PH3080 - Computational Physics

Credits:	10.0	**Semester:**	1
Number of Lectures:		**Lecturer:**	Dr Michael Mazilu and Dr Aly Gillies
Available:	2018-19		

Overview
This module is designed to develop a level of competence in solving, and gaining insight into, physics problems using Mathematica. No prior experience with Mathematica is required as the module starts with a grounding in the use of Mathematica and discusses symbolic solutions and numerical methods. The main focus will be the use of Mathematica for problem solving in physics. The module is continually assessed through online quizzes and a final exam.

Aims & Objectives
To develop a level of expertise in developing physical models and to introduce various common techniques used to solve the problem and visualise the solution; this includes both 2-D and 3-D graphical output.
Data analysis to extract physical information from measured data and images.
Solution of first and second order differential equations.
To introduce various numerical methods.
To experience how modelling is used to explore physical concepts.

Learning Outcomes
The students will be able to program in Mathematica and be able to use Mathematica to solve, visualise and gain insight into a variety of physical problems. They should also be aware of the advanced capabilities of Mathematica including symbolical and numerical equation solving.

Synopsis
There are introductory programming labs teaching basic programming skills in Mathematica, different numerical methods and setting up physical problems. There are 8 case study labs. These are designed to illustrate the use of Mathematica to solve and visualise a variety of Physics problems as well as introducing a number of advanced features in Mathematica. The case studies can vary from year to year but past case studies have included: Solving differential equations, Astronomical data analysis, Modelling oscillations, Classical optics, Waves, Quantum mechanics.
Indicative timetable: weeks 1-2: introduction, weeks 3-5 and 7-11: case studies,
Indicative deadlines: online quiz deadlines: every Wednesday weeks 3-5, and 7-10.

Pre-requisites
PH2012, MT2501 and MT2503

Anti-requisites
PH3082

Assessment
Continuous assessment (online quizzes) = 50%, 3 hour computer based examination = 50%

Additional information on continuous assessment etc.
The continuous assessment takes the form of online activities (in-class and homework). The in-class questions take place at the beginning of the Thursday or Friday labs. The independent homework online tasks are due Wednesdays (weeks 3-5 and 7-10) and vary in difficulty and length (between 30 minutes and 2 hours).

Accreditation Matters
This module may not contain material that is part of the IOP “Core of Physics”, but does contribute to the wider and deeper learning expected in an accredited degree programme. The skills developed in this module, and others, contribute towards the requirements of the IOP “Graduate Skill Base”.

Recommended Books
Please view University online record:
http://resourcelists.st-andrews.ac.uk/modules/ph3080.html

General Information
Please also read the general information in the School's honours handbook.