Study Abroad

Modules in Physics and Astronomy

2022/23 Academic Year

MODULE NAME: Introduction to Astrophysics, Modern Physics and Space Science

MODULE CODE: PA1601

MODULE DESCRIPTION: Click to open.

CREDITS: 15

PERIOD: Academic Year

DEPARTMENT: Physics and Astronomy

INTENDED LEARNING OUTCOMES:

On successful completion of the module, students should be able to:

- Demonstrate a working knowledge of introductory physics as applied to set specialist fields: astrophysics, modern physics, and space science

- Demonstrate this knowledge by describing and discussing key principles, solving simple applied problems and compiling written reports

- Organise appropriate private study time, obtain new information from text books, communicate areas of introductory specialist physics to your peers and to staff

COORDINATOR: Matthew Burleigh

TEACHING AND LEARNING METHODS:

In this course you will benefit from lectures, discussions with peers and staff members, and guided independent study.

PRE-REQUISITES:

TOTAL MODULE HOURS: 150

ASSESSMENT METHODS:

3 pieces of coursework - one for each area - equally weighted

GUIDED INDEPENDENT LEARNING: INDICATIVE ACTIVITIES:

You will read relevant background material and work through appropriate problems. You will discuss problems and solutions with your peers.

MODULE NAME: Introduction to Applied Physics, Astrophysics and Space Science

MODULE CODE: PA1602

MODULE DESCRIPTION: Click to open.

CREDITS: 15

PERIOD: Academic Year

DEPARTMENT: Physics and Astronomy

INTENDED LEARNING OUTCOMES:

On successful completion of the module, students should be able to:

- Demonstrate a working knowledge of introductory physics as applied to set specialist fields: applied physics, astrophysics, and space science

- Demonstrate this knowledge by describing and discussing key principles, solving simple applied problems and compiling written reports

- Organise appropriate private study time, obtain new information from text books, communicate areas of introductory specialist physics to your peers and to staff

COORDINATOR: Michael Goad

TEACHING AND LEARNING METHODS:

In this course you will benefit from lectures, discussions with peers and staff members, and guided independent study.

PRE-REQUISITES:

TOTAL MODULE HOURS: 150

ASSESSMENT METHODS:

3 Pieces of coursework (one for each area) [equally weighted]

GUIDED INDEPENDENT LEARNING: INDICATIVE ACTIVITIES:

You will read relevant background material and work through appropriate problems. You will discuss problems and solutions with your peers.

MODULE NAME: Introduction to Applied Physics, Astrophysics and Modern Physics

MODULE CODE: PA1603

MODULE DESCRIPTION: Click to open.

CREDITS: 15

PERIOD: Academic Year

DEPARTMENT: Physics and Astronomy

INTENDED LEARNING OUTCOMES:

On successful completion of the module, students should be able to:

- Demonstrate a working knowledge of introductory physics as applied to set specialist fields: applied physics, astro physics, and modern physics

- Demonstrate this knowledge by describing and discussing key principles, solving simple applied problems and compiling written reports

- Organise appropriate private study time, obtain new information from text books, communicate areas of introductory specialist physics to your peers and to staff

COORDINATOR: Andrew Blain

TEACHING AND LEARNING METHODS:

In this course you will benefit from lectures, discussions with peers and staff members, and guided independent study.

PRE-REQUISITES:

TOTAL MODULE HOURS: 150

ASSESSMENT METHODS:

Coursework for each area (equally weighted)

GUIDED INDEPENDENT LEARNING: INDICATIVE ACTIVITIES:

You will read relevant background material and work through appropriate problems. You will discuss problems and solutions with your peers.

MODULE NAME: Introduction to Applied Physics, Modern Physics and Space Science

MODULE CODE: PA1604

MODULE DESCRIPTION: Click to open.

CREDITS: 15

PERIOD: Academic Year

DEPARTMENT: Physics and Astronomy

INTENDED LEARNING OUTCOMES:

On successful completion of the module, students should be able to:

- Demonstrate a working knowledge of introductory physics as applied to set specialist fields: applied physics, modern physics, and space science
- Demonstrate this knowledge by describing and discussing key principles, solving simple applied problems and compiling written reports
- Organise appropriate private study time, obtain new information from text books, communicate areas of introductory specialist physics to your peers and to staff

COORDINATOR: Jonathan Nichols

TEACHING AND LEARNING METHODS:

In this course you will benefit from lectures, discussions with peers and staff members, and guided independent study.

PRE-REQUISITES:

TOTAL MODULE HOURS: 150

ASSESSMENT METHODS:

Coursework for each area (equally weighted)

GUIDED INDEPENDENT LEARNING: INDICATIVE ACTIVITIES:

You will read relevant background material and work through appropriate problems. You will discuss problems and solutions with your peers.

MODULE NAME: Experimental Physics 1

MODULE CODE: PA1900

MODULE DESCRIPTION: Click to open.

CREDITS: 15

PERIOD: Academic Year

DEPARTMENT: Physics and Astronomy

INTENDED LEARNING OUTCOMES:

On successful completion of the module, students should be able to:

- Plan and execute laboratory experiments and set up simple equipment following outline instructions
- Comply fully with Departmental safety procedures
- Use standard laboratory equipment competently
- Analyse data appropriately, including errors analyses associated with measurements
- Plan, record and report simple investigations professionally
- Write simple computer programs
- Participate in problem-based learning projects
- Organise appropriate private study time, obtain new information from text books, communicate ideas to your peers and to staff
- Work effectively in teams
- Reflect on and articulate motivations, strengths and experience of developing one or more transferable skills

COORDINATOR: Darren Wright

TEACHING AND LEARNING METHODS:

In this module teaching and learning will be achieved through preparatory skills sessions, handbooks and experiment scripts, interactive demonstrations, problem-based learning projects, R programming workshops and guided independent study.

PRE-REQUISITES:

TOTAL MODULE HOURS: 150

ASSESSMENT METHODS:

No reassessment of labs.

GUIDED INDEPENDENT LEARNING: INDICATIVE ACTIVITIES:

You will be required to prepare for each experiment before starting it by reading up on the topic, answering some preparatory questions and planning the experiments. Plotting and analysis will be required outside of core lab hours. You will need to reflect on your experience and articulate your motivations, strengths and weaknesses

MODULE NAME: Experimental Physics 2

MODULE CODE: PA2900

MODULE DESCRIPTION: Click to open.

CREDITS: 30

PERIOD: Academic Year

DEPARTMENT: Physics and Astronomy

INTENDED LEARNING OUTCOMES:

On successful completion of the module, students should:

- Be able to plan, set up and conduct laboratory experiments following outline instructions; manage simple scientific projects
- Be able to comply fully with Departmental safety procedures; use standard laboratory equipment competently
- Be able to explain aspects of the scientific method, types of logical reasoning and data analysis, and be able to critically analyse statistical and scientific arguments
- Understand types and sources of errors, data quality, and be able to apply error transformations where appropriate
- Produce and interpret common quantitative and graphical statistical summaries using simple, custom computer programs
- Be able to plan and report complex investigations; work effectively in teams
- Be able to design, construct and test a simple electronic circuit; describe how basic electronic components work; determine critical circuit parameters (e.g. RC filters, feedback etc.)
- Reflect on and articulate motivations, strengths and skills in relation to a future, work-related learning opportunity (e.g. placement, internship, employer-led project)

COORDINATOR: Steve Baker

TEACHING AND LEARNING METHODS:

In this course you will benefit from induction lectures, supervised laboratory classes, supervised computing workshops, data handling lectures, group and individual reports, discussions with peers and staff members, and guided independent study.

PRE-REQUISITES:

TOTAL MODULE HOURS: 300

ASSESSMENT METHODS:

No reassessment.

GUIDED INDEPENDENT LEARNING: INDICATIVE ACTIVITIES:

You will work through the relevant parts of the laboratory scripts prior to arriving in the laboratory session. You will analyse your experimental data, and present it in group or individual reports. You will discuss results with your peers, compare with results from the literature and elsewhere if relevant and reflect upon your experience.

MODULE NAME: Specialist Research Project

MODULE CODE: PA4900

MODULE DESCRIPTION: Click to open.

CREDITS: 30

PERIOD: Academic Year

DEPARTMENT: Physics and Astronomy

INTENDED LEARNING OUTCOMES:

Relevant artifact (Computer program, practical demonstration, research knowledge etc) Research report. Students should be able to carry out an original investigation, individually under supervision. Students should be able to apply computational,

experimental or analysis techniques to solve a problem in an area of research. Students should be able to clearly communicate their findings.

COORDINATOR: Matthew Burleigh

TEACHING AND LEARNING METHODS:

Supervised activity. Induction session, handbooks, interactive supervision.

PRE-REQUISITES: PA3900 or equivalent.

TOTAL MODULE HOURS: 300

ASSESSMENT METHODS:

Assessed project report and presentation, task-based.

GUIDED INDEPENDENT LEARNING: INDICATIVE ACTIVITIES:

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MODULE NAME: Mechanics

MODULE CODE: PA1110

MODULE DESCRIPTION: Click to open.

