UNIVERSITY COLLEGE of the FRASER VALLEY

COURSE IMPLEMENTATION DATE: September 2001
COURSE REVISED IMPLEMENTATION DATE: September 2006
COURSE TO BE REVIEWED: November 2009
(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**

PHYSICS 481		**3**
COURSE NAME/NUMBER	FORMER COURSE NUMBER	UCFV CREDITS

Advanced Mathematical Methods of Physics
COURSE DESCRIPTIVE TITLE

CALENDAR DESCRIPTION:

Working physicists analyze physical systems and model them mathematically. The equations that arise are often complicated, so specific mathematical techniques have been developed over the years to solve them. These solutions then predict the future behaviour of that physical system. This course includes: Bessel functions and associated Legendre polynomials and their applications in mechanics, electromagnetism and in the hydrogen atom; the calculus of variations, with applications in classical mechanics, optics and classical field theory, (with attention to coupled systems); Green function techniques; and applications to strings, electromagnetism and heat. Students will work many problems using initially pen and paper, and then with Maple and/or C or FORTRAN. Computers will be used to generate numerical and/or graphical solutions.

PREREQUISITES: PHYS 381, PHYS 222, COMP 150, One of (MATH 221, MATH 152)
COREQUISITES:

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: **75**
STRUCTURE OF HOURS:

Lectures:	**75**	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: **36**
EXPECTED FREQUENCY OF COURSE OFFERINGS: **On student demand, never two years concurrently**

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): Tim Cooper; revised Derek Harnett
Chairperson: Gillian Mimmack *(Curriculum Committee)*
Department Head: Norm Taylor
Dean: Jackie Snodgrass
UPAC Approval in Principle Date:
UPAC Final Approval Date: December 14, 2005

LEARNING OBJECTIVES / GOALS / OUTCOMES / LEARNING OUTCOMES:

- The students will master the specific material listed in the calendar description
- The students will deepen their understanding of the fundamental link between physical phenomena and the math that describes them
- Students will practice their computer skills, especially in Maple, C and/or FORTRAN

METHODS:

- Lecture on theory and examples, followed by homework problems on the same material completed in a timely manner.
- Computer demonstration, followed by students developing their own computer solutions.

PRIOR LEARNING ASSESSMENT RECOGNITION (PLAR):

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

METHODS OF OBTAINING PLAR:

Departmental Review and/or Course Challenge

TEXTBOOKS, REFERENCES, MATERIALS:

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

Text will be the same as for Phys 381, supplemented by instructors notes.

Other texts on mathematical physics will be recommended.

Examples

Advanced Engineering Mathematics (Wyie and Barrett OR Kreyszig)

A First Course in Computational Physics (DeVries)

Mathematical Physics (Butkov)

Mathematical Methods of Physics (Mathews and Walker)

Advanced Mathematics for Scientists and Engineers (Spiegel)

SUPPLIES / MATERIALS:

STUDENT EVALUATION:

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

Midterm	20%
Final	40%
Assignments	30%
Computer Solutions	10%

COURSE CONTENT:

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

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Students will be expected to use both Maple and either C++ or Fortran to solve problems. The start of this course has a small overlap with Phys 381 to help ease students in to the new material.

1. Bessel Functions
2. Applications of Bessel Functions
3. Associated Legendre Functions
4. Applications of Associated Legendre Functions (H-atom,)
5. Calculus of Variations (with and without constraints)

6. Applications of the Calculus of Variations, Rayleigh Ritz, Variational method for He.
7. Minimum Action Principles in Physics (mechanics, optics, Classical Field Theory)
8. Green Functions
9. Applications of Green Functions
10. Advanced Partial Differential Equations, numerous examples, applications.
11. More of week 10
12. Numerical Solutions of ordinary and partial differential equations.
13. Integral Equations, numerical and analytic techniques.
14. (week 14 may not be offered if time is short)
15. Perturbation theory, analytic and numerical

Disclaimer: In first year course is offered, some of the subjects will take more time than allotted, others less, however the total should be about right.