UNIVERSITY OF LEICESTER

Module Specification

NS3107 Molecular Cell Biology and Nanoscience

Academic Year: 2019/0
Module Level: Year 3
Scheme: UG
Department: Physics and Astronomy
Credits: 15

Student Workload (hours)

Lectures	12
Seminars	15
Practical Classes & Workshops	3
Tutorials	8
Fieldwork	
Project Supervision	
Guided Independent Study	112
Demonstration	
Supervised time in studio/workshop	
Work Based Learning	
Placement	
Year Abroad	
Total Module Hours	150

Period: Semester 1
Occurence: E1
Coordinator: Dylan Williams
Mark Scheme: UG Module Mark Scheme

No.	Assessment Description	Weight %	Qual Mark	Exam Hours	Ass't Group	Alt Reass't
001	Coursework (Final)	100				

Intended Learning Outcomes

On successful completion of this module, students should be able to:
Describe the main organelles and cytoskeletal structures and their function within an eukaryotic cell.
Describe the main types of microscopy used in cell biology and the biomarkers/dyes used in each method, and compare the merits and weaknesses of each method
Describe the principles behind key cellular biology techniques and evaluate their use in applications
Describe the properties of cancer cells
Explain how genetic information is transcribed and translated
Apply the relevant mathematical techniques to quantitatively describe quantum systems
Compare the behaviour of nanostructures with macroscopic materials by considering factors including quantum size effects, surface area to volume ratios and surface plasmon resonance
Describe the physical and chemical methods used to produce nanoparticles and quantum dots and describe the therapeutic and diagnostic applications of these systems.
Explain the origin of magnetism including ferromagnetism, diamagnetism and paramagnetism and use domain theory of magnetic materials to rationalise nanoparticle magnetism.

Teaching and Learning Methods

Problem-based learning
Lectures
Group work
Tutorials

Assessment Methods

Coursework:
Short Answer exercise sets
Reports (Group)

Pre-Requisites

Co-Requisites

Excluded Combinations

-

Guided Independent Study: Indicative Activities

Preparation for workshops (including reading, videos, multiple choice questions)
Short Answer exercise sets

Module Specification

NS3108 Sensing and Signalling in Biology and Physics

Academic Year: 2019/0
Module Level: Year 3
Scheme: UG
Department: Physics and Astronomy
Credits: 15

Student Workload (hours)

Lectures	8
Seminars	15
Practical Classes & Workshops	4
Tutorials	8
Fieldwork	
Project Supervision	
Guided Independent Study	115
Demonstration	
Supervised time in studio/workshop	
Work Based Learning	
Placement	
Year Abroad	
Total Module Hours	150

Period: Semester 2
Occurence: E1
Coordinator: Katherine Clark
Mark Scheme: UG Module Mark Scheme

No.	Assessment Description	Weight %	Qual Mark	Exam Hours	Ass't Group	Alt Reass't
001	Coursework (Final)	100				

Intended Learning Outcomes

On successful completion of this module, students should be able to:
Explain the basic principles of cell signalling and why such signalling systems are needed; describe the components of a signalling system. Recognise the modular nature of signalling proteins.
Explain how defects in signalling pathways can lead to disease; describe a specific example of this and approaches to treat disease by targetting signalling pathways.
Design a theoretical biological signalling circuit to sense a particular stimulus and produce a cellular response.
Describe and apply appropriate equations to model the time varying behaviour of RC, RL, LC and RLC circuits with DC and AC power supplies. Describe the conditions under which RLC circuits are deemed to be resonant.
Explain what is meant by a (distributed) transmission line. Calculate the transfer function of a simple transmission line. Explain what is meant by a filter in an electric circuit and carry out simple calculations based on this. Use these principles to understand the Hodgkin-Huxley model of nerve transmission.
Discuss and apply equations related to optical principles and Maxwell's Equations. Describe the effect of negative refractive index materials on the propagation of light.
Discuss the following principles in electrical and biological signalling pathways: noise; channel capacity; sensitivity and selectivity; optimal coding.

Teaching and Learning Methods

Problem-based learning
Lectures
Group work
Tutorials

Assessment Methods

Coursework
Short Answer exercise sets
Reports (Group)

Pre-Requisites

Co-Requisites

Excluded Combinations

-

NS3108 Sensing and Signalling in Biology and Physics

Guided Independent Study: Indicative Activities

Preparation for workshops (including reading, videos, multiple choice questions)
Short Answer exercise sets

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Module Specification

NS3112 Independent Project III

Academic Year: 2019/0
Module Level: Year 3
Scheme: UG
Department: Physics and Astronomy
Credits: 15

Student Workload (hours)

Lectures	1
Seminars	
Practical Classes & Workshops	
Tutorials	
Fieldwork	
Project Supervision	12
Guided Independent Study	137
Demonstration	
Supervised time in studio/workshop	
Work Based Learning	
Placement	
Year Abroad	
Total Module Hours	150

Period: Semester 2
Occurence: E
Coordinator: Katherine Clark
Mark Scheme: UG Module Mark Scheme

No.	Assessment Description	Weight %	Qual Mark	Exam Hours	Ass't Group	Alt Reass't
001	Coursework	50				
002	Dissertation (Final)	50				

Intended Learning Outcomes

On successful completion of this module, students should be able to:
Demonstrate independent research/study skills including:
locate relevant (additional) research materials, time management, maintain a record of written sources, organise regular meetings with your supervisor, obtain a greater depth of knowledge in a discipline specialism.
Critically analyse a variety of written sources
Prepare and deliver a lecture that focusses on an aspect of your research
Demonstrate core presentation skills
Construct a report that synthesises information from a variety of sources.

