333

B. **Meeting Time:** Online, asynchronous, see Office Hours and Exam Times

Location: Online (BeachBoard: <https://beachboard.csulb.edu/>), use <https://sso.csulb.edu> to login

Section: 1

Term: Summer 2022, Session I, May 23– July 1, 2022

Textbook: **Matter and Interactions, Vol. II, 4th Edition**, R. Chabay, B. Sherwood

C. **Course Goals / Learning Outcomes / Course Objectives:**

PHYS 152. “Electricity and Magnetism” (4 units); prerequisite: PHYS 151; prerequisite/corequisite: MATH 123. Mechanical waves, Coulomb's law, electrostatics, electric circuits, introductory electronics, magnetic fields, induction and Maxwell's equations. Letter grade only (A-F).

After instruction, students will be able to:

- approach and solve physics problems from a small set of fundamental principles, through the use of sketches and diagrams, construct the equations describing a given physical situation,
- subject their answers to multiple physical checks, including special cases and limits, physical units, orders of magnitude, and
- provide quantitatively useful predictions based on their general analysis.

The **key ideas and concepts**, which must be mastered by a PHYS 152 student that will be used in subsequent courses, particularly upper-division physics and engineering courses are:

- Matter is composed of atoms with a specific distribution of electrostatic charge.
- Charges in conductors flow only in response to a non-zero electric field.
- Forces on charges occur as a result of the electromagnetic field.
- The electromagnetic field carries momentum, energy, and angular momentum.
- The electromagnetic field has sources (charge distributions, and charges in motion).
- Patterns in the electromagnetic field (Gauss' law, Ampère's law, Faraday's law, and the magnetic version of Gauss' law) imply the existence of travelling wave solutions to Maxwell's equations.

The **key general education skills** outcomes addressed in this course are:

- Critical reasoning. Students will evaluate the quality of their reasoning and the reasonableness of their conclusions and will interpret data.
- Quantitative reasoning. Students will confidently apply mathematical reasoning and formal logic to physical situations
- Teamwork. Students will effectively work in teams for the laboratories.
- Outline of Covered and Thematic Subject Matter:**

Week 1	Coulomb's Law, Electric Fields, Polarization, 3D Computational Model of Electric Field due to Point Charges, Induced Dipole Moment, Insulators
Week 2	Electric Field of Distributed Charges, Lines, Rings, Disks, Capacitors, Electric Potential, Potential Energy, Conservative Fields
Week 3	3D Magnetic Field due to moving charge and current, Biot-Savart Law, Magnetic Compass to determine Magnetic Field from Current in Wire, Simple Circuits, Electric Field of Circuits, Node and Loop Rules (Kirchhoff's Laws)
Week 4	Circuit Elements (Resistors, Capacitors), RC Circuits, Time-Dependent Currents, Magnetic Force, Hall Effect, Circular Motion
Week 5	Gauss' Law, Patterns of Field in Space using Symmetry, Faraday's Law
Week 6	Maxwell's Equations, Ampere Law, Electromagnetic Radiation, Accelerated Charges, Re-radiation, Light Propagation, Index of Refraction

e. **Outline of Laboratory Topics:**

Lab 1	Electrostatic Force and Coulomb's Law
Lab 2	Build a Capacitor and Determine Dielectric Constant
Lab 3	Magnetic Dipole Measurement of a Permanent Magnet in Far Field
Lab 4	Electric Potential and IV Curves of Ohmic Resistors
Lab 5	Circuits on Breadboard in Series and Parallel
Lab 6	RC Circuit with Time Dependence