CREDITS: 15

PERIOD: Semester 1

DEPARTMENT: Physics and Astronomy

INTENDED LEARNING OUTCOMES:

On successful completion of the module, students should:

- Be able to state mathematically the laws of classical dynamics, both linear and rotational
- Understand the definitions and use of concepts such as energy, momentum and angular momentum
- Be able to state the properties of linear elasticity (Hooke's law, Young's modulus)
- Be able to state the basic properties of fluids including Archimedes' principle and Bernoulli's theorem
- Be able to give an account of the relation of theory and experiment or observation, in, for example, planetary motion
- Solve relevant problems at an appropriate level using these concepts
- Be able to organise appropriate private study time, obtain new information from text books, communicate physics concepts and ideas to your peers and to staff

COORDINATOR: Hartmut Boesch

TEACHING AND LEARNING METHODS:

In this course you will benefit from lectures, real-time problem solving classes, assessed homework problems, discussions with peers and staff members, and guided independent study.

PRE-REQUISITES:

TOTAL MODULE HOURS: 150

ASSESSMENT METHODS:

GUIDED INDEPENDENT LEARNING: INDICATIVE ACTIVITIES:

You will work through the course text, including working through the example problems, and practice problems. You will discuss problems and solutions with your peers, and review other texts on the subject to find alternative strategies to problem solving and alternative descriptions of the material.

MODULE NAME: Electricity and Magnetism

MODULE CODE: PA1130

MODULE DESCRIPTION: Click to open.

CREDITS: 15

PERIOD: Semester 1

DEPARTMENT: Physics and Astronomy

INTENDED LEARNING OUTCOMES:

On successful completion of the module, students should be able to:

- State mathematically the laws of electric and magnetic fields and the use of related quantities such as field strength, potential, energy, charge and current;
- Solve basic problems in electromagnetism, set out solutions to physics problems correctly and describe experiments and applications in clear, simple prose
- Understand basic circuit theory involving resistors and capacitors and solve basic circuit problems
- Undertake related practical experiments as part of the first year laboratory
- Organise appropriate private study time, obtain new information from text books, communicate physical concepts to your peers and to staff

COORDINATOR: Jonathan Nichols

TEACHING AND LEARNING METHODS:

In this course you will benefit from lectures, real-time problem solving classes, assessed homework problems, discussions with peers and staff members, and guided independent study.

PRE-REQUISITES:

TOTAL MODULE HOURS: 150

ASSESSMENT METHODS:

GUIDED INDEPENDENT LEARNING: INDICATIVE ACTIVITIES:

You will work through the course text, including working through the example problems, and practice problems. You will discuss problems and solutions with your peers, and review other texts on the subject to find alternative strategies to problem solving and alternative descriptions of the material.

MODULE NAME: Mathematical Physics 1.1

MODULE CODE: PA1710

MODULE DESCRIPTION: Click to open.

CREDITS: 15

PERIOD: Semester 1

DEPARTMENT: Physics and Astronomy

INTENDED LEARNING OUTCOMES:

On successful completion of the module, students should:

- Be able to compute derivatives and integrals for a range of one dimensional functions
- Manipulate vectors, including computing scalar (dot), vector (cross), and triple products and understand their geometrical interpretation
- Derive series expansions for a range of functions using binomial, Maclaurin and Taylor series, and be able to manipulate inverse and hyperbolic trigonometric functions
- Sketch functions of a single variable, paying attention to stationary points and limits, be able to compute limits for simple functions, understand and use the basic properties of finite and infinite series, and their convergence
- Calculate double and triple integrals of simple functions in two or three dimensions, using Cartesian, polar, cylindrical and spherical coordinates
- Recite and use the basic rules of probability theory, recognise and be able to apply some simple probability functions such as the binomial, Poisson and Gaussian distributions, calculate expectation values and variances for random variables
- Be able to organise appropriate private study time, clearly set out solutions to mathematical problems, obtain new information from text books, communicate mathematical ideas to your peers and to staff

COORDINATOR: Simon Vaughan

TEACHING AND LEARNING METHODS:

In this course you will benefit from lectures, real-time problem solving classes, electronic practice problems, discussions with peers and staff members, and guided independent study.

PRE-REQUISITES:

TOTAL MODULE HOURS: 150

ASSESSMENT METHODS:

GUIDED INDEPENDENT LEARNING: INDICATIVE ACTIVITIES:

You will work through the course text, including working through the example problems, and practice problems. You will discuss problems and solutions with your peers, and review other texts on the subject to find alternative strategies to problem solving and alternative descriptions of the material.

MODULE NAME: Electromagnetic Fields

MODULE CODE: PA2240

MODULE DESCRIPTION: Click to open.

CREDITS: 15

PERIOD: Semester 1

DEPARTMENT: Physics and Astronomy

INTENDED LEARNING OUTCOMES:

On successful completion of the module, students should be able to:

- Be able to solve problems involving the electric field and electric displacement, the magnetic field and magnetic intensity, polarisation and magnetisation

- State mathematically the integral and differential forms of Maxwell's equations

- Be able, to use Maxwell's equations to derive the wave equation for electromagnetic (EM) waves, to solve basic problems in electromagnetism and wave propagation in a vacuum, in dielectric media and in conductors

- Be able to solve problems involving calculations of electromagnetic energy density and electromagnetic energy propagation

- Be able to define and derive the boundary conditions for EM waves at boundaries

- Be able to derive the reflection and transmission coefficients of EM waves, and solve problems involving waves at boundaries under a number of geometries

- Be able to organise appropriate private study time, obtain supplementary information from text books to consolidate your understanding, and communicate the physical principles underlying Maxwell's equations and electromagnetic waves to your peers and to staff

COORDINATOR: Suzanne Imber

TEACHING AND LEARNING METHODS:

In this course you will benefit from lectures, real-time problem solving classes, assessed homework problems, discussions with peers and staff members, and guided independent study.

PRE-REQUISITES:

TOTAL MODULE HOURS: 150

ASSESSMENT METHODS:

GUIDED INDEPENDENT LEARNING: INDICATIVE ACTIVITIES:

You will work through the course text, including working through the example problems, and practice problems. You will discuss problems and solutions with your peers, and review other texts on the subject to find alternative strategies to problem solving and alternative descriptions of the material. As part of your revision you should work through the past papers provided on blackboard and make reference to your course handouts and the numerical answers provided to ensure you have mastered the subject.

MODULE NAME: Relativity, Quantum Physics and Particles

MODULE CODE: PA2260

MODULE DESCRIPTION: Click to open.

CREDITS: 15

PERIOD: Semester 1

DEPARTMENT: Physics and Astronomy

INTENDED LEARNING OUTCOMES:

On successful completion of the module, students should be able to:

- Be able to state the concepts developed in Einstein's theory of Special Relativity, and apply basic formulae, including the Lorentz transforms, to predict behaviour in physical situations where velocities are high; use the energy-momentum relationship to solve problems involving the collision of relativistic particles; explain the principles underlying the General Theory of Relativity

- Be able to describe the wave-like properties of matter at the quantum level; state the time dependent and time-independent Schrödinger equations; be able to solve simple 1-dimensional problems involving infinite and finite wells and barriers, including the calculation of expectation values and probability densities; use the De Broglie relations and Uncertainty principle to estimate physical properties in quantum systems

- Be able to demonstrate knowledge of the basic concepts of the Standard Model of particle physics, including stating the properties of elementary particles such as leptons and quarks; use the conservation laws to deduce whether a decay or reaction is allowed; be able to explain how quarks combine to form hadrons and mesons; be able to state the properties and use appropriate mathematical descriptions of Fermions and Bosons

- Be able to organise appropriate private study time, obtain new information from text books, communicate complex ideas to your peers and to staff

COORDINATOR: Nial Tanvir

TEACHING AND LEARNING METHODS:

In this course you will benefit from lectures, real-time problem solving classes, assessed homework problems, discussions with peers and staff members, and guided independent study.

PRE-REQUISITES:

TOTAL MODULE HOURS: 150

ASSESSMENT METHODS:

GUIDED INDEPENDENT LEARNING: INDICATIVE ACTIVITIES:

You will work through the set problems, including working through examples, and practice problems in textbooks that cover the requisite material. You will discuss problems and solutions with your peers, and review texts on the subject to find alternative strategies to problem solving and alternative descriptions of the material.

MODULE NAME: Mathematical Physics 2

MODULE CODE: PA2710

MODULE DESCRIPTION: Click to open.

CREDITS: 15

PERIOD: Semester 1

DEPARTMENT: Physics and Astronomy

INTENDED LEARNING OUTCOMES:

On successful completion of the module, students should:

- Be able to solve basic second order partial differential equations; be able to describe physical systems mathematically using second order partial differential equations; use the method of separation of variables

- Apply standard solutions of the wave equation on finite and infinite strings; apply the wave equation to calculate reflection and transmission of waves at barriers

- Be able to calculate Fourier series and transforms of 1-dimensional functions; know or be able to derive, the formulae for Fourier series coefficients; be able to apply the Fourier formulae to obtain Fourier series coefficients and use these to solve equations

- Use knowledge of symmetry to know when to apply sine, cosine and full range series; be able to calculate Fourier transforms, and to apply the convolution principle

- Be able to state the properties of, and use, the vector calculus operators grad, curl and div in 3-dimensional problems; state Gauss' and Stokes' theorems and know how these relate to flux and circulation

- Solve simple physical problems using Gauss' and Stokes' theorems; be able to manipulate partial derivatives

- Be able to organise appropriate private study time, clearly set out solutions to mathematical problems, obtain new information from text books, communicate mathematical ideas to your peers and to staff

COORDINATOR: Mervyn Roy

TEACHING AND LEARNING METHODS:

In this course you will benefit from lectures, real-time problem solving classes, assessed homework problems, discussions with peers and staff members, and guided independent study.