Teaching and Learning Methods

Guided Independent Research

Assessment Methods

Review Report
Presentation

Pre-Requisites

Co-Requisites

Excluded Combinations

-

Guided Independent Study: Indicative Activities

Directed reading
Guided individual discussion with academic

Module Specification

NS3116 Scientific Computing (Microcontroller Programming)

Academic Year: 2019/0
Module Level: Year 3
Scheme: UG
Department: Physics and Astronomy
Credits: 15

Student Workload (hours)

Lectures	
Seminars	10
Practical Classes & Workshops	
Tutorials	
Fieldwork	
Project Supervision	
Guided Independent Study	140
Demonstration	
Supervised time in studio/workshop	
Work Based Learning	
Placement	
Year Abroad	
Total Module Hours	150

Period: Semester 2
Occurence: E
Coordinator: Cheryl Hurkett
Mark Scheme: UG Module Mark Scheme

No.	Assessment Description	Weight %	Qual Mark	Exam Hours	Ass't Group	Alt Reass't
001	Coursework (Final)	100				

Intended Learning Outcomes

On successful completion of this module, students should be able to:
Apply basic principles of microcontroller programming to an Arduino device; utilise the Arduino IDE to program a microcontroller to perform a variety of actions
Plan and implement a small scale group project involving a software-hardware interface developed specifically for a scientific application

Teaching and Learning Methods

Preparation for workshops (including reading, videos)
Group research projects
Computer laboratory projects

Assessment Methods

Coursework: Source Code
Coursework: Report

Pre-Requisites

Co-Requisites

Excluded Combinations

Guided Independent Study: Indicative Activities

-

Module Specification

PA1110 Mechanics

Academic Year: 2019/0
Module Level: Year 1
Scheme: UG
Department: Physics and Astronomy
Credits: 15

Student Workload (hours)

Lectures	16
Seminars	4
Practical Classes & Workshops	10
Tutorials	
Fieldwork	
Project Supervision	
Guided Independent Study	120
Demonstration	
Supervised time in studio/workshop	
Work Based Learning	
Placement	
Year Abroad	
Total Module Hours	150

Period: Semester 1
Occurence: E
Coordinator: Mark Lester
Mark Scheme: UG Module Mark Scheme

No.	Assessment Description	Weight %	Qual Mark	Exam Hours	Ass't Group	Alt Reass't
003	Exam (Final)	70		2		
004	Coursework	30				

Period: Semester 1
Occurence: E1
Coordinator: Mark Lester
Mark Scheme: UG Module Mark Scheme

No.	Assessment Description	Weight %	Qual Mark	Exam Hours	Ass't Group	Alt Reass't
001	Coursework	100				

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

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.

Assessment Methods

-

Pre-Requisites

-

Co-Requisites

-

Excluded Combinations

-

Guided Independent Study: 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 Specification

PA1120 Light and Matter

Academic Year: 2019/0
Module Level: Year 1
Scheme: UG
Department: Physics and Astronomy
Credits: 15

Student Workload (hours)

Lectures	16
Seminars	4
Practical Classes & Workshops	10
Tutorials	
Fieldwork	
Project Supervision	
Guided Independent Study	120
Demonstration	
Supervised time in studio/workshop	
Work Based Learning	
Placement	
Year Abroad	
Total Module Hours	150

Period: Semester 2
Occurence: E
Coordinator: Rhaana Starling
Mark Scheme: UG Module Mark Scheme

No.	Assessment Description	Weight %	Qual Mark	Exam Hours	Ass't Group	Alt Reass't
003	Examination (Final)	70		2		
004	Coursework	30				

Period: Semester 2
Occurence: E1
Coordinator: Rhaana Starling
Mark Scheme: UG Module Mark Scheme

No.	Assessment Description	Weight %	Qual Mark	Exam Hours	Ass't Group	Alt Reass't
001	Coursework	100				

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

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.

Assessment Methods

-

Pre-Requisites

-

Co-Requisites

-

Excluded Combinations

-

Guided Independent Study: 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.

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Module Specification

PA1130 Electricity and Magnetism

Academic Year: 2019/0
Module Level: Year 1
Scheme: UG
Department: Physics and Astronomy
Credits: 15

Student Workload (hours)

Lectures	16
Seminars	4
Practical Classes & Workshops	10
Tutorials	
Fieldwork	
Project Supervision	
Guided Independent Study	120
Demonstration	
Supervised time in studio/workshop	
Work Based Learning	
Placement	
Year Abroad	
Total Module Hours	150

Period: Semester 1
Occurence: E
Coordinator: Jonathan Nichols
Mark Scheme: UG Module Mark Scheme

No.	Assessment Description	Weight %	Qual Mark	Exam Hours	Ass't Group	Alt Reass't
003	Examination (Final)	70		2		
004	Coursework	30				

Period: Semester 1
Occurence: E1
Coordinator: Jonathan Nichols
Mark Scheme: UG Module Mark Scheme

No.	Assessment Description	Weight %	Qual Mark	Exam Hours	Ass't Group	Alt Reass't
001	Coursework	100				

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

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.

Assessment Methods

-

Pre-Requisites

-

Co-Requisites

-

Excluded Combinations

-

Guided Independent Study: 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.

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Module Specification

PA1140 Waves and Quanta

Academic Year: 2019/0
Module Level: Year 1
Scheme: UG
Department: Physics and Astronomy
Credits: 15

Student Workload (hours)

Lectures	16
Seminars	4
Practical Classes & Workshops	10
Tutorials	
Fieldwork	
Project Supervision	
Guided Independent Study	120
Demonstration	
Supervised time in studio/workshop	
Work Based Learning	
Placement	
Year Abroad	
Total Module Hours	150

Period: Semester 2
Occurence: E
Coordinator: Richard Alexander
Mark Scheme: UG Module Mark Scheme

No.	Assessment Description	Weight %	Qual Mark	Exam Hours	Ass't Group	Alt Reass't
003	Examination (Final)	70		2		
004	Coursework	30				

Period: Semester 2
Occurence: E1
Coordinator: Richard Alexander
Mark Scheme: UG Module Mark Scheme

No.	Assessment Description	Weight %	Qual Mark	Exam Hours	Ass't Group	Alt Reass't
001	Coursework	100				

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

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.