D. Required Texts and Materials

- a. **Textbook:** Matter and Interactions (M&I), Vol. II, 3rd or 4th Edition, R. Chabay and B. Sherwood (<https://matterandinteractions.org/>), eBook licensed through **Perusall** (perusall.com), textbook cost is \$29 (for 120 days) through BeachBoard portal upon first use, or \$90 for unlimited book access.
- b. **Lab Manual:** Online Laboratory: Electricity and Magnetism: Home Experiments, ed. 2022 by Thomas Gredig (freely available on BeachBoard)
- c. **E&M Lab Kit:** Full suggested list: <https://tinyurl.com/phys152labKit> includes (1) Ebonite friction rod; (2) 9V battery; (3) ruler; (4) composition notebook; (5) post-it notes; (6) extra fine thread (100wt); (7) aluminum foil; (8) safety goggles; (9) Keywishbot Upgraded Electronics Component Start Kit with power supply, breadboard, wires, resistors and capacitors (\$18); (10) Honeytek A6013L Capacitor Tester (\$18); (11) rare earth magnets; (12) compass; (13) Etekcity Digital Multimeter (\$13); (14) flannel towel or sweater; for all equivalent substitutes are possible, please discuss with instructor.
- d. **Computer** with microphone and camera; Smartphone with Camera (photo, video) to record experiments, share data; PDF scanner, such as GeniusScan (Grizzly Labs) or CamScanner; **PhyPhox** software on phone, available from <https://phyphox.org/>; hardware to do video conferencing via **zoom.us** (<https://zoom.us/>), including microphone and camera; **Pulse App** for news updates, make sure that you receive emails from the BeachBoard configured email.
- e. **Bound college ruled composition books** to (1) record daily progress, notes, and keep records for seminar, to (2) record experimental data and analysis and write notebook lab reports.

E. Basis for Assigned Course Grade:

Responses, Penalties and Student Rights: Students should consult the appropriate sections of the Catalog for examples of cheating, fabrication and plagiarism, and instructor and/or CSULB response options in such circumstances. The Catalog also outlines student rights. Any instance of academic dishonesty may result in your immediate expulsion from the class with a grade of "F" and/or other sanctions, as the instructor deems appropriate.

The course grade will be determined by total number of points (1000 points = 100%): A=900 points and more, B=800-899 points, C=700-799 points, D=600-699 points, F for less than 599 points.

- a) Seminar, see point distribution on calendar in section I
- b) Lab, see point distribution on calendar in section II

Weekly Homework Sets (individual) are scheduled regularly and auto-graded online. **Online Office Hours** are held via Zoom at the designated times, see BeachBoard. First-time users: allow some time to install the zoom.us software required to run the meeting. The **Reading Annotations (team)** refer to the textbook on Perusall, grade is based on active reading of the textbook online, insightful interpretation of the reading, annotations, and interactive discussions with peers. The 5 - 7 most insightful comments will be used for the grade computation. The **Assessments (individual)** are available through Qualtrics, an individual link will be emailed to your BeachBoard configured email address (check Spam folder), and a few assessments are also available through the Quiz function on BeachBoard, having the word "assessment" in the title. Assessments are evaluated on participatory basis. Points are given for participation, no points are given, if not submitted on time, incomplete submissions, or if submitted completed, but with random answers, or if key questions (such as "select A for this question") are answered incorrectly. The **Quiz (individual)** should be taken after you finish reading the assigned book chapter and it is graded based on the correct answers. The **Video Quiz (individual)** relates specifically to the chapter videos posted on BeachBoard. You can check your answers by going to "past quizzes", right-click on "submissions" to see your answers. **Midterms (individual)** are scheduled at specific times and require you to solve problems using the problem-solving steps from this course. You submit your scanned solutions to Dropbox in order to receive a grade. The solutions need to include name and a signature indicating that you solved the problems without help (see plagiarism section). The **Final Exam (individual)** is the same format as the Midterm, but longer, and there are more problems to complete.

Additional information is provided in the news section. It is important to daily check BeachBoard News or use the Pulse app from BrightSpace.

The laboratory consists of home experiments that you conduct on your own with help from the instructor and peers. It provides you training towards an ethical and professional approach in 6 key areas: experimental design, construction of knowledge, technical and practical skills, modeling, communication, and analysis and graphing. In the first step, read the experiment and post your **predictions** in the DropBox on BeachBoard. Create the setup with a post-it note that includes name, ID, and date and post as **Exp Photo**, then participate in the peer **discussion** to get ideas, resolve questions, and learn more about the experimental approach, or simply share your experiences. Use your experimental setup to collect the data and submit the **Data Sheet** via Dropbox. Continue to analyze, graph, and write a summary of the report. The **lab report** is scanned from the hand-written notes in the lab notebook. It is not a formal lab report, rather a collection of observations, data, graphs, analysis, uncertainties, and summary documented via a lab notebook, which you fill out continuously. Portions with errors can be crossed out and are an expected part of this kind of lab report, see more information on BeachBoard.

