ORIGINAL COURSE IMPLEMENTATION DATE: September 2007
REVISED COURSE IMPLEMENTATION DATE: January 2018
COURSE TO BE REVIEWED: (six years after UEC approval) August 2023
Course outline form version: 09/15/14

OFFICIAL UNDERGRADUATE COURSE OUTLINE FORM

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

Course Code and Number: PHYS 457	**Number of Credits:** 3 Course credit policy (105)
Course Full Title: Particle Physics **Course Short Title (if title exceeds 30 characters):**	
Faculty: Faculty of Science	**Department (or program if no department):** PHYSICS

Calendar Description:

The Standard Model of particle physics describing electromagnetic, weak, and strong interactions. Analyze decays and scattering processes using relativistic kinematics, conservation laws, and Feynman rules. Determine masses and magnetic dipole moments of light hadrons in the quark model.

Prerequisites (or NONE):	PHYS 351. Note: PHYS 352 is recommended as a pre/corequisite.
Corequisites (if applicable, or NONE):	
Pre/corequisites (if applicable, or NONE):	

Equivalent Courses (cannot be taken for additional credit)
Former course code/number:
Cross-listed with:
Equivalent course(s):
Note: Equivalent course(s) should be included in the calendar description by way of a note that students with credit for the equivalent course(s) cannot take this course for further credit.

Transfer Credit
Transfer credit already exists: ☐ Yes ☒ No
Transfer credit requested (OReg to submit to BCCAT):
☐ Yes ☒ No (if yes, fill in transfer credit form)
Resubmit revised outline for articulation: ☐ Yes ☐ No
To find out how this course transfers, see **bctransferguide.ca**.

Total Hours: 75
Typical structure of instructional hours:

Lecture hours	75
Seminars/tutorials/workshops	
Laboratory hours	
Field experience hours	
Experiential (practicum, internship, etc.)	
Online learning activities	
Other contact hours:	
Total	**75**

Special Topics
Will the course be offered with different topics?
☐ Yes ☒ No
If yes, different lettered courses may be taken for credit:
☐ No ☐ Yes, repeat(s) ☐ Yes, no limit
Note: The specific topic will be recorded when offered.

Maximum enrolment (for information only): 24

Expected frequency of course offerings (every semester, annually, every other year, etc.): Based on student demand; normally once every 2 to 3 years

Department / Program Head or Director: Dr. Jeff Chizma	**Date approved:**	May 2017
Faculty Council approval	**Date approved:**	May 26, 2017
Campus-Wide Consultation (CWC)	**Date of posting:**	n/a
Dean/Associate VP: Dr. Lucy Lee	**Date approved:**	May 26, 2017
Undergraduate Education Committee (UEC) approval	**Date of meeting:**	Auguat 31, 2017

Learning Outcomes

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

- Identify the essential features of the Standard Model of particle physics including quarks, leptons, antiparticles, generations, quantum numbers, the three interactions, gauge vector bosons, and hadrons
- Define (operationally) lifetimes, branching ratios, and cross sections (both inclusive and exclusive)
- Sketch Feynman diagrams corresponding to decays and scattering processes
- Apply conservation of 4-momentum to particle processes
- Analyze particle processes using conservation of angular momentum, lepton number, parity, and charge conjugation number
- Identify CKM-suppressed weak processes
- Compare related strong interaction processes using conservation of isospin
- Calculate ground state masses and magnetic dipole moments of light hadrons within the quark model

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)

- Lectures, assignments, exams
- Possibly audio-visual materials, seminars, student projects/presentations

Grading system: Letter Grades: ☒ Credit/No Credit: ☐ Labs to be scheduled independent of lecture hours: Yes ☐ No ☒

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.	Griffiths, D.	Introduction to Elementary Particles	☒	Wiley-VCH	2008
2.	Perkins, D.	Introduction to High Energy Physics	☒	Cambridge	2015
3.	Martin, Brian and Shaw, Graham	Particle Physics	☒	Wiley	2017
4.			☐		
5.			☐		

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

Typical Evaluation Methods and Weighting

Final exam:	40%	Assignments:	15%	Midterm exam:	%	Practicum:	%
Quizzes/tests:	30%	Lab work:	%	Field experience:	%	Shop work:	%
Project/Presentation:	15%	Other:	%	Other:	%	Total:	100%

Details (if necessary):

Typical Course Content and Topics

- Introduction to the Standard Model of particle physics
- Decay rates and cross sections
- Relativistic kinematics: scattering and decays
- Symmetries and conservation laws: angular momentum, isospin, flavor, parity, and charge conjugation
- Hadron masses and magnetic dipole moments from the quark model