UNIVERSITY OF CALGARY
DEPARTMENT OF PHYSICS and ASTRONOMY
**COURSE OUTLINE**

**1. Physics 501, The Theory of Relativity**

Lecture Section **L01:** MWF, 15:00-15:50, SS 117
**Instructor,** D.Leahy Office SB517 Tel. No., 403-220-7192 e-mail address leahy@ucalgary.ca Office Hours: MWF 13:00-13:50
Blackboard course name: Phys501
Departmental Office SB605, telephone no. 220-5385

**2. PREREQUISITES:** Physics 325 and 457; Mathematics 353 or Applied Mathematics 309

**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:

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|---|---|---|
| Assignments | 20% | |
| In-class tests (2) | 20% | |
| Final Examination | 40% | (To be scheduled by the Registrar)] |

**There will be a final examination scheduled by the Registrar's Office. A passing grade on the final examination is required in order to pass the course.**

In Phys 501**:** Percentage grades will be given for all elements of term work and examinations in Physics 501. 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 given on the Phys 501 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. TEXTBOOK**: "Introduction to Special Relativity, 2nd Edition ", Wolfgang Rindler, Oxford Science Publ.
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**6. 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**_____

**7. 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

Topics to be covered:

Foundations of Special Relativity
The Michelson-Morley Experiment
Inertial Frames in Relativity
Einstein's Two Axioms
Coordinates: the Relativity of Time
Derivation of the Lorentz Transformation
Properties of the Lorentz Transformation
Relativistic Kinematics
Length Contraction
Time Dilation
The Twin Paradox
Velocity Transformation
Acceleration Transformation
Relativistic Optics
The Drag Effect
The Doppler Effect
Aberration
Spacetime and Four-tensors
Minkowski Map of Spacetime
Four-velocity and four-acceleration
Wave Motion
Relativistic Particle Mechanics
Conservation of Four-momentum
Equivalence of Mass and Energy
Four-momentum Identities
Center of momentum frame
Threshold energies
DeBroglie Waves
Photons
Angular momentum four-tensor
Three-force and four-force
Formal structure of Maxwell's theory
Transformations of E and B
Potential and field of a moving charge
Field of a uniformly moving charge
Electromagnetic energy tensor
Electromagnetic wave