PRE-REQUISITES:

TOTAL MODULE HOURS: 150

ASSESSMENT METHODS:

GUIDED INDEPENDENT LEARNING: INDICATIVE ACTIVITIES:

You will work through the course text, including working through the example problems and practice problems. You will discuss problems and their solutions with your peers, and review other texts on the subject to find alternative strategies to problem solving and alternative descriptions of the material.

MODULE NAME: Quantum Mechanics

MODULE CODE: PA3210

MODULE DESCRIPTION: Click to open.

CREDITS: 15

PERIOD: Semester 1

DEPARTMENT: Physics and Astronomy

INTENDED LEARNING OUTCOMES:

On successful completion of the module, students should be able to:

- Calculate the solutions to the time independent Schrödinger equation for problems including 1-dimensional barriers, wells and harmonic oscillators in 1D, 2D and 3D, and hydrogen-like atoms; use the method of separation of variables and an understanding of symmetry to simplify 2D and 3D problems and calculate the degeneracy of energy levels

- State mathematically, and use, the laws of quantum mechanics, and the definitions of related quantities such as energy, momentum and angular momentum and their corresponding operators; use the matrix formulation of quantum mechanics and to solve basic problems involving Pauli spin matrices

- Calculate the energy level splitting arising from spin-orbit coupling and Zeeman splitting; calculate approximate analytical solutions to the time independent Schrödinger equation using first order perturbation theory and the variational method

- Analyse problems in quantum mechanics in order to identify their essential elements, implement planned solutions that address the problems, evaluate the effectiveness of solutions and reflect upon them

- Communicate ideas clearly and concisely to peers and staff; work in teams to solve problems in quantum mechanics; organise appropriate private study time and gain new information from text books

COORDINATOR: Mervyn Roy

TEACHING AND LEARNING METHODS:

In this course you will benefit from lectures, real-time problem solving classes, assessed homework problems, discussions with peers and staff members, and guided independent study using a set text.

PRE-REQUISITES:

TOTAL MODULE HOURS: 150

ASSESSMENT METHODS:

Coursework - 30%

Exam (2 hours) 70%

GUIDED INDEPENDENT LEARNING: INDICATIVE ACTIVITIES:

You will work through the set problems, and the examples and practice problems from the course text. You will discuss problems and solutions with your peers, and review other texts on the subject to find alternative strategies to problem solving and alternative descriptions of the material.

MODULE NAME: Industry project

MODULE CODE: PA3241

MODULE DESCRIPTION: Click to open.

CREDITS: 15

PERIOD: Semester 1

DEPARTMENT: Physics and Astronomy

INTENDED LEARNING OUTCOMES:

On successful completion of the module, students should be able to:

- Apply computational, experimental or practical techniques in an applied area of physics appropriate to careers in research, education, industry or business (e.g. advanced programming, data analysis, pedagogy, project management) and be able to demonstrate new skills on the basis of your experience; appreciate the impact on the wider environment/economy/society

- Apply the skills you have obtained to novel situations, clearly explain your approach to solving the problem given, describe alternative approaches to problem solving and determine the relative merits of each

- Present the results of an investigation into a problem clearly in report and presentation form

- Work effectively in a team, demonstrating an understanding of the value of equality, diversity and social cohesion, and fostering an inclusive and sensitive communication style

- Organise appropriate private study time, communicate ideas clearly to your peers and staff, devise and manage plans to solve the problems given in the time available

COORDINATOR: Ian Hutchinson

TEACHING AND LEARNING METHODS:

In this course you will take part in a project-based activity, whereby students are partnered with a client from industry, and tasked with project managing an industrially relevant task or problem according to best practice and industry standards. During

PRE-REQUISITES:

TOTAL MODULE HOURS: 150

ASSESSMENT METHODS:

Team report and individual reflective accounts; Team presentation; Group progress & project planning informed by regular progress meetings with project supervisor in which students will need to reflect and forward plan.

GUIDED INDEPENDENT LEARNING: INDICATIVE ACTIVITIES:

Your independent study will include researching the background to the project(s) to be investigated, working on the problem(s) given, and tackling practical difficulties as they arise. In many cases you will need to put into practice specific skills, such as computer programming, communication skills, mathematical analysis, and data-analysis.

MODULE NAME: Astrodynamics

MODULE CODE: PA3242

MODULE DESCRIPTION: Click to open.

CREDITS: 15

PERIOD: Semester 1

DEPARTMENT: Physics and Astronomy

INTENDED LEARNING OUTCOMES:

On successful completion of the module, students should be able to:

- Demonstrate familiarity with a specific, community-adopted mission planning tool (GMAT)

- Demonstrate, within the tool environment, the application of astrodynamics theory to produce closed orbits and interplanetary trajectories that fulfil specific goals

- Use numerical methods to find and demonstrate solutions to N-body problems and explore the effects of orbital perturbations

- Apply skills to meet a set of mission requirements and critically assess your solution; present technical material in front of a panel, using the numerical simulation system as the primary presentation method, and providing answers to questions by interactive use of the system

- Work effectively in a team; organise appropriate private study time, communicate ideas clearly to your peers and staff, devise and manage plans to solve the problems given in the time available

COORDINATOR: Nigel Bannister

TEACHING AND LEARNING METHODS:

In this course you will benefit from tackling a multi-week, multi-faceted investigation with regular guidance from a supervisor. You will benefit from working in a team during the second phase of work and can discuss the work with your peers throughout th

PRE-REQUISITES:

TOTAL MODULE HOURS: 150

ASSESSMENT METHODS:

Coursework

GUIDED INDEPENDENT LEARNING: INDICATIVE ACTIVITIES:

Your independent study will include researching the background to the project(s) to be investigated, working on the problem(s) given, and tackling practical difficulties as they arise. In many cases you will need to put into practice specific skills, such as computer programming, communication skills, mathematical analysis, and data-analysis.

MODULE NAME: Electronics

MODULE CODE: PA3243

MODULE DESCRIPTION: Click to open.

CREDITS: 15

PERIOD: Semester 1

DEPARTMENT: Physics and Astronomy

INTENDED LEARNING OUTCOMES:

On successful completion of the module, students should be able to:

- Apply your electronics experience as well as experimental and practical laboratory techniques in an appropriate applied area of physics appropriate to careers in research and industry (e.g. electronic design and development and data analysis) and be able to demonstrate new skills on the basis of your experience

- Apply the skills you have obtained to novel situations, clearly explain your approach to solving the problem given, describe alternative approaches to problem solving and determine the relative merits of each

- Present the results of an investigation into a problem clearly in report and presentation form

- Demonstrate leadership and project management skills during aspects of the project, where the group is sub-divided into smaller teams

- Work effectively in a team; organise appropriate private study time, communicate ideas clearly to your peers and staff, devise and manage plans to solve the problems given in the time available

COORDINATOR: Darren Wright

TEACHING AND LEARNING METHODS:

In this course, you will benefit from tackling a multi-week, multi-faceted investigation with regular guidance from a supervisor. You will benefit from working in a team but will also have to rely on your individual initiative, creativity and diligence. Y

PRE-REQUISITES:

TOTAL MODULE HOURS: 150

ASSESSMENT METHODS:

Coursework

GUIDED INDEPENDENT LEARNING: INDICATIVE ACTIVITIES:

Your independent study will include researching the background to the project(s) to be investigated, working on the problems agreed within your team, tackling practical difficulties as they arise and developing a good working relationship with the rest of your team. You will need to apply specific skills, such as soldering, component design, data-analysis, creating presentations and group working.

MODULE NAME: Lean Launchpad: Evidence Based Entrepreneurship

MODULE CODE: PA3244

MODULE DESCRIPTION: Click to open.