Assessment Methods

-

Pre-Requisites

-

PA1140 Waves and Quanta

Co-Requisites

-

Excluded Combinations

-

Guided Independent Study: 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 Specification

PA1601 Introduction to Astrophysics, Modern Physics and Space Science

Academic Year: 2019/0
Module Level: Year 1
Scheme: UG
Department: Physics and Astronomy
Credits: 15

Student Workload (hours)

Lectures	30
Seminars	
Practical Classes & Workshops	
Tutorials	
Fieldwork	
Project Supervision	
Guided Independent Study	120
Demonstration	
Supervised time in studio/workshop	
Work Based Learning	
Placement	
Year Abroad	
Total Module Hours	150

Period: Academic Year
Occurence: E
Coordinator: Matthew Burleigh
Mark Scheme: UG Module Mark Scheme

No.	Assessment Description	Weight %	Qual Mark	Exam Hours	Ass't Group	Alt Reass't
001	Introduction to Astrophysics Coursework (Final)	33.33				
002	Introduction to Modern Physics Coursework	33.33				
003	Introduction to Space Science Coursework	33.33				

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

Teaching and Learning Methods

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

Assessment Methods

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

Pre-Requisites

-

Co-Requisites

-

Excluded Combinations

-

Guided Independent Study: Indicative Activities

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

Module Specification

PA1602 Introduction to Applied Physics, Astrophysics and Space Science

Academic Year: 2019/0
Module Level: Year 1
Scheme: UG
Department: Physics and Astronomy
Credits: 15

Student Workload (hours)

Lectures	30
Seminars	
Practical Classes & Workshops	
Tutorials	
Fieldwork	
Project Supervision	
Guided Independent Study	120
Demonstration	
Supervised time in studio/workshop	
Work Based Learning	
Placement	
Year Abroad	
Total Module Hours	150

Period: Academic Year
Occurence: E
Coordinator: Michael Goad
Mark Scheme: UG Module Mark Scheme

No.	Assessment Description	Weight %	Qual Mark	Exam Hours	Ass't Group	Alt Reass't
001	Introduction to Applied Physics Coursework (Final)	33.33				
002	Introduction to Astrophysics Coursework	33.33				
003	Introduction to Space Science Coursework	33.33				

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

Teaching and Learning Methods

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

Assessment Methods

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

Pre-Requisites

-

Co-Requisites

-

Excluded Combinations

-

Guided Independent Study: Indicative Activities

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

Module Specification

PA1603 Introduction to Applied Physics, Astrophysics and Modern Physics

Academic Year: 2019/0
Module Level: Year 1
Scheme: UG
Department: Physics and Astronomy
Credits: 15

Student Workload (hours)

Lectures	30
Seminars	
Practical Classes & Workshops	
Tutorials	
Fieldwork	
Project Supervision	
Guided Independent Study	120
Demonstration	
Supervised time in studio/workshop	
Work Based Learning	
Placement	
Year Abroad	
Total Module Hours	150

Period: Academic Year
Occurence: E
Coordinator: Andrew Blain
Mark Scheme: UG Module Mark Scheme

No.	Assessment Description	Weight %	Qual Mark	Exam Hours	Ass't Group	Alt Reass't
001	Introduction to Applied Physics Coursework (Final)	33.33				
002	Introduction to Astrophysics Coursework	33.33				
003	Introduction to Modern Physics Coursework	33.33				

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

Teaching and Learning Methods

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

Assessment Methods

Coursework for each area (equally weighted)

Pre-Requisites

-

Co-Requisites

-

Excluded Combinations

-

Guided Independent Study: Indicative Activities

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

Module Specification

PA1604 Introduction to Applied Physics, Modern Physics and Space Science

Academic Year: 2019/0
Module Level: Year 1
Scheme: UG
Department: Physics and Astronomy
Credits: 15

Student Workload (hours)

Lectures	30
Seminars	
Practical Classes & Workshops	
Tutorials	
Fieldwork	
Project Supervision	
Guided Independent Study	120
Demonstration	
Supervised time in studio/workshop	
Work Based Learning	
Placement	
Year Abroad	
Total Module Hours	150

Period: Academic Year
Occurence: E
Coordinator: Jonathan Nichols
Mark Scheme: UG Module Mark Scheme

No.	Assessment Description	Weight %	Qual Mark	Exam Hours	Ass't Group	Alt Reass't
001	Introduction to Applied Physics Coursework (Final)	33.33				
002	Introduction to Modern Physics Coursework	33.33				
003	Introduction to Space Science	33.33				

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

Teaching and Learning Methods

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

Assessment Methods

Coursework for each area (equally weighted)

Pre-Requisites

-

Co-Requisites

-

Excluded Combinations

-

Guided Independent Study: Indicative Activities

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

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Module Specification

PA1710 Mathematical Physics 1.1

Academic Year: 2019/0
Module Level: Year 1
Scheme: UG
Department: Physics and Astronomy
Credits: 15

Student Workload (hours)

Lectures	25
Seminars	
Practical Classes & Workshops	22
Tutorials	
Fieldwork	
Project Supervision	
Guided Independent Study	103
Demonstration	
Supervised time in studio/workshop	
Work Based Learning	
Placement	
Year Abroad	
Total Module Hours	150

Period: Semester 1
Occurence: E
Coordinator: Simon Vaughan
Mark Scheme: UG Module Mark Scheme

No.	Assessment Description	Weight %	Qual Mark	Exam Hours	Ass't Group	Alt Reass't
001	Examination (Final)	70		2		
002	Coursework	30				

Period: Semester 1
Occurence: E1
Coordinator: Simon Vaughan
Mark Scheme: UG Module Mark Scheme

No.	Assessment Description	Weight %	Qual Mark	Exam Hours	Ass't Group	Alt Reass't
001	Coursework (final)	100				

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

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.

Assessment Methods

-

Pre-Requisites

-

PA1710 Mathematical Physics 1.1

Co-Requisites

-

Excluded Combinations

-

Guided Independent Study: 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 Specification

PA1720 Mathematical Physics 1.2

Academic Year: 2019/0
Module Level: Year 1
Scheme: UG
Department: Physics and Astronomy
Credits: 15

Student Workload (hours)

Lectures	25
Seminars	
Practical Classes & Workshops	22
Tutorials	
Fieldwork	
Project Supervision	
Guided Independent Study	103
Demonstration	
Supervised time in studio/workshop	
Work Based Learning	
Placement	
Year Abroad	
Total Module Hours	150

Period: Semester 2
Occurence: E
Coordinator: Emma Bunce
Mark Scheme: UG Module Mark Scheme

No.	Assessment Description	Weight %	Qual Mark	Exam Hours	Ass't Group	Alt Reass't
001	Examination (Final)	70		2		
002	Coursework	30				

Period: Semester 2
Occurence: E1
Coordinator: Emma Bunce
Mark Scheme: UG Module Mark Scheme

No.	Assessment Description	Weight %	Qual Mark	Exam Hours	Ass't Group	Alt Reass't
001	Coursework (Final)	100				

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
- 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

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.

