ORIGINAL COURSE IMPLEMENTATION DATE:	September 2002
REVISED COURSE IMPLEMENTATION DATE:	January 2021
COURSE TO BE REVIEWED (six years after UEC approval)**:**	October 2026

Course outline form version: 05/18/2018

OFFICIAL UNDERGRADUATE COURSE OUTLINE FORM

Note: The University reserves the right to amend course outlines as needed without notice.

Course Code and Number: PHYS 352	**Number of Credits:** 3 Course credit policy (105)

Course Full Title: Special Relativity and Classical Fields
Course Short Title: Special Relativity
(Transcripts only display 30 characters. Departments may recommend a short title if one is needed. If left blank, one will be assigned.)

Faculty: Faculty of Applied and Technical Studies	**Department (or program if no department):** Physics

Calendar Description:

The constancy of the speed of light for all inertial observers has dramatic effects on our very concepts of space and time. Students will be introduced to the mathematics of tensors to study the implications of Einstein's seminal theory.

Prerequisites (or NONE):	PHYS 221 and PHYS 381/MATH 381/ENGR 257.
Corequisites (if applicable, or NONE):	NONE
Pre/corequisites (if applicable, or NONE):	NONE

Antirequisite Courses *(Cannot be taken for additional credit.)*
Former course code/number:
Cross-listed with:
Dual-listed with:
Equivalent course(s):
(If offered in the previous five years, antirequisite course(s) will be included in the calendar description as a note that students with credit for the antirequisite course(s) cannot take this course for further credit.)

Typical Structure of Instructional Hours

Lecture/seminar hours	75
Tutorials/workshops	
Supervised laboratory hours	
Experiential (field experience, practicum, internship, etc.)	
Supervised online activities	
Other contact hours:	
Total hours	**75**

Labs to be scheduled independent of lecture hours: ☐ No ☒ Yes

Special Topics *(Double-click on boxes to select.)*
This course is offered with different topics:
☒ No ☐ Yes *(If yes, topic will be recorded when offered.)*

Independent Study
If offered as an Independent Study course, this course may be repeated for further credit: *(If yes, topic will be recorded.)*
☒ No ☐ Yes, repeat(s) ☐ Yes, no limit

Transfer Credit
Transfer credit already exists: *(See **bctransferguide.ca**.)*
☒ No ☐ Yes
Submit outline for (re)articulation:
☒ No ☐ Yes *(If yes, fill in transfer credit form.)*

Grading System
☒ Letter Grades ☐ Credit/No Credit

Maximum enrolment (for information only): 24

Expected Frequency of Course Offerings: Every two years
Once every two years *(Every semester, Fall only, annually, etc.)*

Department / Program Head or Director: Norm Taylor	**Date approved:**	November 1, 2019
Faculty Council approval	**Date approved:**	January 10, 2020
Dean/Associate VP: John English	**Date approved:**	January 10, 2020
Campus-Wide Consultation (CWC)	**Date of posting:**	February 21, 2020
Undergraduate Education Committee (UEC) approval	**Date of meeting:**	October 2, 2020

Learning Outcomes:

Upon successful completion of this course, students will be able to:

- Explain time dilation and length contraction in terms of the constancy of the speed of light.
- Determine the relative velocity between objects when they are moving at speeds approaching c.
- State the assumptions behind the development of Special Relativity (SR), and have a knowledge of the various paradoxes which arise (and possible resolutions).
- Perform basic tensor analysis in Minkowski space involving tensor ranks of 0, 1, 2, 3 or more.
- Derive the famous $E=mc^2$ relationship, with a deeper understanding of what it means.
- Utilize the Lorentz transformations within the algebra of tensors, and be able to apply them to classical fields.
- Provide explanations as to the relationships between the electric and magnetic fields as a consequence of SR.
- Extend the basic ideas regarding tensors in flat space-time (SR), to the more general cases of curved space-time (GR).
- Discern how relativistic and classical calculations differ, and know the circumstances under which each is valid.
- Collaborate in small groups to research a relevant topic or experiment.

Prior Learning Assessment and Recognition (PLAR)

☒ Yes ☐ No, PLAR cannot be awarded for this course because

Typical Instructional Methods *(Guest lecturers, presentations, online instruction, field trips, etc.; may vary at department's discretion.)*

The course will be taught using lectures, seminars, presentations, and projects.
Problems will be assigned and marked on a regular basis.

NOTE: The following sections may vary by instructor. Please see course syllabus available from the instructor.

Typical Text(s) and Resource Materials *(If more space is required, download Supplemental Texts and Resource Materials form.)*

	Author (surname, initials)	Title (article, book, journal, etc.)	Current ed.	Publisher	Year
1.	French, F.	Special Relativity	☐	CRC press	1968
2.	Schwarz & Schwarz	Special Relativity: From Einstein to Strings	☐	Cambridge University Press	2004
3.	Susskind & Friedman	Special Relativity and Classical Field Theory: The Theoretical Minimum	☐	Basic Books	2017
4.			☐		
5.			☐		

Required Additional Supplies and Materials *(Software, hardware, tools, specialized clothing, etc.)*

Typical Evaluation Methods and Weighting

Final exam:	40%	Assignments:	20%	Field experience:	%	Portfolio:	%
Midterm exam:	20%	Project:	%	Practicum:	%	Other: Presentation	10%
Quizzes/tests:	10%	Lab work:	%	Shop work:	%	Total:	100%

Details (if necessary):

Typical Course Content and Topics

1. Classical mechanics and Cartesian tensors (index notation)
2. Inertial and Non-inertial coordinate systems
3. Galilean relativity and Galilean transformations
4. The constancy of the speed of light and the Lorentz transformations
5. Time dilation, length contraction, relativistic mass and energy
6. Covariant and contravariant tensors and the Einstein summation convention
7. Relativistic velocity addition, relativistic kinematics and dynamics
8. Consequences of charge conservation and the relationship to the electromagnetic field within tensor analysis
9. The electromagnetic field tensor and the conceptof gauge invariance
10. Extending the basic ideas of tensors in Minkowski space to that of more general Riemannian spaces