CREDITS: 15

PERIOD: Semester 1

DEPARTMENT: Physics and Astronomy

INTENDED LEARNING OUTCOMES:

On successful completion of the module, students should be able to:

- Apply Lean LaunchPad® methodology to develop a business model canvas for a business concept; apply the different concepts associated with the Lean LaunchPad® methodology to determine if the product or service fits one or many markets or customer segments

- Determine if a business idea can be developed into a scalable business by searching for a business model through iteration and hypothesis testing

- Apply the skills you have obtained to novel situations, clearly explain your approach to solving the problem given, describe alternative approaches to problem solving and determine the relative merits of each

- Present the results of an investigation into a problem clearly in report and presentation form; pitch a business idea to an audience of potential investors

- Work effectively in a team; organise appropriate private study time, communicate ideas clearly to your peers and staff, devise and manage plans to solve the problems given in the time available

COORDINATOR: Richard Ambrosi

TEACHING AND LEARNING METHODS:

The programme will include formal lecture-based teaching sessions as well as workshops and mentoring sessions that will allow students to interact with the academic and industry teams delivering the module. A “flipped classroom” approach will be used to d

PRE-REQUISITES:

TOTAL MODULE HOURS: 150

ASSESSMENT METHODS:

Weekly progress meetings in which students will reflect on their experience and plan ahead; interim/preliminary report; final report; final presentation

GUIDED INDEPENDENT LEARNING: INDICATIVE ACTIVITIES:

Your independent study will include customer discovery, which will require interacting with potential customers to test hypotheses. Researching the background to the project(s) to be investigated, iterating and modifying the products or services based on market date and evidence from customer discovery and tackling practical difficulties as they arise. In many cases you will need to put into practice the Lean LaunchPad® methodology and interpersonal skills.

MODULE NAME: Python

MODULE CODE: PA3246

MODULE DESCRIPTION: Click to open.

CREDITS: 15

PERIOD: Semester 1

DEPARTMENT: Physics and Astronomy

INTENDED LEARNING OUTCOMES:

On successful completion of the module, students should be able to:

- Apply computational techniques in advanced Python programming, data analysis, image processing, numerical methods, and signal processing and be able to demonstrate new skills on the basis of your experience

- Write efficient and clear code in Python

- Apply the skills you have obtained to novel situations, and clearly explain your approach to solving the problem given

- Present solutions to each task verbally and clearly in a laboratory workbook

- Organise appropriate private study time, communicate ideas clearly to your peers and staff, devise and manage plans to solve the problems given in the time available

COORDINATOR: Jonathan Nichols

TEACHING AND LEARNING METHODS:

In this course you will benefit from tackling a multi-week, multi-faceted computer workshop with regular guidance from a supervisor and/or workshop demonstrators. You will benefit from working with peers but will also have to rely on your individual initi

PRE-REQUISITES:

TOTAL MODULE HOURS: 150

ASSESSMENT METHODS:

Coursework

GUIDED INDEPENDENT LEARNING: INDICATIVE ACTIVITIES:

Your independent study will include researching coding and numerical methods, and the background to the tasks to be investigated. You will work on the problems given, tackling practical difficulties as they arise. In addition to your computer programming skills you will also need to develop communication skills, mathematical analysis, and data-analysis.

MODULE NAME: Numerical Programming in C

MODULE CODE: PA3247

MODULE DESCRIPTION: Click to open.

CREDITS: 15

PERIOD: Semester 1

DEPARTMENT: Physics and Astronomy

INTENDED LEARNING OUTCOMES:

On successful completion of the module, students should be able to:

- Apply computational techniques in C programming and numerical methods to model and analyse mathematical and physical systems, and be able to demonstrate new skills on the basis of your experience

- Write clear, efficient and well documented code in C

- Apply the skills you have obtained to novel situations, and clearly explain your approach to solving the problem given

- Present solutions to each task verbally and clearly in a laboratory workbook

- Organise appropriate private study time, communicate ideas clearly to your peers and staff, devise and manage plans to solve the problems given in the time available

COORDINATOR: Christopher Nixon

TEACHING AND LEARNING METHODS:

In this course you will benefit from tackling a multi-week, multi-faceted computer workshop with regular guidance from a supervisor and/or workshop demonstrators. You will benefit from working with peers but will also have to rely on your individual initi

PRE-REQUISITES:

TOTAL MODULE HOURS: 150

ASSESSMENT METHODS:

Coursework

GUIDED INDEPENDENT LEARNING: INDICATIVE ACTIVITIES:

Your independent study will include researching coding and numerical methods, and the background to the tasks to be investigated. You will work on the problems given, tackling practical difficulties as they arise. In addition to your computer programming skills you will also need to develop communication skills, mathematical analysis, and data-analysis.

MODULE NAME: Mathematical Physics 3

MODULE CODE: PA3250

MODULE DESCRIPTION: Click to open.

CREDITS: 15

PERIOD: Semester 1

DEPARTMENT: Physics and Astronomy

INTENDED LEARNING OUTCOMES:

On successful completion of the module, students should be able to:

- calculate the Fourier transform and inverse Fourier transform of simple functions; understand the connection between the Fourier transforms and convolutions, and between the Dirac delta function and the Fourier transform.

- apply the Calculus of Variations to a range of minimisation problems in physics and mechanics.

- define and apply the differential vector operators div, grad, curl in general coordinate systems

- manipulate matrices and determinants; calculate eigenvectors and eigenvalues and understand their relation to diagonalization; recognize special types of matrices (diagonal, symmetric, Hermitian, etc.); perform LU decomposition and use to solve simple systems of equations.

- communicate ideas clearly and concisely to peers and staff; work in teams to solve problems in mathematical physics; organise appropriate private study time and gain new information from text books.

COORDINATOR: Paul Abel

TEACHING AND LEARNING METHODS:

In this course you will benefit from lectures, real-time problem solving classes, discussions with peers and staff members, and guided independent study.

PRE-REQUISITES:

TOTAL MODULE HOURS: 150

ASSESSMENT METHODS:

Coursework - 30%

Exam (2 hours) - 70%

GUIDED INDEPENDENT LEARNING: INDICATIVE ACTIVITIES:

You will work through the course text, including working through the example problems, and practice problems. You will discuss problems and solutions with your peers, and review other texts on the subject to find alternative strategies to problem solving and alternative descriptions of the material.

MODULE NAME: Applied and Medical Physics

MODULE CODE: PA3601

MODULE DESCRIPTION: Click to open.

CREDITS: 15

PERIOD: Semester 1

DEPARTMENT: Physics and Astronomy

INTENDED LEARNING OUTCOMES:

On successful completion of the module, students should be able to:

- Explain the physics that underpins a range of techniques used in medical diagnoses; these include ultrasound imaging, positron tomography and radionuclide imaging

- Describe the fundamental sources of magnetism in materials and the magnetic behaviour of different types of material.

- Explain what the fundamental factors are that limit the performance of magnetic materials and how these may be overcome by new technological approaches, for example, by the use of nanostructured materials.

- Explain how magnetic materials are used in modern technology such as high density magnetic recording and also, potentially, in various biomedical applications.

- Critically analyse and solve problems in areas of magnetic materials, and medical physics including ultrasound imaging, positron tomography and radionuclide imaging.

- Organise appropriate private study time, obtain new information from text books, communicate areas of specialist physics to your peers and to staff.

COORDINATOR: Steve Baker

TEACHING AND LEARNING METHODS:

In this course you will benefit from lectures, problem solving, discussions with peers and staff members, and guided independent study.

PRE-REQUISITES:

TOTAL MODULE HOURS: 150

ASSESSMENT METHODS:

- Coursework - 30%

- Exam (2 hours) - 70%

GUIDED INDEPENDENT LEARNING: INDICATIVE ACTIVITIES:

You will read relevant background material and work through appropriate problems. You will discuss problems and solutions with your peers.

MODULE NAME: The Space Environment

MODULE CODE: PA3603

MODULE DESCRIPTION: Click to open.

CREDITS: 15

PERIOD: Semester 1

DEPARTMENT: Physics and Astronomy

INTENDED LEARNING OUTCOMES:

On successful completion of the module, students should be able to:

- demonstrate a working knowledge of the theory of orbits and the problems of launch, orbital manoeuvres and orbital perturbations. The techniques required to calculate orbits for feasibility studies will be demonstrated as will a familiarity with the general concepts of entry, descent and landing for planetary missions

- demonstrate a working knowledge of physics as applied to the basic properties of, and the fundamental physics controlling, the space environment, including the formation of the ionosphere and magnetosphere, magnetospheric and ionospheric current systems and the coupled solar-wind-magnetosphere-ionosphere system, and some of the main dynamical process involved in the terrestrial magnetosphere

- demonstrate how knowledge of spacecraft orbits and the space environment are combined to assess mission vulnerability to issues including radiation dose and spacecraft charging and gain a familiarity with numerical modelling tools for orbital design

- demonstrate this knowledge by describing and discussing key principles, including the recall of short derivations, and the application of the basic physics to numerical calculations of the expected behaviour of the systems and compiling written reports on these findings

- organise appropriate private study time, obtain new information from text books, communicate areas of specialist physics to your peers and to staff

- set out solutions to problems correctly, and be able to describe and explain spacecraft dynamics and planetary space environments in clear, simple prose

COORDINATOR: Timothy Yeoman

TEACHING AND LEARNING METHODS:

In this course you will benefit from lectures, problem solving, discussions with peers and staff members, and guided independent study.

PRE-REQUISITES:

TOTAL MODULE HOURS: 150

ASSESSMENT METHODS:

Coursework and Examination (final)

GUIDED INDEPENDENT LEARNING: INDICATIVE ACTIVITIES:

You will read relevant background material and work through appropriate problems. You will discuss problems and solutions with your peers.

MODULE NAME: Quasars and Cosmology

MODULE CODE: PA3605

MODULE DESCRIPTION: Click to open.