Assessment Methods

-

Pre-Requisites

-

PA1720 Mathematical Physics 1.2

Co-Requisites

-

Excluded Combinations

-

Guided Independent Study: 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 Specification

PA1900 Experimental Physics 1

Academic Year: 2019/0
Module Level: Year 1
Scheme: UG
Department: Physics and Astronomy
Credits: 15

Student Workload (hours)

Lectures	4
Seminars	
Practical Classes & Workshops	79
Tutorials	
Fieldwork	
Project Supervision	
Guided Independent Study	67
Demonstration	
Supervised time in studio/workshop	
Work Based Learning	
Placement	
Year Abroad	
Total Module Hours	150

Period: Academic Year
Occurence: E
Coordinator: Darren Wright
Mark Scheme: UG Module Mark Scheme

No.	Assessment Description	Weight %	Qual Mark	Exam Hours	Ass't Group	Alt Reass't
001	Core Lab (Final)	45				
002	Group Research Projects	45				
003	Computing	10				

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
- Reflect on and articulate motivations, strengths and experience of developing one or more transferable skills
- Work effectively in teams

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.

Assessment Methods

No reassessment of labs.

Pre-Requisites

-

Co-Requisites

-

Excluded Combinations

-

Guided Independent Study: 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 Specification

PA2230 Condensed Matter Physics

Academic Year: 2019/0
Module Level: Year 2
Scheme: UG
Department: Physics and Astronomy
Credits: 15

Student Workload (hours)

Lectures	24
Seminars	3
Practical Classes & Workshops	8
Tutorials	
Fieldwork	
Project Supervision	
Guided Independent Study	115
Demonstration	
Supervised time in studio/workshop	
Work Based Learning	
Placement	
Year Abroad	
Total Module Hours	150

Period: Semester 2
Occurence: E
Coordinator: Steve Baker
Mark Scheme: UG Module Mark Scheme

No.	Assessment Description	Weight %	Qual Mark	Exam Hours	Ass't Group	Alt Reass't
003	Examination (Final)	70		2		
004	Coursework	30				

Period: Semester 2
Occurence: E1
Coordinator: Steve Baker
Mark Scheme: UG Module Mark Scheme

No.	Assessment Description	Weight %	Qual Mark	Exam Hours	Ass't Group	Alt Reass't
001	Coursework (Final)	100				

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

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.

Assessment Methods

-

Pre-Requisites

-

Co-Requisites

-

Excluded Combinations

-

Guided Independent Study: 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 Specification

PA2240 Electromagnetic Fields

Academic Year: 2019/0
Module Level: Year 2
Scheme: UG
Department: Physics and Astronomy
Credits: 15

Student Workload (hours)

Lectures	24
Seminars	3
Practical Classes & Workshops	8
Tutorials	
Fieldwork	
Project Supervision	
Guided Independent Study	115
Demonstration	
Supervised time in studio/workshop	
Work Based Learning	
Placement	
Year Abroad	
Total Module Hours	150

Period: Semester 1
Occurence: E
Coordinator: Suzanne Imber
Mark Scheme: UG Module Mark Scheme

No.	Assessment Description	Weight %	Qual Mark	Exam Hours	Ass't Group	Alt Reass't
003	Examination (Final)	70		2		
004	Coursework	30				

Period: Semester 1
Occurence: E1
Coordinator: Suzanne Imber
Mark Scheme: UG Module Mark Scheme

No.	Assessment Description	Weight %	Qual Mark	Exam Hours	Ass't Group	Alt Reass't
001	Coursework	100				

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

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.

Assessment Methods

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Pre-Requisites

\-

PA2240 Electromagnetic Fields

Co-Requisites

-

Excluded Combinations

-

Guided Independent Study: 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 Specification

PA2260 Relativity, Quantum Physics and Particles

Academic Year: 2019/0
Module Level: Year 2
Scheme: UG
Department: Physics and Astronomy
Credits: 15

Student Workload (hours)

Lectures	24
Seminars	3
Practical Classes & Workshops	8
Tutorials	
Fieldwork	
Project Supervision	
Guided Independent Study	115
Demonstration	
Supervised time in studio/workshop	
Work Based Learning	
Placement	
Year Abroad	
Total Module Hours	150

Period: Semester 1
Occurence: E
Coordinator: Nial Tanvir
Mark Scheme: UG Module Mark Scheme

No.	Assessment Description	Weight %	Qual Mark	Exam Hours	Ass't Group	Alt Reass't
001	Coursework	30				
002	Examination (Final)	70		2		

Period: Semester 1
Occurence: E1
Coordinator: Nial Tanvir
Mark Scheme: UG Module Mark Scheme

No.	Assessment Description	Weight %	Qual Mark	Exam Hours	Ass't Group	Alt Reass't
001	Coursework (final)	100				

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

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.

Assessment Methods

-

Pre-Requisites

-

PA2260 Relativity, Quantum Physics and Particles

Co-Requisites

-

Excluded Combinations

-

Guided Independent Study: 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.

