

UNIVERSITY OF CALGARY
DEPARTMENT OF PHYSICS and ASTRONOMY
COURSE OUTLINE

1. **Physics 613, Electrodynamics**

Lecture Sections: **L01:** MW, 17:00-18:15, Education C 152

Instructor, **D.W. Hobill**

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Office Hours: M F 10:00-11:00 (or by appointment)

Departmental Office location: SB 605, telephone no.: (403)-220-5385

2. **PREREQUISITES:** Background should include Physics 457 and Physics 501 or equivalent

3. **GRADING:** The University policy on grading and related matters is described sections F.1 and F.2 of the online University Calendar. In determining the overall grade in the course the following weights will be used:

Assignments	40%
Midterm test	20% (See Syllabus for date)
Final Examination	40% (To be scheduled by the Registrar)

Percentage grades will be given for all elements of term work and examinations. A weighted course percentage will be calculated for each student after the final exam is written. A table of conversion from final course percentage to final course letter grade appears on the last page of this outline.

4. **Missed Components of Term Work.** The regulations of the Faculty of Science pertaining to this matter are found in the Faculty of Science area of the Calendar in section 3.6: <http://www.ucalgary.ca/pubs/calendar/current/sc-3-6.html>. It is the student's responsibility to familiarize himself/herself with these regulations.

See also <http://www.ucalgary.ca/pubs/calendar/current/e-3.html>.

5. **REGULARLY SCHEDULED CLASSES HAVE PRECEDENCE OVER ANY OUT-OF-CLASS-TIME-ACTIVITY.** If you have a clash with this out-of-class-time-activity, please inform your instructor as soon as possible so that alternative arrangements may be made for you.

6. **TEXTBOOK:** *Classical Electrodynamics*, (3rd Edition), J.D. Jackson, J. Wiley and Sons.

7. **EXAMINATION POLICY:** Students are encouraged to read the Calendar, Section G, on Examinations: <http://www.ucalgary.ca/pubs/calendar/current/g.html>.

Department Approval _____ Date _____

8. **OTHER IMPORTANT INFORMATION FOR STUDENTS:**

(a) **ACADEMIC MISCONDUCT** (cheating, plagiarism, or any other form) is a very serious offence that will be dealt with rigorously in all cases. A single offence may lead to disciplinary probation or suspension or expulsion. The Faculty of Science follows a zero tolerance policy regarding dishonesty. Please read the sections of the University Calendar under K. Student Misconduct (<http://www.ucalgary.ca/pubs/calendar/current/k.html>) to inform yourself of definitions, processes and penalties

(b) **ASSEMBLY POINTS in case of emergency during class time.** Be sure to **FAMILIARIZE YOURSELF** with the information at <http://www.ucalgary.ca/emergencyplan/assemblypoints>.

(c) **ACADEMIC ACCOMMODATION POLICY.** Students with documentable disabilities are referred to the following links:
Calendar entry on students with disabilities: <http://www.ucalgary.ca/pubs/calendar/current/b-1.html>
Disability Resource Centre: <http://www.ucalgary.ca/drc/>

(d) **SAFEWALK:** Campus Security will escort individuals day or night (<http://www.ucalgary.ca/security/safewalk/>). Call **220-5333** for assistance. Use any campus phone, emergency phone or the yellow phones located at most parking lot pay booths.

(e) **FREEDOM OF INFORMATION AND PRIVACY:** This course will be conducted in accordance with the Freedom of Information and Protection of Privacy Act (FOIPP). As one consequence, **students should identify themselves on all written work by**

placing their name on the front page and their ID number on each subsequent page. For more information see also <http://www.ucalgary.ca/secretariat/privacy>.

- (f) **STUDENT UNION INFORMATION:** VP Academic **Phone:** 220-3911 **Email:** suvpaca@ucalgary.ca.
SU Faculty Rep. **Phone:** 220-3913 **Email:** sciencerep@su.ucalgary.ca Website
<http://www.su.ucalgary.ca/home/contact.html>.
Student Ombudsman: <http://www.su.ucalgary.ca/services/student-services/student-rights.html>

- (i) **INTERNET and ELECTRONIC COMMUNICATION DEVICE Information.** You can assume that in all classes that you attend, **your cell phone should be turned off.** Also, communication with other individuals, via laptop computers, Blackberries or other devices connectable to the Internet is not allowed in class time unless specifically permitted by the instructor. If you violate this policy you may be asked to leave the classroom. Repeated abuse may result in a charge of misconduct.

Course Syllabus

The course will be taught from the point of view that Classical Electrodynamics is a relativistic field theory. Both the equations of motion for charged particles and the Maxwell equations will be derived from a relativistically invariant Lagrangian (or Lagrangian density). Special solutions that depend on symmetries, initial and/or boundary conditions will be presented and analyzed. Topics to be covered are:

1. Review of special relativity (Chap 11)
 - (a) Lorentz transformations
 - (b) Four vectors and tensors
2. Particle motion in external fields (Chap 12)
 - (a) Lorentz force equation
 - (b) Motion in different Electric and Magnetic field configurations
3. Maxwell's equations (Chap 6)
 - (a) Electromagnetic four-potential
 - (b) Lagrangian densities
 - (c) Electromagnetic field tensor
 - (d) Electromagnetic field energy momentum tensor and conservation laws
4. Constant Electromagnetic Fields (Chaps 1-3, 5)
 - (a) Electrostatics
 - (b) Multipole fields (time independent)
 - (c) Magnetostatics
5. Electromagnetic waves (Chap 7)
 - (a) Gauge conditions
 - (b) Plane waves
 - (c) Polarization
6. Fields of moving charges
 - (a) Lienard-Wiechert potentials
 - (b) Retarded potentials
 - (c) Multipole fields (time dependent)
 - (d) Radiation reaction

There will be one (in-class) mid-term examination in late February or early March. The final exam will consist of two parts: (a) a "take home" part and (b) a shorter exam to be scheduled by the Registrar during the final exam period.

The assignment of letter grades will be based upon the following total percentages:

$$\begin{array}{cccccccc} X \geq .97, & .97 > X \geq .87, & .87 > X \geq .82, & .82 > X \geq .77, & .77 > X \geq .72, & .72 > X \geq .67, & .67 > X \geq .62, & .62 > X \geq .57 \\ \text{A+} & \text{A} & \text{A-} & \text{B+} & \text{B} & \text{B-} & \text{C+} & \text{C} \end{array}$$
$$\begin{array}{ccc} .57 > X \geq .52, & .52 > X \geq .48, & .48 > X \\ \text{C-} & \text{D} & \text{F} \end{array}$$