CREDITS: 15

PERIOD: Semester 1

DEPARTMENT: Physics and Astronomy

INTENDED LEARNING OUTCOMES:

On successful completion of the module, students should be able to:

- Understand the physical processes involved in accretion onto super-massive black holes and their observable consequences, and be able to explain these

- discuss the observed properties of AGN and interpret these in terms of physical model, and show how the key parameters such as central black hole mass and radius can be determined by observations

- Recall and explain the basic observational facts of cosmology and have an understanding of theoretical models of the universe that are based on the general theory of relativity and the cosmological principle

- Understand some of the successes of cosmology in interpreting the observations, and some of the unresolved issues, and demonstrate this knowledge by describing and discussing these

- Organise appropriate private study time, obtain new information from text books, communicate areas of specialist physics to your peers and to staff

COORDINATOR: Nial Tanvir

TEACHING AND LEARNING METHODS:

In this course you will benefit from lectures, problem solving, discussions with peers and staff members, and guided independent study.

PRE-REQUISITES:

TOTAL MODULE HOURS: 150

ASSESSMENT METHODS:

Coursework and Examination (final)

GUIDED INDEPENDENT LEARNING: INDICATIVE ACTIVITIES:

In this course you will benefit from lectures, problem solving, discussions with peers and staff members, and guided independent study.

MODULE NAME: Literature Review Project

MODULE CODE: PA4440

MODULE DESCRIPTION: Click to open.

CREDITS: 15

PERIOD: Semester 1

DEPARTMENT: Physics and Astronomy

INTENDED LEARNING OUTCOMES:

On successful completion of the module, students should be able to:

- Know how to approach a new to you research topic in a way expected from a researcher/PhD student

- Be able to absorb information effectively during supervisory meetings, taking notes as necessary, and ask questions to further your understanding

- Be able to prepare a professionally looking report on the results of their project and a give a detailed presentation. Be able to answer the questions from the audience, demonstrating good understanding of the material presented.

COORDINATOR: Paul O'Brien

TEACHING AND LEARNING METHODS:

Introductory lecture; individual guidance via supervisor.

PRE-REQUISITES:

TOTAL MODULE HOURS: 150

ASSESSMENT METHODS:

Report - 50%

Presentation - 40%

Progress - 10%

GUIDED INDEPENDENT LEARNING: INDICATIVE ACTIVITIES:

Reading research literature and discussing it with the supervisor; deciding on its relevance to your arguments; Taking notes during discussion meetings and also notes on your reading; Report preparation, including relevant plots, equations and references; Preparation for the final lecture.

MODULE NAME: Scientific Data Analysis

MODULE CODE: PA4602

MODULE DESCRIPTION: [Click to open.]

CREDITS: 15

PERIOD: Semester 1

DEPARTMENT: Physics and Astronomy

INTENDED LEARNING OUTCOMES:

On successful completion of the module, students should be able to:

- Explain aspects of the scientific method, types of logical reasoning and data analysis; critically analyse statistical and scientific arguments

- apply the probability calculus to statistical and scientific problems

- Select and apply statistical methods – such as model fitting, monte carlo calculations, time series and image analysis – to scientific data, and use them to learn about data

- plan and write simple computer codes to carry out data processing and analysis

- describe the statistical analysis of scientific data, and critique the statistical analysis described in scientific papers

COORDINATOR: Simon Vaughan

TEACHING AND LEARNING METHODS:

In this course you will benefit from lectures, computing workshops, problem solving, discussions with peers and staff members, and guided independent study.

PRE-REQUISITES:

TOTAL MODULE HOURS: 150

ASSESSMENT METHODS:

Coursework

GUIDED INDEPENDENT LEARNING: INDICATIVE ACTIVITIES:

You will research the background to the material covered using both undergraduate and graduate level texts, and scientific research papers where appropriate. You will work through set problems, and computing tasks. You will discuss problems and solutions with your peers.

MODULE NAME: Space Plasmas and Planetary Atmospheres

MODULE CODE: PA4603

MODULE DESCRIPTION: Click to open.

CREDITS: 15

PERIOD: Semester 1

DEPARTMENT: Physics and Astronomy

INTENDED LEARNING OUTCOMES:

On successful completion of the module, students should be able to:

- Derive mathematically the laws governing charged particle motion in static electromagnetic fields

- Understand the application of Maxwell's Laws to plasmas and derive basic plasma properties such as the Debye length

- Derive the laws of plasma fluid dynamics; solve problems relating to space plasma physics

- Apply plasma fluid dynamics to solve the problem of solar wind outflow; Use knowledge of the solar wind to explain the geometry of the interplanetary magnetic field

- Explain the influence of the solar wind and interplanetary magnetic field on the near-Earth and near-Jupiter plasma environments, including internal dynamics

- Obtain new information from course notes and lectures, be able to set out solutions to physics problems correctly, be able to describe physical systems and processes in clear, simple prose

COORDINATOR: STEPHEN MILAN

TEACHING AND LEARNING METHODS:

In this course you will benefit from lectures, problem solving, discussions with peers and staff members, and guided independent study.

PRE-REQUISITES:

TOTAL MODULE HOURS: 150

ASSESSMENT METHODS:

Coursework and Examination

GUIDED INDEPENDENT LEARNING: INDICATIVE ACTIVITIES:

You will research the background to the material covered using both undergraduate and graduate level texts, and scientific research papers where appropriate. You will work through set problems, and/or computing tasks if given. You will discuss problems and solutions with your peers.

MODULE NAME: Radiative Processes

MODULE CODE: PA4604

MODULE DESCRIPTION: Click to open.

CREDITS: 15

PERIOD: Semester 1

DEPARTMENT: Physics and Astronomy

INTENDED LEARNING OUTCOMES:

On successful completion of the module, students should be able to:

- determine the expected power and spectrum of the radiation emitted by an accelerated charge from a fundamental level

- describe the basic properties and underlying physics of emission processes such as blackbody, bremsstrahlung, cyclotron, synchrotron, and pair production.

- calculate the emergent intensity of a beam of radiation modified by emitting and absorbing material along its path; analyse scattering processes and derive the relevant scattering cross-section

- describe the basic properties of radiative transitions and line broadening mechanisms, and apply them to physical systems such as astrophysical plasmas

- break down a complex problem in order to identify its essential elements, apply prior knowledge to analyse a problem, implement a planned solution that addresses a problem, evaluate a solution and reflect upon it.

- infer radiation mechanisms and measure physical parameters of astrophysical sources from interpretation of observational data.

COORDINATOR: Rhaana Starling

TEACHING AND LEARNING METHODS:

In this course you will benefit from lectures, problem solving, discussions with peers and staff members, and guided independent study.

PRE-REQUISITES:

TOTAL MODULE HOURS: 150

ASSESSMENT METHODS:

Coursework and Examination

GUIDED INDEPENDENT LEARNING: INDICATIVE ACTIVITIES:

You will research the background to the material covered using both undergraduate and graduate level texts, and scientific research papers where appropriate. You will work through set problems, and/or computing tasks if given. You will discuss problems and solutions with your peers.

MODULE NAME: General Relativity and Quantum Fields

MODULE CODE: PA4609

MODULE DESCRIPTION: Click to open.

CREDITS: 15

PERIOD: Semester 1

DEPARTMENT: Physics and Astronomy

INTENDED LEARNING OUTCOMES:

On successful completion of the module, students should be able to:

- Solve problems in special relativity, involving dynamics, energy and light, discuss the physical principles underlying general relativity, i.e. the equivalence principle and special relativity); Explain how these are formulated mathematically in terms of curved spacetime

- Give a semi-quantitative account of some of the experimental support for the theory; discuss the Schwarzschild solution for a spherical gravitational field and derive its properties; Be aware of the Kerr solution for rotating blackholes and some simple properties

- Appreciate the need for quantum field theory; Recall the Heisenberg and Schrodinger pictures from quantum mechanics and derive equations of motion for the quantum mechanical oscillator

- Identify the Klein Gordon equation and Dirac equation and their solutions and be able to demonstrate the importance of symmetries and Gauge fields; Analyse how scalar fields interact and demonstrate the use of Green's functions

- Demonstrate the applications of QFT to a blackhole spacetime which shows black holes have a temperature derived from the Hawking process

- Critically analyse complex problems in order to identify their essential elements, implement planned solutions that address the problems, evaluate the effectiveness of solutions and reflect upon them.

COORDINATOR: Paul Abel

TEACHING AND LEARNING METHODS:

In this course you will benefit from lectures, problem solving, discussions with peers and staff members, and guided independent study.

PRE-REQUISITES:

TOTAL MODULE HOURS: 150

ASSESSMENT METHODS:

Coursework

GUIDED INDEPENDENT LEARNING: INDICATIVE ACTIVITIES:

You will research the background to the material covered using both undergraduate and graduate level texts, and scientific research papers where appropriate. You will work through set problems, and/or computing tasks if given. You will discuss problems and solutions with your peers.

MODULE NAME: Light and Matter

MODULE CODE: PA1120

MODULE DESCRIPTION: Click to open.