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Module Specification

PA2601 Intermediate Astrophysics and Modern Physics

Academic Year:	2019/0
Module Level:	Year 2
Scheme:	UG
Department:	Physics and Astronomy
Credits:	15

Student Workload (hours)

Lectures	30
Seminars	
Practical Classes & Workshops	
Tutorials	
Fieldwork	
Project Supervision	
Guided Independent Study	120
Demonstration	
Supervised time in studio/workshop	
Work Based Learning	
Placement	
Year Abroad	
Total Module Hours	150

Period:	Semester 2
Occurence:	E
Coordinator:	Michael Goad
Mark Scheme:	UG Module Mark Scheme

No.	Assessment Description	Weight %	Qual Mark	Exam Hours	Ass't Group	Alt Reass't
001	Astrophysics Coursework (Final)	50				
002	Modern Physics Coursework	50				

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

Teaching and Learning Methods

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

Assessment Methods

-

Pre-Requisites

-

Co-Requisites

-

Excluded Combinations

-

Guided Independent Study: Indicative Activities

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

Module Specification

PA2602 Intermediate Astrophysics and Applied Physics

Academic Year: 2019/0
Module Level: Year 2
Scheme: UG
Department: Physics and Astronomy
Credits: 15

Student Workload (hours)

Lectures	30
Seminars	
Practical Classes & Workshops	
Tutorials	
Fieldwork	
Project Supervision	
Guided Independent Study	120
Demonstration	
Supervised time in studio/workshop	
Work Based Learning	
Placement	
Year Abroad	
Total Module Hours	150

Period: Semester 2
Occurence: E
Coordinator: Steve Baker
Mark Scheme: UG Module Mark Scheme

No.	Assessment Description	Weight %	Qual Mark	Exam Hours	Ass't Group	Alt Reass't
001	Applied Physics Coursework (Final)	50				
002	Astrophysics Coursework	50				

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

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

Assessment Methods
-

Pre-Requisites
-

Co-Requisites
-

Excluded Combinations
-

Guided Independent Study: Indicative Activities
You will read relevant background material and work through appropriate problems. You will discuss problems and solutions with your peers.

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Module Specification

PA2603 Intermediate Astrophysics and Space Science

Academic Year: 2019/0
Module Level: Year 2
Scheme: UG
Department: Physics and Astronomy
Credits: 15

Student Workload (hours)

Lectures	30
Seminars	
Practical Classes & Workshops	
Tutorials	
Fieldwork	
Project Supervision	
Guided Independent Study	120
Demonstration	
Supervised time in studio/workshop	
Work Based Learning	
Placement	
Year Abroad	
Total Module Hours	150

Period: Semester 2
Occurence: E
Coordinator: Thomas Stallard
Mark Scheme: UG Module Mark Scheme

No.	Assessment Description	Weight %	Qual Mark	Exam Hours	Ass't Group	Alt Reass't
001	Astrophysics Coursework (Final)	50				
002	Space Science Coursework	50				

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

Teaching and Learning Methods

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

Assessment Methods

-

Pre-Requisites

-

Co-Requisites

-

Excluded Combinations

-

Guided Independent Study: Indicative Activities

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

Module Specification

PA2604 Intermediate Modern Physics and Space Science

Academic Year: 2019/0
Module Level: Year 2
Scheme: UG
Department: Physics and Astronomy
Credits: 15

Student Workload (hours)

Lectures	30
Seminars	
Practical Classes & Workshops	
Tutorials	
Fieldwork	
Project Supervision	
Guided Independent Study	120
Demonstration	
Supervised time in studio/workshop	
Work Based Learning	
Placement	
Year Abroad	
Total Module Hours	150

Period: Semester 2
Occurence: E
Coordinator: Stephen Milan
Mark Scheme: UG Module Mark Scheme

No.	Assessment Description	Weight %	Qual Mark	Exam Hours	Ass't Group	Alt Reass't
001	Modern Physics Coursework (Final)	50				
002	Space Science Coursework	50				

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

Teaching and Learning Methods

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

Assessment Methods

-

Pre-Requisites

-

Co-Requisites

-

Excluded Combinations

-

Guided Independent Study: Indicative Activities

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

Module Specification

PA2605 Intermediate Applied Physics and Space Science

Academic Year: 2019/0
Module Level: Year 2
Scheme: UG
Department: Physics and Astronomy
Credits: 15

Student Workload (hours)

Lectures	30
Seminars	
Practical Classes & Workshops	
Tutorials	
Fieldwork	
Project Supervision	
Guided Independent Study	120
Demonstration	
Supervised time in studio/workshop	
Work Based Learning	
Placement	
Year Abroad	
Total Module Hours	150

Period: Semester 2
Occurence: E
Coordinator: Steve Baker
Mark Scheme: UG Module Mark Scheme

No.	Assessment Description	Weight %	Qual Mark	Exam Hours	Ass't Group	Alt Reass't
001	Applied Physics Coursework (Final)	50				
002	Space Science Coursework	50				

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

Teaching and Learning Methods

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

Assessment Methods

-

Pre-Requisites

-

Co-Requisites

-

Excluded Combinations

-

Guided Independent Study: Indicative Activities

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

Module Specification

PA2606 Intermediate Applied Physics and Modern Physics

Academic Year: 2019/0
Module Level: Year 2
Scheme: UG
Department: Physics and Astronomy
Credits: 15

Student Workload (hours)

Lectures	30
Seminars	
Practical Classes & Workshops	
Tutorials	
Fieldwork	
Project Supervision	
Guided Independent Study	120
Demonstration	
Supervised time in studio/workshop	
Work Based Learning	
Placement	
Year Abroad	
Total Module Hours	150

Period: Semester 2
Occurence: E
Coordinator: Steve Baker
Mark Scheme: UG Module Mark Scheme

No.	Assessment Description	Weight %	Qual Mark	Exam Hours	Ass't Group	Alt Reass't
001	Applied Physics Coursework (Final)	50				
002	Modern Physics Coursework	50				

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

Teaching and Learning Methods

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

Assessment Methods

-

Pre-Requisites

-

Co-Requisites

-

Excluded Combinations

-

Guided Independent Study: Indicative Activities

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

Module Specification

PA2710 Mathematical Physics 2

Academic Year: 2019/0
Module Level: Year 2
Scheme: UG
Department: Physics and Astronomy
Credits: 15

Student Workload (hours)

Lectures	18
Seminars	3
Practical Classes & Workshops	16
Tutorials	
Fieldwork	
Project Supervision	
Guided Independent Study	113
Demonstration	
Supervised time in studio/workshop	
Work Based Learning	
Placement	
Year Abroad	
Total Module Hours	150

Period: Semester 1
Occurence: E
Coordinator: Mervyn Roy
Mark Scheme: UG Module Mark Scheme

No.	Assessment Description	Weight %	Qual Mark	Exam Hours	Ass't Group	Alt Reass't
001	Examination (Final)	70		2		
002	Coursework	30				

Period: Semester 1
Occurence: E1
Coordinator: Mervyn Roy
Mark Scheme: UG Module Mark Scheme

No.	Assessment Description	Weight %	Qual Mark	Exam Hours	Ass't Group	Alt Reass't
001	Coursework	100				

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

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.