Informal **Notebook Lab Reports (individual)**: include the following sections:

- a. Title, author, date, goal of the experiment
- b. Model and schematic of the setup
- c. Experiment: Photo (experimental setup photo with your hand-written name and date on post-it)
- d. Analysis: Graphs with full-sentenced captions
- e. Summary and reflection paragraphs
- f. Acknowledgment (mention contributions from peers)

Importantly, it is the Department policy that you can only get a passing grade for this course, if you pass the lab. Moreover, all lab reports must be submitted. If more than one lab report is missing or your lab score is less than 60%, you may be assigned a grade F for the course regardless of your performance in the seminar portion.

You are *not allowed to share your student ID* with any other student or use the ID as your username / login name of peers. Lab reports MUST NOT include student ID.

CSULB Cheating/Plagiarism/Fabrication Policy: CSU Long Beach takes issues of academic dishonesty very seriously. If you use any deceptive or dishonest method to complete an assignment, take an exam, or gain credit in a course in any other way, or if you help someone else to do so, you are guilty of cheating. The definition of plagiarism here extends to all actions by a student that are intended to gain an unearned academic advantage by fraudulent or deceptive means. If you use someone else's ideas or work and represent it as your own without giving credit to the source, you are guilty of plagiarism. In the lab report, clearly indicate work from others or obtained through collaboration in acknowledgment, proper citing, or use of quotation marks. This does not apply if the ideas are recognized as common knowledge, or if you can show that you honestly developed the ideas through your own work. Any instructor can show you the correct ways of citing your sources, and you should use quotation marks, footnotes or endnotes and bibliographic references to give credit to your sources according to the standard formatting. Lab reports will be checked for originality. Unquoted reproduction of other's work (including Wikipedia) of more than 10% is considered cheating and will result in 0 points. The penalty for plagiarism ranges from 0 points for an assignment, through an F for the course, to University expulsion, see <https://tinyurl.com/csulbCheating>.

Use of third-person emails or re-routing may lead to a failing grade for the course. Without instructor pre-approval, website access (BeachBoard, etc.) through VPN services (IP hiding), proxies or Tor, etc. is not allowed and may lead to failing grade.

Copyright laws and fair use policies protect the rights of those who have produced the material. The copy in this has been provided for private study, scholarship, or research. Other uses may require permission from the copyright holder. The user of this work is responsible for adhering to copyright law of the U.S. (Title 17, U.S. Code). More information is available at <https://www.csulb.edu/university-library/copyright-policy>. These course web sites contain material protected by copyrights held by the instructor, other individuals or institutions. Such material is used for educational purposes in accord with copyright law and/or with permission given by the owners of the original material. You may download one copy of the materials on any single computer for non-commercial, personal, or educational purposes only, provided that you (1) do not modify it, (2) use it only for the duration of this course, and (3) include both this notice and any copyright notice originally included with the material. Beyond this use, no material from the course web site may be copied, reproduced, re-published, uploaded, posted, transmitted, or distributed in any way without the permission of the original copyright holder. The instructor assumes no responsibility for individuals who improperly use copyrighted material placed on the web site.

F. Withdrawals: Withdrawal of Classes Policy: We refer to the University's "Withdrawal Petition" form that can be found either on BeachBoard or on the following link: <http://www.ccpe.csulb.edu/summer/about.aspx?ID=41> - No

instructor or office staff can add or change a class for you. Only YOU, THE STUDENT, can add or change classes in YOUR schedule. You may either add classes on-line through your MyCSULB account or in person at Enrollment Services during the registration period. Each student is responsible to check their MyCSULB account weekly to be certain that the Class Schedule listed accurately reflects the courses s/he is enrolled in for the current semester. All students should also check the MyCSULB account regularly for any notices the University has sent to them.