CREDITS: 15

PERIOD: Semester 2

DEPARTMENT: Physics and Astronomy

INTENDED LEARNING OUTCOMES:

On successful completion of the module, students should be able to:

- state the laws of thermodynamics and the basic laws which describe the behaviour of light
- give an account of the origins of the laws studied and show how they are derived
- state the laws in mathematical form and define all the terms used
- describe some key properties of heat and light
- derive mathematical relationships which describe the properties and behaviour of heat and light
- solve problems relating to thermodynamics and optics at an appropriate level
- organise appropriate private study time, obtain new information from text books, communicate physics concepts and ideas to your peers and to staff

COORDINATOR: Rhaana Starling

TEACHING AND LEARNING METHODS:

In this course you will benefit from lectures, real-time problem solving classes, assessed homework problems, discussions with peers and staff members, and guided independent study.

PRE-REQUISITES:

TOTAL MODULE HOURS: 150

ASSESSMENT METHODS:

GUIDED INDEPENDENT LEARNING: INDICATIVE ACTIVITIES:

You will work through the course text, including working through the example problems, and practice problems. You will discuss problems and solutions with your peers, and review other texts on the subject to find alternative strategies to problem solving and alternative descriptions of the material.

MODULE NAME: Waves and Quanta

MODULE CODE: PA1140

MODULE DESCRIPTION: Click to open.

CREDITS: 15

PERIOD: Semester 2

DEPARTMENT: Physics and Astronomy

INTENDED LEARNING OUTCOMES:

On successful completion of the module, students should:

- Be able to state the basic language and equations used to describe oscillations and oscillators; apply this knowledge to solve basic problems in simple harmonic motion, damped simple harmonic motion, forced oscillations and resonance

- Be able to state the basic language and equations used to describe waves, including the 1-D wave equation and harmonic waves; apply this knowledge to solve basic problems in wave propagation, wave superposition (including standing waves and beats), and the non-relativistic Doppler effect

- Be able to demonstrate the need for a quantum theory of matter, as evidenced by the photo-electric effect, UV catastrophe, Compton scattering and electron diffraction

- Be able to demonstrate knowledge of the wave and particle natures of light and matter as described by De Broglie and Heisenberg, including the description of wave functions, expectation values and probability densities

- Be able to state and apply the basic theory of the Bohr atom and quantized electron energy levels, in order to demonstrate the origin of spectral lines; state and apply the basic theory and equations of radioactive decay

- Be able to organise appropriate private study time, obtain new information from text books, communicate mathematical ideas to your peers and to staff

COORDINATOR: Richard Alexander

TEACHING AND LEARNING METHODS:

In this course you will benefit from lectures, real-time problem solving classes, assessed homework problems, discussions with peers and staff members, and guided independent study.

PRE-REQUISITES:

TOTAL MODULE HOURS: 150

ASSESSMENT METHODS:

GUIDED INDEPENDENT LEARNING: INDICATIVE ACTIVITIES:

You will work through the course text, including working through the example problems, and practice problems. You will discuss problems and solutions with your peers, and review other texts on the subject to find alternative strategies to problem solving and alternative descriptions of the material.

MODULE NAME: Mathematical Physics 1.2

MODULE CODE: PA1720

MODULE DESCRIPTION: Click to open.

CREDITS: 15

PERIOD: Semester 2

DEPARTMENT: Physics and Astronomy

INTENDED LEARNING OUTCOMES:

On successful completion of the module, students should:

- Be able to compute partial derivatives for multivariate functions, use Taylor series and find stationary points for multivariate functions, and be able to calculate gradient, divergence and curl.

- Recognise types of differential equation, select and apply basic methods for solving first and second order ordinary differential equations with real or complex coefficients, including applying boundary conditions

- Manipulate complex numbers, express complex numbers in terms of their modulus and argument, and interpret these geometrically using the Argand diagram, use complex numbers to simplify trigonometric identities

- Manipulate simple matrices, use matrices to solve systems of linear equations, recognise symmetric and antisymmetric matrices and identity matrices, compute matrix inverses and determinants for 2x2 and 3x3 matrices, find eigenvalues and eigenvectors for 3x3 matrices

- Understand how simple AC circuits can be modelled mathematically using differential equations and complex numbers, use phasors and complex impedance to study simple circuits, recognise and compute the basic properties of a resonance

- Be able to organise appropriate private study time, clearly set out solutions to mathematical problems, obtain new information from text books, communicate mathematical ideas to your peers and to staff

COORDINATOR: Paul Abel

TEACHING AND LEARNING METHODS:

In this course you will benefit from lectures, real-time problem solving classes, electronic practice problems, discussions with peers and staff members, and guided independent study.

PRE-REQUISITES:

TOTAL MODULE HOURS: 150

ASSESSMENT METHODS:

GUIDED INDEPENDENT LEARNING: INDICATIVE ACTIVITIES:

You will work through the course text, including working through the example problems, and practice problems. You will discuss problems and solutions with your peers, and review other texts on the subject to find alternative strategies to problem solving and alternative descriptions of the material.

MODULE NAME: Condensed Matter Physics

MODULE CODE: PA2230

MODULE DESCRIPTION: Click to open.

CREDITS: 15

PERIOD: Semester 2

DEPARTMENT: Physics and Astronomy

INTENDED LEARNING OUTCOMES:

On successful completion of the module, students should be able to:

- Be able to sketch simple crystal structures adopted by solid materials; perform simple calculations relating to crystal structures

- Be able to describe simple models for lattice vibrations

- Be able to state and apply the laws governing the behaviour of electrons in various condensed matter environments including metals, insulators, semiconductors and superconductors

- Be able to organise appropriate private study time, obtain new information from text books, communicate mathematical ideas to your peers and to staff

COORDINATOR: Steve Baker

TEACHING AND LEARNING METHODS:

In this course you will benefit from lectures, small group tutorial classes, workshops, discussions with peers and staff members, and guided independent study.

PRE-REQUISITES:

TOTAL MODULE HOURS: 150

ASSESSMENT METHODS:

GUIDED INDEPENDENT LEARNING: INDICATIVE ACTIVITIES:

You will work through the course, including working through the example problems, and practice problems. You will discuss problems and solutions wih your peers, and review other texts on the subject to find alternative strategies to problem solving and alternative descriptions of the material.

MODULE NAME: Intermediate Astrophysics and Modern Physics

MODULE CODE: PA2601

MODULE DESCRIPTION: Click to open.

CREDITS: 15

PERIOD: Semester 2

DEPARTMENT: Physics and Astronomy

INTENDED LEARNING OUTCOMES:

On successful completion of the module, students should be able to:

- Demonstrate a working knowledge of intermediate physics as applied to set specialist fields: astrophysics, and modern physics

- Demonstrate this knowledge by describing and discussing key principles, solving applied problems and compiling written reports

- Organise appropriate private study time, obtain new information from text books, communicate areas of intermediate specialist physics to your peers and to staff

COORDINATOR: Michael Goad

TEACHING AND LEARNING METHODS:

In this course you will benefit from lectures, discussions with peers and staff members, and guided independent study.

PRE-REQUISITES:

TOTAL MODULE HOURS: 150

ASSESSMENT METHODS:

GUIDED INDEPENDENT LEARNING: INDICATIVE ACTIVITIES:

You will read relevant background material and work through appropriate problems. You will discuss problems and solutions with your peers.

MODULE NAME: Intermediate Astrophysics and Applied Physics

MODULE CODE: PA2602

MODULE DESCRIPTION: Click to open.

CREDITS: 15

PERIOD: Semester 2

DEPARTMENT: Physics and Astronomy

INTENDED LEARNING OUTCOMES:

On successful completion of the module, students should be able to:

- Demonstrate a working knowledge of intermediate physics as applied to set specialist fields: applied physics, and astrophysics

- Demonstrate this knowledge by describing and discussing key principles, solving applied problems and compiling written reports

- Organise appropriate private study time, obtain new information from text books, communicate areas of intermediate specialist physics to your peers and to staff

COORDINATOR: Steve Baker

TEACHING AND LEARNING METHODS:

In this course you will benefit from lectures, discussions with peers and staff members, and guided independent study.

PRE-REQUISITES:

TOTAL MODULE HOURS: 150

ASSESSMENT METHODS:

GUIDED INDEPENDENT LEARNING: INDICATIVE ACTIVITIES:

You will read relevant background material and work through appropriate problems. You will discuss problems and solutions with your peers.

MODULE NAME: Intermediate Astrophysics and Space Science

MODULE CODE: PA2603

MODULE DESCRIPTION: Click to open.

CREDITS: 15

PERIOD: Semester 2

DEPARTMENT: Physics and Astronomy

INTENDED LEARNING OUTCOMES:

On successful completion of the module, students should be able to:

- Demonstrate a working knowledge of intermediate physics as applied to set specialist fields: astrophysics, and space science

- Demonstrate this knowledge by describing and discussing key principles, solving applied problems and compiling written reports

- Organise appropriate private study time, obtain new information from text books, communicate areas of intermediate specialist physics to your peers and to staff

COORDINATOR: Tom Stallard

TEACHING AND LEARNING METHODS:

In this course you will benefit from lectures, discussions with peers and staff members, and guided independent study.