Assessment Methods

-

Pre-Requisites

-

PA2710 Mathematical Physics 2

Co-Requisites

-

Excluded Combinations

-

Guided Independent Study: 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.

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Module Specification

PA2720 Statistical Physics

Academic Year: 2019/0
Module Level: Year 2
Scheme: UG
Department: Physics and Astronomy
Credits: 15

Student Workload (hours)

Lectures	24
Seminars	3
Practical Classes & Workshops	8
Tutorials	
Fieldwork	
Project Supervision	
Guided Independent Study	115
Demonstration	
Supervised time in studio/workshop	
Work Based Learning	
Placement	
Year Abroad	
Total Module Hours	150

Period: Semester 2
Occurence: E
Coordinator: Simon Vaughan
Mark Scheme: UG Module Mark Scheme

No.	Assessment Description	Weight %	Qual Mark	Exam Hours	Ass't Group	Alt Reass't
001	Examination (Final)	70		2		
002	Coursework	30				

Period: Semester 2
Occurence: E1
Coordinator: Simon Vaughan
Mark Scheme: UG Module Mark Scheme

No.	Assessment Description	Weight %	Qual Mark	Exam Hours	Ass't Group	Alt Reass't
001	Coursework	100				

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

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.

Assessment Methods

-

Pre-Requisites

-

Co-Requisites

-

Excluded Combinations

-

Guided Independent Study: 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.

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Module Specification

PA2900 Experimental Physics 2

Academic Year: 2019/0
Module Level: Year 2
Scheme: UG
Department: Physics and Astronomy
Credits: 30

Student Workload (hours)

Lectures	6
Seminars	
Practical Classes & Workshops	88
Tutorials	
Fieldwork	
Project Supervision	
Guided Independent Study	206
Demonstration	
Supervised time in studio/workshop	
Work Based Learning	
Placement	
Year Abroad	
Total Module Hours	300

Period: Academic Year
Occurence: E
Coordinator: Steve Baker
Mark Scheme: UG Module Mark Scheme

No.	Assessment Description	Weight %	Qual Mark	Exam Hours	Ass't Group	Alt Reass't
001	Core Physics Experiments	50				
002	Group Research Projects (Final)	20				
003	Data Handling and Computing	20				
004	Electronics Workshop	10				

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)

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.

Assessment Methods

No reassessment.

Pre-Requisites

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Co-Requisites

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Excluded Combinations

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Guided Independent Study: 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.

PA2900 **Experimental Physics 2**

Module Specification

PA3210 Quantum Mechanics

Academic Year: 2019/0
Module Level: Year 3
Scheme: UG
Department: Physics and Astronomy
Credits: 15

Student Workload (hours)

Lectures	24
Seminars	3
Practical Classes & Workshops	8
Tutorials	
Fieldwork	
Project Supervision	
Guided Independent Study	115
Demonstration	
Supervised time in studio/workshop	
Work Based Learning	
Placement	
Year Abroad	
Total Module Hours	150

Period: Semester 1
Occurence: E
Coordinator: Mervyn Roy
Mark Scheme: UG Module Mark Scheme

No.	Assessment Description	Weight %	Qual Mark	Exam Hours	Ass't Group	Alt Reass't
001	Examination (Summer) (Final)	70		2		
002	Coursework	30				

Period: Semester 1
Occurence: E1
Coordinator: Mervyn Roy
Mark Scheme: UG Module Mark Scheme

No.	Assessment Description	Weight %	Qual Mark	Exam Hours	Ass't Group	Alt Reass't
001	Coursework	100				

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 and 3D, and hydrogen-like atoms; use the method of separation of variables and an understanding of symmetry to simplify 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

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.

Assessment Methods

Coursework - 30%
Exam (2 hours) 70%

Pre-Requisites

-

PA3210 Quantum Mechanics

Co-Requisites

-

Excluded Combinations

-

Guided Independent Study: 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 Specification

PA3230 Radiation and Matter

Academic Year: 2019/0
Module Level: Year 3
Scheme: UG
Department: Physics and Astronomy
Credits: 15

Student Workload (hours)

Lectures	24
Seminars	3
Practical Classes & Workshops	8
Tutorials	
Fieldwork	
Project Supervision	
Guided Independent Study	115
Demonstration	
Supervised time in studio/workshop	
Work Based Learning	
Placement	
Year Abroad	
Total Module Hours	150

Period: Semester 2
Occurence: E
Coordinator: Michael Goad
Mark Scheme: UG Module Mark Scheme

No.	Assessment Description	Weight %	Qual Mark	Exam Hours	Ass't Group	Alt Reass't
001	Examination (Final)	70		2		
002	Coursework	30				

Period: Semester 2
Occurence: E1
Coordinator: Michael Goad
Mark Scheme: UG Module Mark Scheme

No.	Assessment Description	Weight %	Qual Mark	Exam Hours	Ass't Group	Alt Reass't
001	Coursework	100				

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.

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.

Assessment Methods

Coursework - 30%
Exam (2 hours) - 70%

Pre-Requisites

-

Co-Requisites

-

Excluded Combinations

-

Guided Independent Study: 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 Specification

PA3241 Group Project

Academic Year: 2019/0
Module Level: Year 3
Scheme: UG
Department: Physics and Astronomy
Credits: 15

Student Workload (hours)

Lectures	
Seminars	
Practical Classes & Workshops	
Tutorials	
Fieldwork	
Project Supervision	10
Guided Independent Study	140
Demonstration	
Supervised time in studio/workshop	
Work Based Learning	
Placement	
Year Abroad	
Total Module Hours	150

Period: Semester 1
Occurence: E
Coordinator: Ian Hutchinson
Mark Scheme: UG Module Mark Scheme

No.	Assessment Description	Weight %	Qual Mark	Exam Hours	Ass't Group	Alt Reass't
001	Coursework	100				

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

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.