- G. Any student missing a timed exam for a university-approved absence (requires documentation) is entitled to a reasonable make-up task. The absence needs to be discussed with the instructor within one week of the absence. Unexcused absences from any scheduled event will be recorded as 0 points.
- H. Students in need of special accommodations contact the Bob Murphy Access Center (BMAC) at (562) 985-5401. If you have a disability, it is your responsibility to notify your instructor of your need for accommodation at any time during the session, see <https://www.csulb.edu/student-affairs/bob-murphy-access-center> for information.

I. **Course calendar I:** (optional assignments, practice assignments are not listed here), deadlines for all assignments are at 11 pm (PST) unless noted, exams see BeachBoard. [Pts = points, Cum. = cumulative]

Week	Date	Day	Office Hours (Zoom)	Chap.	Description	Due	Pts	Exams	Pts	Cum. Points
1	23-May	Mon	X	13	Electric Field, Coulomb's Law					0
	24-May	Tue		13		Assessment	5	Video Quiz	5	10
	25-May	Wed		13		Reading Annotation	20	Quiz	5	35
	26-May	Thu		14	Electric Field and Matter, Polarization	Homework Set	20			55
	27-May	Fri	X	14				Video Quiz	5	60
	28-May	Sat		14		Reading Annotation	20	Quiz	5	85
	29-May	Sun								
2	30-May	Mon	X	15	Electric Field of Distributed Charges, Lines, Rings, Disks (Calculus Approach)	Homework Set	20			105
	31-May	Tue		15		Assessment	5	Video Quiz	5	115
	1-Jun	Wed		15		Reading Annotation	20	Quiz	5	140
	2-Jun	Thu		16	Electric Potential, Path Independence	Homework Set	20			160
	3-Jun	Fri	X	16				Midterm 1 6pm	45	205
	4-Jun	Sat		16		Reading Annotation	20	Quiz	5	230
	5-Jun	Sun							230	
3	6-Jun	Mon	X	17	Magnetic Field, Biot-Savart Law (Calculus Approach)	Homework Set	20			250
	7-Jun	Tue		17		Assessment	5	Video Quiz	5	260
	8-Jun	Wed		17		Reading Annotation	20	Quiz	5	285
	9-Jun	Thu		18	Electric Field and Circuits, Node and Loop Rule (Kirchhoff's Laws)	Homework Set	20			305
	10-Jun	Fri	X	18				Video Quiz	5	310
	11-Jun	Sat		18		Reading Annotation	20	Quiz	5	335
	12-Jun	Sun							335	
4	13-Jun	Mon	X	19	Circuit Elements, RC circuits, time-dependent current	Homework Set	20			355
	14-Jun	Tue		19		Assessment	5	Video Quiz	5	365
	15-Jun	Wed		19		Reading Annotation	20	Quiz	5	390
	16-Jun	Thu		20	Magnetic Force, Circular motion, Hall effect	Homework Set	20	Video Quiz	5	415
	17-Jun	Fri	X	20				Midterm 2 6pm	50	465
	18-Jun	Sat		20		Reading Annotation	20	Quiz	5	490
	19-Jun	Sun							490	
5	20-Jun	Mon	X	21	Patterns of Field in Space, Gauss Law	Homework Set	20			510
	21-Jun	Tue		21		Assessment	5	Video Quiz	5	520
	22-Jun	Wed		21		Reading Annotation	20	Quiz	5	545
	23-Jun	Thu		22	Faraday's Law	Homework Set	20			565
	24-Jun	Fri	X	22				Video Quiz	5	570
	25-Jun	Sat		22		Reading Annotation	20	Quiz	5	595
	26-Jun	Sun							595	
6	27-Jun	Mon		23	Electromagnetic Radiation, Maxwell's Equations, Accelerated Charges, Visible EM Radiation, Light Propagation, Optics	Homework Set	20			615
	28-Jun	Tue		23		Assessment	5	Video Quiz	5	625
	29-Jun	Wed	X	23		Reading Annotation	20	Quiz	5	650
	30-Jun	Thu		23		Homework Set	20	Final Exam 6pm	90	760
	1-Jul	Fri	X	23						760

