COURSE IMPLEMENTATION DATE:	January 2003
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

PHYS 493		3
COURSE NAME/NUMBER	FORMER COURSE NUMBER	UCFV CREDITS

Computer Algebra Physics II
COURSE DESCRIPTIVE TITLE

CALENDAR DESCRIPTION:

This course extends and augments the problem-solving skills of physics students taught in Physics 393. Problems amenable to solving with computer algebra systems will be emphasized. The problem-solving emphasis will be on an understanding of the physics and on checking whether the solution correctly predicts the actual physical behaviour.

PREREQUISITES: PHYS 393 and PHYS 381
or COREQUISITES: PHYS 393 and PHYS 381

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: *(CurriculumCommittee)*
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 demonstrate their acquired knowledge by being able to use a CAS to solve physics problems, especially those problems related to the material in this course outline.
2. Students should have acquired a competent and working knowledge of the physics enumerated in this course outline.

Goals:

1. To provide the students with the opportunities to learn and master new CAS methods and to practice the computer skills acquired in Physics 393.
2. To provide opportunities for the students to augment their physics problem-solving skills.
3. To provide opportunities for the students to enhance their critical and abstract reasoning skills.
4. To provide opportunities for the students to gain confidence in their problem-solving abilities.
5. To provide methods for students to assess whether they wish to continue their studies in physics.

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 who successfully complete this course should be better able to assess their chances of having a successful career in physics.
3. Students should have acquired many of the skills needed by industry or other employers who hire physics graduates.

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, 2001.

Recommended Readings:

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

SUPPLIES / MATERIALS:

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

STUDENT EVALUATION:

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

Assignments	40%
Research problem discussion	20%
Final exam	40%

COURSE CONTENT:

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

Difference Equations
1. First order linear
2. Second order linear
3. Nonlinear equations
4. Nonlinear models
5. Numerical solving

Analytical Approaches
1. Checking solutions
2. Calculus of variations
3. Fourier series
4. FFT and the power spectrum

Fractal Patterns
1. Difference equation patterns
2. ODE patterns
3. Cellular automata

Diagnostic Tools for Nonlinear Dynamics
1. Poincaré section
2. Bifurcation diagrams
3. Lyapunov exponents
4. Strange attractors

Linear PDE Models
1. Separation of variables
2. Models using diffusion and Laplace’s equation
3. Wave equation models
4. Semi-infinite and infinite domains

Solitons and Nonlinear PDE Models
1. Solitary waves
2. Graphically hunting solitons
3. Analytic solition solutions

Simulating PDE Models
1. Diffusion and waves equations
2. Soliton collisions