UNIVERSITY OF CALGARY
DEPARTMENT OF PHYSICS and ASTRONOMY
COURSE OUTLINE

1. **PHYSICS 457, Electromagnetic Theory III**

   Lecture Sections:

   L01: MWF, 13:00-13:50, ST 063 **Instructor,** Dr. B. Jackel
   Office: SB 627 Phone: 220-4271, e-mail: brian.jackel@ucalgary.ca, Office Hours: Thursday 2-4pm
   Blackboard: PHYS 457 L01 - (WINTER 2011) - ELECTROMAGNETIC THEORY III (W2011PHYS457L01)

   Physics and Astronomy office: SB 605, 403-220-5385

2. **PREREQUISITES:** Physics 455 and Applied Mathematics 413.

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 (8)	25%	
2 in class quizzes (15% each)	30%	
Final Examination	45%	(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 will be published on the Blackboard site later in the term

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. There is no planned out of class activity.

6. TEXTBOOK: ***"Introduction to Electrodynamics "***, 3rd Edition. David Griffiths, Prentice-Hall 1999

7. **EXAMINATION POLICY**: Students may bring a double-sided 8.5x11" formula sheet to all tests.
   Students are encouraged to read the Calendar, Section G, on Examinations:
   http://www.ucalgary.ca/pubs/calendar/current/g.html.

8. There are no additional course fees

Department Approval _____ **Date** Dec 2011

Associate Dean's Approval for
out of regular class-time activity: _____ **Date:** _____

11. 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@ucagary.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.

DETAILED COURSE SYLLABUS

Electrodynamics
- Electromotive force: Ohm's law, Joule heating, motional EMF
- Electromagnetic induction: Faraday's law, Lenz's law, induced electric field, inductance, magnetic field energy
- Maxwell's equations: displacement current, magnetic charge, polarization current, boundary conditions

Conservation laws
- Charge and energy: continuity equation, Poynting flux,
- Momentum: Newton's 3rd law, Maxwell stress tensor, momentum flux density, angular momentum

Electromagnetic waves
- One dimension: wave equation, sinusoids, reflection and transmission, polarization
- Waves in vacuum: E&B wave equation, monochromatic plane waves, energy and momentum
- Waves in matter: linear media, normal incidence reflection and transmission, oblique incidence, Snell's law, Fresnel equations, Brewster's angle
- Absorption and dispersion: waves in conductors, reflection at conductors, group velocity, phase velocity, anomalous dispersion
- Guided waves: wave guides, TE/TM, rectangular, cutoff frequency, coaxial transmission line,

Potentials and Fields
- Potential formulation: scalar and vector potentials, gauge transformations, Coulomb gauge, Lorentz gauge
- Continuous distributions: retarded potentials, Jefimenko's equations
- Point charges: Lienard-Weichert potentials, moving point charges

Radiation
- Dipole radiation: electric dipole, magnetic dipole, arbitrary source
- Point charges: radiated power, radiation reaction

Relativity
- Special theory: Einstein's postulates, time dilation, Lorentz contraction, Lorentz transformations, four-vectors
- Mechanics: proper time and velocity, energy and momentum, kinematics, dynamics
- Electrodynamics: magnetism, field transformation, field tensor, potentials,