PRE-REQUISITES:

TOTAL MODULE HOURS: 150

ASSESSMENT METHODS:

GUIDED INDEPENDENT LEARNING: INDICATIVE ACTIVITIES:

You will read relevant background material and work through appropriate problems. You will discuss problems and solutions with your peers.

MODULE NAME: Intermediate Modern Physics and Space Science

MODULE CODE: PA2604

MODULE DESCRIPTION: Click to open.

CREDITS: 15

PERIOD: Semester 2

DEPARTMENT: Physics and Astronomy

INTENDED LEARNING OUTCOMES:

On successful completion of the module, students should be able to:

- Demonstrate a working knowledge of intermediate physics as applied to set specialist fields: modern physics, and space science

- Demonstrate this knowledge by describing and discussing key principles, solving applied problems and compiling written reports

- Organise appropriate private study time, obtain new information from text books, communicate areas of intermediate specialist physics to your peers and to staff

COORDINATOR: Stephen Milan

TEACHING AND LEARNING METHODS:

In this course you will benefit from lectures, discussions with peers and staff members, and guided independent study.

PRE-REQUISITES:

TOTAL MODULE HOURS: 150

ASSESSMENT METHODS:

GUIDED INDEPENDENT LEARNING: INDICATIVE ACTIVITIES:

You will read relevant background material and work through appropriate problems. You will discuss problems and solutions with your peers.

MODULE NAME: Intermediate Applied Physics and Space Science

MODULE CODE: PA2605

MODULE DESCRIPTION: Click to open.

CREDITS: 15

PERIOD: Semester 2

DEPARTMENT: Physics and Astronomy

INTENDED LEARNING OUTCOMES:

On successful completion of the module, students should be able to:

- Demonstrate a working knowledge of intermediate physics as applied to set specialist fields: applied physics and space science

- Demonstrate this knowledge by describing and discussing key principles, solving applied problems and compiling written reports

- Organise appropriate private study time, obtain new information from text books, communicate areas of intermediate specialist physics to your peers and to staff

COORDINATOR: Steve Baker

TEACHING AND LEARNING METHODS:

In this course you will benefit from lectures, discussions with peers and staff members, and guided independent study.

PRE-REQUISITES:

TOTAL MODULE HOURS: 150

ASSESSMENT METHODS:

GUIDED INDEPENDENT LEARNING: INDICATIVE ACTIVITIES:

You will read relevant background material and work through appropriate problems. You will discuss problems and solutions with your peers.

MODULE NAME: Intermediate Applied Physics and Modern Physics

MODULE CODE: PA2606

MODULE DESCRIPTION: Click to open.

CREDITS: 15

PERIOD: Semester 2

DEPARTMENT: Physics and Astronomy

INTENDED LEARNING OUTCOMES:

On successful completion of the module, students should be able to:

- Demonstrate a working knowledge of intermediate physics as applied to set specialist fields: applied physics, and modern physics

- Demonstrate this knowledge by describing and discussing key principles, solving applied problems and compiling written reports

- Organise appropriate private study time, obtain new information from text books, communicate areas of intermediate specialist physics to your peers and to staff

COORDINATOR: Steve Baker

TEACHING AND LEARNING METHODS:

In this course you will benefit from lectures, discussions with peers and staff members, and guided independent study.

PRE-REQUISITES:

TOTAL MODULE HOURS: 150

ASSESSMENT METHODS:

GUIDED INDEPENDENT LEARNING: INDICATIVE ACTIVITIES:

You will read relevant background material and work through appropriate problems. You will discuss problems and solutions with your peers.

MODULE NAME: Thermal and Statistical Physics

MODULE CODE: PA2720

MODULE DESCRIPTION: Click to open.

CREDITS: 15

PERIOD: Semester 2

DEPARTMENT: Physics and Astronomy

INTENDED LEARNING OUTCOMES:

On successful completion of the module, students should be able to:

- Use the thermodynamic potentials to obtain relationships between these and other thermodynamic variables, and use the Maxwell relations

- Be able to derive the three distribution functions appropriate to fermions, bosons and classical particles; use the partition function to obtain the properties of simple systems

- Be able to describe mathematically and solve problems involving electrons in the free electron gas

- Be aware of, and be able to solve simple problems involving the magnetic properties of matter

- Be able to organize appropriate private study time; obtain new information from text; apply mathematical techniques to solving problems in statistical physics; be able to discuss basic physics and ideas with your peers and staff; be able to set out solutions to problems clearly and correctly

COORDINATOR: Simon Vaughan

TEACHING AND LEARNING METHODS:

In this course you will benefit from lectures, real-time problem solving classes, assessed homework problems, discussions with peers and staff members, and guided independent study.

PRE-REQUISITES:

TOTAL MODULE HOURS: 150

ASSESSMENT METHODS:

GUIDED INDEPENDENT LEARNING: INDICATIVE ACTIVITIES:

You will work through the set problems, including working through examples, and practice problems in textbooks that cover the requisite material. You will discuss problems and solutions with your peers, and review texts on the subject to find alternative strategies to problem solving and alternative descriptions of the material.

MODULE NAME: Radiation and Matter

MODULE CODE: PA3230

MODULE DESCRIPTION: Click to open.

CREDITS: 15

PERIOD: Semester 2

DEPARTMENT: Physics and Astronomy

INTENDED LEARNING OUTCOMES:

On successful completion of the module, students should be able to:

- Interpret the spectrum of hydrogen and simple atoms

- Explain the Zeeman effect and other spectroscopic

phenomena

- Describe simple models of atomic nuclei, understand the mechanisms of radioactive decay and other nuclear reactions; demonstrate knowledge of the quantum numbers and their physical significance

- Describe laser action and solve problems involving basic laser design and use

- Communicate ideas clearly and concisely to peers and staff; work in teams to solve problems in atomic, nuclear and laser physics; organise appropriate private study time and gain new information from text books.

COORDINATOR: Michael Goad

TEACHING AND LEARNING METHODS:

In this course you will benefit from lectures, real-time problem solving classes, assessed homework problems, discussions with peers and staff members, and guided independent study using a set text.

PRE-REQUISITES:

TOTAL MODULE HOURS: 150

ASSESSMENT METHODS:

Coursework - 30%

Exam (2 hours) - 70%

GUIDED INDEPENDENT LEARNING: INDICATIVE ACTIVITIES:

You will work through the set problems, and the examples and practice problems from the course text. You will discuss problems and solutions with your peers, and review other texts on the subject to find alternative strategies to problem solving and alternative descriptions of the material.

MODULE NAME: Stellar Astrophysics

MODULE CODE: PA3602

MODULE DESCRIPTION: Click to open.

CREDITS: 15

PERIOD: Semester 2

DEPARTMENT: Physics and Astronomy

INTENDED LEARNING OUTCOMES:

On successful completion of the module, students should be able to:

- derive and apply the basic equations governing stellar structure

- describe and discuss the fundamental physics of star formation, interpret stellar evolutionary tracks in the H-R diagram, and discuss the physics of stellar evolution

- know the basic facts about compact objects and be able to interpret these using basic physics arguments

- demonstrate knowledge of the physics of compact objects and accretion flows by applying the key equations to simple problems

- Organise appropriate private study time, obtain new information from text books, communicate areas of specialist physics to your peers and to staff

COORDINATOR: Sergei Nayakshin

TEACHING AND LEARNING METHODS:

In this course you will benefit from lectures, problem solving, discussions with peers and staff members, and guided independent study.

PRE-REQUISITES:

TOTAL MODULE HOURS: 150

ASSESSMENT METHODS:

Coursework - 30%

Exam (2 hours) - 70%

GUIDED INDEPENDENT LEARNING: INDICATIVE ACTIVITIES:

You will read relevant background material and work through appropriate problems. You will discuss problems and solutions with your peers.

MODULE NAME: Elementary Particles, The Standard Model and Beyond

MODULE CODE: PA3604

MODULE DESCRIPTION: Click to open.

CREDITS: 15

PERIOD: Semester 2

DEPARTMENT: Physics and Astronomy

INTENDED LEARNING OUTCOMES:

On successful completion of the module, students should be able to:

- demonstrate a working knowledge of methods and issues in elementary particle physics

- demonstrate this knowledge by describing and discussing key principles, and solving applied problems

- describe ideas and concepts of theories beyond the standard model

- organise appropriate private study time, obtain new information from text books, communicate areas of specialist physics to your peers and to staff

COORDINATOR: Andrew Blain

TEACHING AND LEARNING METHODS:

In this course you will benefit from lectures, problem solving, discussions with peers and staff members, and guided independent study.

PRE-REQUISITES:

TOTAL MODULE HOURS: 150

ASSESSMENT METHODS:

Coursework and Examination (final)

GUIDED INDEPENDENT LEARNING: INDICATIVE ACTIVITIES:

You will read relevant background material and work through appropriate problems. You will discuss problems and solutions with your peers.

MODULE NAME: Planetary Physics

MODULE CODE: PA3606

MODULE DESCRIPTION: Click to open.