Laboratory calendar II: (All assignments are due at 11 pm (PST) unless noted. [Pts = points, Cum. = cumulative])

Week	Date	Day	Office Hours (Zoom)	Chap.	Description	Due	Pts	Activities	Pts	Cum. Points
1	23-May	Mon	X	13	Electric Field, Coulomb's Law					0
	24-May	Tue		13		Quiz Uncertainty	6	Predictions	5	11
	25-May	Wed		13						11
	26-May	Thu		14	Electric Field and Matter, Polarization	Exp Photo	10			21
	27-May	Fri	X	14						21
	28-May	Sat		14		Data Sheet	6			27
	29-May	Sun								27
2	30-May	Mon	X	15	Electric Field of Distributed Charges, Lines, Rings, Disks (Calculus Approach)					27
	31-May	Tue		15		Lab Report	18	Predictions	5	50
	1-Jun	Wed		15						50
	2-Jun	Thu		16	Electric Potential, Path Independence	Exp Photo	10			60
	3-Jun	Fri	X	16		Data Sheet	6			66
	4-Jun	Sat		16						66
	5-Jun	Sun								66
3	6-Jun	Mon	X	17	Magnetic Field, Biot-Savart Law (Calculus Approach)	Lab Report	18			84
	7-Jun	Tue		17				Predictions	5	89
	8-Jun	Wed		17						89
	9-Jun	Thu		18	Electric Field and Circuits, Node and Loop Rule (Kirchhoff's Laws)	Exp Photo	10			99
	10-Jun	Fri	X	18		Data Sheet	6			105
	11-Jun	Sat		18						105
	12-Jun	Sun								105
4	13-Jun	Mon	X	19	Circuit Elements, RC circuits, time-dependent current	Lab Report	18			123
	14-Jun	Tue		19				Predictions	5	128
	15-Jun	Wed		19						128
	16-Jun	Thu		20	Magnetic Force, Circular motion, Hall effect	Exp Photo	10			138
	17-Jun	Fri	X	20		Data Sheet	6			144
	18-Jun	Sat		20						144
	19-Jun	Sun								144
5	20-Jun	Mon	X	21	Patterns of Field in Space, Gauss Law	Lab Report	18			162
	21-Jun	Tue		21				Predictions	5	167
	22-Jun	Wed		21						167
	23-Jun	Thu		22	Faraday's Law	Exp Photo	10			177
	24-Jun	Fri	X	22		Data Sheet	6			183
	25-Jun	Sat		22						183
	26-Jun	Sun								183
6	27-Jun	Mon		23	Electromagnetic Radiation, Maxwell's Equations, Accelerated Charges, Visible EM Radiation, Light Propagation, Optics	Lab Report	18			201
	28-Jun	Tue		23		Exp Photo	10	Predictions	5	216
	29-Jun	Wed	X	23		Data Sheet	6			222
	30-Jun	Thu		23		Lab Report	18			240
	1-Jul	Fri	X	23						240

J. Online course:

- Communication: Course communication occurs on BeachBoard, and through Zoom.us (Video Conferencing), and Email communication with response time of less than 24 hours during workdays. It is your responsibility to install the software, video and audio capabilities and check the BeachBoard configured email address.
- Online participation is assessed based on activity (regularity, content, conceptual understanding, quantitative reasoning), and participation.
- Student work is collected via Dropbox on BeachBoard, assessed and graded consistent with instructions for assignment. Rubrics are available on BeachBoard and through the Gradebook.
- Standards of appropriate online behavior are maintained according to University policy.
- Students should have basic knowledge of using computers, word processing, spreadsheets, basic programming, phone cameras, scanning, uploading and sharing content.
- Computer access with high-speed Internet is required; also, ability to capture pictures, video, and audio. Ability to build, perform, execute, and measure lab experiments remotely.
- No on-campus meeting is required.
- Cheating or plagiarism may result in 0 points for assignment and/or failing grade for the entire course as deemed by the instructor.