Assessment Methods

Coursework

Pre-Requisites

-

Co-Requisites

-

Excluded Combinations

-

Guided Independent Study: 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.

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Module Specification

PA3242 Astrodynamics

Academic Year: 2019/0
Module Level: Year 3
Scheme: UG
Department: Physics and Astronomy
Credits: 15

Student Workload (hours)

Lectures	
Seminars	
Practical Classes & Workshops	20
Tutorials	
Fieldwork	
Project Supervision	
Guided Independent Study	130
Demonstration	
Supervised time in studio/workshop	
Work Based Learning	
Placement	
Year Abroad	
Total Module Hours	150

Period: Semester 1
Occurence: E
Coordinator: Nigel Bannister
Mark Scheme: UG Module Mark Scheme

No.	Assessment Description	Weight %	Qual Mark	Exam Hours	Ass't Group	Alt Reass't
001	Coursework	100				

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

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 the workshop, but will also have to rely on your individual initiative, creativity and diligence.

Assessment Methods

Coursework

Pre-Requisites

-

Co-Requisites

-

Excluded Combinations

-

Guided Independent Study: 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 Specification

PA3243 Electronics

Academic Year: 2019/0
Module Level: Year 3
Scheme: UG
Department: Physics and Astronomy
Credits: 15

Student Workload (hours)

Lectures	
Seminars	
Practical Classes & Workshops	10
Tutorials	
Fieldwork	
Project Supervision	20
Guided Independent Study	30
Demonstration	
Supervised time in studio/workshop	90
Work Based Learning	
Placement	
Year Abroad	
Total Module Hours	150

Period: Semester 1
Occurence: E
Coordinator: Darren Wright
Mark Scheme: UG Module Mark Scheme

No.	Assessment Description	Weight %	Qual Mark	Exam Hours	Ass't Group	Alt Reass't
001	Coursework	100				

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

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. You will participate in lab-based practical sessions and prepare and deliver a presentation as well as work to produce a group report.

Assessment Methods

Coursework

Pre-Requisites

-

Co-Requisites

-

Excluded Combinations

-

Guided Independent Study: 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 Specification

PA3244 Lean Launchpad: Evidence Based Entrepreneurship

Academic Year: 2019/0
Module Level: Year 3
Scheme: UG
Department: Physics and Astronomy
Credits: 15

Student Workload (hours)

Lectures	5
Seminars	
Practical Classes & Workshops	30
Tutorials	
Fieldwork	
Project Supervision	
Guided Independent Study	115
Demonstration	
Supervised time in studio/workshop	
Work Based Learning	
Placement	
Year Abroad	
Total Module Hours	150

Period: Semester 1
Occurence: E
Coordinator: Richard Ambrosi
Mark Scheme: UG Module Mark Scheme

No.	Assessment Description	Weight %	Qual Mark	Exam Hours	Ass't Group	Alt Reass't
001	Coursework	100				

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

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. Experiential learning will be used to allow students to discuss the outcomes of business model hypothesis testing. Students will be required to test their ideas outside the classroom. A “flipped classroom” approach will be used to deliver the core elements of the programme where students will use both texts and online lectures to familiarize themselves with the course material. You will benefit from working in a team but will also have to rely on your individual initiative, creativity and diligence.

Assessment Methods

Coursework

Pre-Requisites

-

Co-Requisites

-

Excluded Combinations

-

PA3244 Lean Launchpad: Evidence Based Entrepreneurship

Guided Independent Study: 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 Specification

PA3246 Python

Academic Year: 2019/0
Module Level: Year 3
Scheme: UG
Department: Physics and Astronomy
Credits: 15

Student Workload (hours)

Lectures
Seminars
Practical Classes & Workshops
Tutorials
Fieldwork
Project Supervision
Guided Independent Study
Demonstration
Supervised time in studio/workshop
Work Based Learning
Placement
Year Abroad
Total Module Hours

Period: Semester 1
Occurence: E
Coordinator: Jonathan Nichols
Mark Scheme: UG Module Mark Scheme

No.	Assessment Description	Weight %	Qual Mark	Exam Hours	Ass't Group	Alt Reass't
001	Coursework	100				

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

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 initiative, creativity and diligence.

Assessment Methods

Coursework

Pre-Requisites

-

Co-Requisites

-

Excluded Combinations

-

Guided Independent Study: 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.

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Module Specification

PA3247 Numerical Programming in C

Academic Year: 2019/0
Module Level: Year 3
Scheme: UG
Department: Physics and Astronomy
Credits: 15

Student Workload (hours)

Lectures	
Seminars	
Practical Classes & Workshops	30
Tutorials	
Fieldwork	
Project Supervision	
Guided Independent Study	120
Demonstration	
Supervised time in studio/workshop	
Work Based Learning	
Placement	
Year Abroad	
Total Module Hours	150

Period: Semester 1
Occurence: E
Coordinator: Mervyn Roy
Mark Scheme: UG Module Mark Scheme

No.	Assessment Description	Weight %	Qual Mark	Exam Hours	Ass't Group	Alt Reass't
001	Coursework	100				

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

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 initiative, creativity and diligence.

Assessment Methods

Coursework

Pre-Requisites

-

Co-Requisites

-

Excluded Combinations

-

Guided Independent Study: 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 Specification

PA3250 Mathematical Physics 3

Academic Year: 2019/0
Module Level: Year 3
Scheme: UG
Department: Physics and Astronomy
Credits: 15

Student Workload (hours)

Lectures	20
Seminars	4
Practical Classes & Workshops	12
Tutorials	
Fieldwork	
Project Supervision	
Guided Independent Study	114
Demonstration	
Supervised time in studio/workshop	
Work Based Learning	
Placement	
Year Abroad	
Total Module Hours	150

Period: Semester 1
Occurence: E
Coordinator: Sergei Nayakshin
Mark Scheme: UG Module Mark Scheme

No.	Assessment Description	Weight %	Qual Mark	Exam Hours	Ass't Group	Alt Reass't
001	Coursework	30				
002	Examination (Summer) (Final)	70		2		

Period: Semester 1
Occurence: E1
Coordinator: Sergei Nayakshin
Mark Scheme: UG Module Mark Scheme

No.	Assessment Description	Weight %	Qual Mark	Exam Hours	Ass't Group	Alt Reass't
001	Coursework	100				

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.