CREDITS: 15

PERIOD: Semester 2

DEPARTMENT: Physics and Astronomy

INTENDED LEARNING OUTCOMES:

On successful completion of the module, students should be able to:

- Demonstrate a working knowledge of physics as applied to multidisciplinary fields centred around planetary physics. This includes some multidisciplinary topics, geophysics, planetary geology and astrobiology, exoplanets though no prior knowledge of these are required.

- Use your physical and mathematical knowledge to describe the observed behaviour of planetary systems, planetary structure, formation and differentiation, climate systems, conditions for habitability, and to solve problems related to these areas.

- Demonstrate this knowledge by describing and discussing key principles, solving applied problems and compiling written reports.

- Organise appropriate private study time, obtain new information from text books, communicate areas of specialist physics to your peers and to staff.

COORDINATOR: John Bridges

TEACHING AND LEARNING METHODS:

In this course you will benefit from lectures, problem solving, discussions with peers and staff members, and guided independent study. The coursework assessment will be based on a mixture of written and numerical work.

PRE-REQUISITES:

TOTAL MODULE HOURS: 150

ASSESSMENT METHODS:

Mixture of written, numerical answers, online NUMBAS tests and a final exam

GUIDED INDEPENDENT LEARNING: INDICATIVE ACTIVITIES:

You will read relevant background material and work through appropriate problems. You will discuss problems and solutions with your peers.

MODULE NAME: Quantum Theory of Solids

MODULE CODE: PA4601

MODULE DESCRIPTION: Click to open.

CREDITS: 15

PERIOD: Semester 2

DEPARTMENT: Physics and Astronomy

INTENDED LEARNING OUTCOMES:

On successful completion of the module, students should be able to:

- Clearly describe the approximations to the many body Hamiltonian that lead to the hierarchy of methods (Hartree, Hartree-Fock, Configuration interaction) commonly used to approximate the many-electron wave function; analyse problems involving the many-electron wave function and determine the method most appropriate to each problem and its limitations;

- Use standard density functional theory software to compute the equilibrium structure and band-structure of real crystals, demonstrating an understanding of the basic formulation of the theory and the limitations of the results obtained and the methods used.

- Use empirical methods to calculate the electronic structure of model systems, clearly describing the method most appropriate for a given problem and its limitations

- Obtain, interpret, and critically analyse new information from standard texts and the research literature; discuss relevant concepts clearly with peers and staff.

- Critically analyse complex problems in order to identify their essential elements, implement planned solutions that address the problems, evaluate the effectiveness of solutions and reflect upon them.

COORDINATOR: Mervyn Roy

TEACHING AND LEARNING METHODS:

In this course you will benefit from lectures, computing workshops, problem solving, discussions with peers and staff members, and guided independent study

PRE-REQUISITES:

TOTAL MODULE HOURS: 150

ASSESSMENT METHODS:

Coursework 50%

Coursework (Final) 50%

GUIDED INDEPENDENT LEARNING: INDICATIVE ACTIVITIES:

You will research the background to the material covered using both undergraduate and graduate level texts, and scientific research papers where appropriate. You will work through set problems, and computing tasks. You will discuss problems and solutions with your peers.

MODULE NAME: Nanotechnology: Techniques and Devices

MODULE CODE: PA4605

MODULE DESCRIPTION: Click to open.

CREDITS: 15

PERIOD: Semester 2

DEPARTMENT: Physics and Astronomy

INTENDED LEARNING OUTCOMES:

On successful completion of the module, students should be able to:

- Demonstrate an understanding of physical behavior of matter at the nanoscale, and explain how the properties change with size from atoms to bulk material.

- Describe some of the methods for preparing nanoscale materials, and some of the applications for nanostructured materials.

- Understand the physics underpinning a range of experimental techniques that are used for investigating materials at the atomic scale, including various x-ray techniques, electron microscopy and Raman spectroscopy.

- Describe in some detail the physics underpinning various material types (including semiconductors, graphene, magnetic nanocomposites) and nanostructured devices formed from them.

- Critically analyse and solve problems in areas described above.

- Organise appropriate private study time, obtain new information from text books and the research literature, communicate specialist areas of physics to your peers and to staff.

COORDINATOR: Steve Baker

TEACHING AND LEARNING METHODS:

In this course you will benefit from lectures, problem solving, discussions with peers and staff members, and guided independent study.

PRE-REQUISITES:

TOTAL MODULE HOURS: 150

ASSESSMENT METHODS:

Coursework and Examination

GUIDED INDEPENDENT LEARNING: INDICATIVE ACTIVITIES:

You will research the background to the material covered using both undergraduate and graduate level texts, and scientific research papers where appropriate. You will work through set problems, and/or computing tasks if given. You will discuss problems and solutions with your peers.

MODULE NAME: Advanced Space Science

MODULE CODE: PA4607

MODULE DESCRIPTION: Click to open.

CREDITS: 15

PERIOD: Semester 2

DEPARTMENT: Physics and Astronomy

INTENDED LEARNING OUTCOMES:

On successful completion of the module, students should be able to:

- Demonstrate a working knowledge of advanced space science by clearly describing and discussing key principles of detectors, instrumentation and analytical techniques, solving advanced applied problems relating to them and compiling written reports. The latter includes a New Scientist style article.

- Students should be able to breakdown complex problems in space science in order to identify their essential elements, apply prior knowledge to analyse a problem, implement a planned solution that addresses a problem, evaluate the solution and then reflect upon it.

Topics covered in this course include X-ray and other photon detectors for space telescopes notably the Mercury Imaging X-ray Spectrometer MIXS built at Leicester, the Cherenkov Telescope Array; X-ray diffraction with Mars Science Laboratory, electron microscopy of material returned from asteroids and comets and remote analysis of planetary surfaces. Most of the topics covered are areas of active research in the School of Physics and Astronomy.

- Critically evaluate research papers and results on these space science topics.

- Organise private study time, obtain new information from text books and the research literature, clearly communicate areas of advanced space science to peers and to staff.

COORDINATOR: Jon Lapington

TEACHING AND LEARNING METHODS:

In this course you will benefit from lectures, problem solving, discussions with peers and staff members, and guided independent study.

PRE-REQUISITES:

TOTAL MODULE HOURS: 150

ASSESSMENT METHODS:

Coursework and Examination

GUIDED INDEPENDENT LEARNING: INDICATIVE ACTIVITIES:

You will research the background to the material covered using both undergraduate and graduate level texts, and scientific research papers where appropriate. You will work through set problems, and/or computing tasks if given. You will discuss problems and solutions with your peers.

MODULE NAME: Advanced Space Science

MODULE CODE: PA4607

MODULE DESCRIPTION: [Click to open.]

CREDITS: 15

PERIOD: Semester 2

DEPARTMENT: Physics and Astronomy

INTENDED LEARNING OUTCOMES:

On successful completion of the module, students should be able to:

- Demonstrate a working knowledge of advanced space science by clearly describing and discussing key principles of detectors, instrumentation and analytical techniques, solving advanced applied problems relating to them and compiling written reports. The latter includes a New Scientist style article.

- Students should be able to breakdown complex problems in space science in order to identify their essential elements, apply prior knowledge to analyse a problem, implement a planned solution that addresses a problem, evaluate the solution and then reflect upon it.

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- Critically evaluate research papers and results on these space science topics.

- Organise private study time, obtain new information from text books and the research literature, clearly communicate areas of advanced space science to peers and to staff.

COORDINATOR:

TEACHING AND LEARNING METHODS:

In this course you will benefit from lectures, problem solving, discussions with peers and staff members, and guided independent study.

PRE-REQUISITES:

TOTAL MODULE HOURS: 150

ASSESSMENT METHODS:

Coursework and Examination

GUIDED INDEPENDENT LEARNING: INDICATIVE ACTIVITIES:

You will research the background to the material covered using both undergraduate and graduate level texts, and scientific research papers where appropriate. You will work through set problems, and/or computing tasks if given. You will discuss problems and solutions with your peers.

MODULE NAME: Supermassive Black Holes and Large-Scale Structure

MODULE CODE: PA4608

MODULE DESCRIPTION: Click to open.

CREDITS: 15

PERIOD: Semester 2

DEPARTMENT: Physics and Astronomy

INTENDED LEARNING OUTCOMES:

On successful completion of the module, students should be able to:

- discuss, quantitatively describe and solve problems involving the physics of accretion on to supermassive black holes;

- quantitatively describe the evolution of supermassive black holes in the Universe;

- describe the most important processes shaping galaxies and larger-scale structures, and apply this knowledge to interpret observations;

- break down a complex problem in order to identify its essential elements, apply prior knowledge to analyse a problem, implement a planned solution that addresses a problem, evaluate a solution and reflect upon it;

- critically evaluate current research papers and results.

COORDINATOR: Christopher Nixon

TEACHING AND LEARNING METHODS:

In this course you will benefit from lectures, problem solving, discussions with peers and staff members, and guided independent study.

PRE-REQUISITES:

TOTAL MODULE HOURS: 150

ASSESSMENT METHODS:

Coursework and Examination

GUIDED INDEPENDENT LEARNING: INDICATIVE ACTIVITIES:

You will research the background to the material covered using both undergraduate and graduate level texts, and scientific research papers where appropriate. You will work through set problems, and/or computing tasks if given. You will discuss problems and solutions with your peers.