UNIVERSITY COLLEGE of the FRASER VALLEY

COURSE IMPLEMENTATION DATE:	September 2002
COURSE REVISED IMPLEMENTATION DATE:	September 2007
COURSE TO BE REVIEWED:	February 2011
(Four years after UPAC final approval date)	(MONTH YEAR)

OFFICIAL COURSE OUTLINE INFORMATION

Students are advised to keep course outlines in personal files for future use.
Shaded headings are subject to change at the discretion of the department and the material will vary - see course syllabus available from instructor

FACULTY/DEPARTMENT: **Faculty of Science, Health & Human Services/Physics**

COURSE NAME/NUMBER	FORMER COURSE NUMBER	UCFV CREDITS
PHYS 393		**3**

COURSE DESCRIPTIVE TITLE: **Computer Algebra Physics I**

CALENDAR DESCRIPTION:

This is the first of two courses designed to illustrate how computer algebra systems (CAS) can be used in physics. The emphasis is on using computer algebra methods to form, manipulate, simplify, and plot equations along with its ability to interactively answer "what if" questions. No prior knowledge of any CAS software is assumed or needed.

PREREQUISITES: **Physics 221**
or COREQUISITES: **Physics 221**

SYNONYMOUS COURSE(S)
(a) Replaces: **N/A** *(Course #)*
(b) Cannot take: **N/A** *(Course #)* for further credit.

SERVICE COURSE TO: *(Department/Program)* *(Department/Program)*

TOTAL HOURS PER TERM: **45**

STRUCTURE OF HOURS:

Lectures:	**45**	Hrs
Seminar:		Hrs
Laboratory:		Hrs
Field Experience:		Hrs
Student Directed Learning:		Hrs
Other (Specify):		Hrs

TRAINING DAY-BASED INSTRUCTION
LENGTH OF COURSE:
HOURS PER DAY:

MAXIMUM ENROLLMENT: **24**
EXPECTED FREQUENCY OF COURSE OFFERINGS: **Once every two or three years**

WILL TRANSFER CREDIT BE REQUESTED? (lower-level courses only)	☐ Yes	☒ No
WILL TRANSFER CREDIT BE REQUESTED? (upper-level requested by department)	☐ Yes	☒ No
TRANSFER CREDIT EXISTS IN BCCAT TRANSFER GUIDE:	☐ Yes	☒ No

AUTHORIZATION SIGNATURES:

Course Designer(s): George McGuire
Chairperson: Art Last *(Curriculum Committee)*
Department Head: Norm Taylor
Dean: Wanda Gordon
UPAC Approval in Principle Date:
UPAC Final Approval Date: Feb. 2, 2007

LEARNING OBJECTIVES / GOALS / OUTCOMES / LEARNING OUTCOMES:

Learning Objectives:
1. Students should be able to use a CAS to interactively form, manipulate, simplify, and solve equations.
2. Students should be able to use a computer to communicate, visually present, and discuss their solutions in a more efficient and effective manner.
3. Students should have a competent and working knowledge of the material enumerated in this course outline.

Goals:
1. To provide opportunities for the students to acquire and deepen their computer and physics problem-solving skills.
2. To provide opportunities for the students to enhance their critical and abstract reasoning skills.
3. To provide opportunities for the students to gain confidence in their problem-solving abilities.

Learning Outcomes:
1. Students who successfully complete this course should gain confidence in their ability to use their knowledge of physics and computers in a manner which makes them more employable.
2. Students should augment the skills needed to help ensure their success in other physics courses and in industry

METHODS:

1. The computer algebra system used in this course will be Maple.
2. The course will need to be taught in a room containing computers. The upper-level physics lab might be used as an alternate room.
3. The teaching style will abandon the "sage on the stage" with its companion "talk and chalk" lecture style in favour of a more student "hands-on" and instructor facilitator approach.
4. The course contains enough extra material to allow the students to make choices and delve deeper into problems of their choice and interest.
5. A research problem will be assigned and the student will be expected to present their results to their classmates.

PRIOR LEARNING ASSESSMENT RECOGNITION (PLAR):

Credit can be awarded for this course through PLAR (Please check:) ☒ Yes ☐ No

METHODS OF OBTAINING PLAR:

Please refer to the Physics PLAR policy on the department's webpage.

TEXTBOOKS, REFERENCES, MATERIALS:

[Textbook selection varies by instructor. An example of texts for this course might be:]

Enns/McGuire, Computer Algebra Recipes, A Gourmet's Guide to the Mathematical Models of Science. Springer Verlag, New York, 2(

Recommended Readings:

Enns/McGuire, Nonlinear Physics with Maple for Scientists and Engineers, 2nd Ed., Birkhauser, Boston, 2000.

SUPPLIES / MATERIALS:

The classroom must be computer equipped.

Although not essential, it is recommended that students have a home computer.

STUDENT EVALUATION:

[An example of student evaluation for this course might be:]

Marked assignments	40%
Research problem and report	20%
Final exam	40%

COURSE CONTENT:

[Course content varies by instructor. An example of course content might be:]

The Graphs of Physics

1. Data simulation and graphical evaluation
2. Investigating and asking “what if” questions
3. Topics: waves, similitude, gradient, contour plots, Fermat’s Principle

Deriving Model Equations

1. Linear Correlation
2. Multiple regression

Algebraic Models

Examples from a variety of disciplines and areas

Monte Carlo Methods

1. Random walks
2. Monte Carlo Integration
3. Probability Distributions

Phase Plane Portraits

1. Stability
2. Classification of nonlinear stationary points

Linear ODE Models

1.Problem solving techniques
2. Special functions: i.e., Bessel and Legendre ODE Models

Nonlinear ODE Models

1. First order models
2. Second order models
3. Limit cycles