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.

Assessment Methods

Coursework - 30%
Exam (2 hours) - 70%

Pre-Requisites

-

Co-Requisites

-

PA3250 Mathematical Physics 3

Excluded Combinations

-

Guided Independent Study: 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.

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Module Specification

PA3601 Applied and Medical Physics

Academic Year: 2019/0
Module Level: Year 3
Scheme: UG
Department: Physics and Astronomy
Credits: 15

Student Workload (hours)

Lectures	30
Seminars	
Practical Classes & Workshops	2
Tutorials	
Fieldwork	
Project Supervision	
Guided Independent Study	118
Demonstration	
Supervised time in studio/workshop	
Work Based Learning	
Placement	
Year Abroad	
Total Module Hours	150

Period: Semester 1
Occurence: E
Coordinator: Steve Baker
Mark Scheme: UG Module Mark Scheme

No.	Assessment Description	Weight %	Qual Mark	Exam Hours	Ass't Group	Alt Reass't
001	Coursework	30				
002	Exam (Final)	70		2		

Period: Semester 1
Occurence: E1
Coordinator: Steve Baker
Mark Scheme: UG Module Mark Scheme

No.	Assessment Description	Weight %	Qual Mark	Exam Hours	Ass't Group	Alt Reass't
001	Coursework	100				

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.

Teaching and Learning Methods

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

Assessment Methods

- Coursework - 30%
- Exam (2 hours) - 70%

Pre-Requisites

-

Co-Requisites

-

PA3601 Applied and Medical Physics

Excluded Combinations

-

Guided Independent Study: Indicative Activities

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

Module Specification

PA3602 Stellar Astrophysics

Academic Year: 2019/0
Module Level: Year 3
Scheme: UG
Department: Physics and Astronomy
Credits: 15

Student Workload (hours)

Lectures	30
Seminars	
Practical Classes & Workshops	2
Tutorials	
Fieldwork	
Project Supervision	
Guided Independent Study	118
Demonstration	
Supervised time in studio/workshop	
Work Based Learning	
Placement	
Year Abroad	
Total Module Hours	150

Period: Semester 1
Occurence: E1
Coordinator: GRAHAM WYNN
Mark Scheme: UG Module Mark Scheme

No.	Assessment Description	Weight %	Qual Mark	Exam Hours	Ass't Group	Alt Reass't
001	Coursework	100				

Period: Semester 2
Occurence: E
Coordinator: Graham Wynn
Mark Scheme: UG Module Mark Scheme

No.	Assessment Description	Weight %	Qual Mark	Exam Hours	Ass't Group	Alt Reass't
001	Examination (Final)	70		2		
002	Coursework	30				

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

Teaching and Learning Methods

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

Assessment Methods

Coursework - 30%
Exam (2 hours) - 70%

Pre-Requisites

-

Co-Requisites

-

Excluded Combinations

-

Guided Independent Study: Indicative Activities

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

Module Specification

PA3603 The Space Environment

Academic Year:	2019/0
Module Level:	Year 3
Scheme:	UG
Department:	Physics and Astronomy
Credits:	15

Student Workload (hours)

Lectures	30
Seminars	
Practical Classes & Workshops	2
Tutorials	
Fieldwork	
Project Supervision	
Guided Independent Study	118
Demonstration	
Supervised time in studio/workshop	
Work Based Learning	
Placement	
Year Abroad	
Total Module Hours	150

Period:	Semester 1
Occurence:	E
Coordinator:	Timothy Yeoman
Mark Scheme:	UG Module Mark Scheme

No.	Assessment Description	Weight %	Qual Mark	Exam Hours	Ass't Group	Alt Reass't
001	Coursework	30				
002	Examinaton (Final)	70		2		

Period:	Semester 1
Occurence:	E1
Coordinator:	Timothy Yeoman
Mark Scheme:	UG Module Mark Scheme

No.	Assessment Description	Weight %	Qual Mark	Exam Hours	Ass't Group	Alt Reass't
001	Coursework	100				

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

Teaching and Learning Methods

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

Assessment Methods

Coursework and Examination (final)

PA3603 The Space Environment

Pre-Requisites

-

Co-Requisites

-

Excluded Combinations

-

Guided Independent Study: Indicative Activities

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

Module Specification

PA3604 Elementary Particles, The Standard Model and Beyond

Academic Year: 2019/0
Module Level: Year 3
Scheme: UG
Department: Physics and Astronomy
Credits: 15

Student Workload (hours)

Lectures	30
Seminars	
Practical Classes & Workshops	2
Tutorials	
Fieldwork	
Project Supervision	
Guided Independent Study	118
Demonstration	
Supervised time in studio/workshop	
Work Based Learning	
Placement	
Year Abroad	
Total Module Hours	150

Period: Semester 2
Occurence: E
Coordinator: Andrew Blain
Mark Scheme: UG Module Mark Scheme

No.	Assessment Description	Weight %	Qual Mark	Exam Hours	Ass't Group	Alt Reass't
001	Coursework	30				
002	Examination (Final)	70		2		

Period: Semester 2
Occurence: E1
Coordinator: Andrew Blain
Mark Scheme: UG Module Mark Scheme

No.	Assessment Description	Weight %	Qual Mark	Exam Hours	Ass't Group	Alt Reass't
001	Coursework	100				

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

Teaching and Learning Methods

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

Assessment Methods

Coursework and Examination (final)

Pre-Requisites

-

Co-Requisites

-

Excluded Combinations

-

Guided Independent Study: Indicative Activities

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

Module Specification

PA3605 Quasars and Cosmology

Academic Year: 2019/0
Module Level: Year 3
Scheme: UG
Department: Physics and Astronomy
Credits: 15

Student Workload (hours)

Lectures	30
Seminars	
Practical Classes & Workshops	2
Tutorials	
Fieldwork	
Project Supervision	
Guided Independent Study	118
Demonstration	
Supervised time in studio/workshop	
Work Based Learning	
Placement	
Year Abroad	
Total Module Hours	150

Period: Semester 1
Occurence: E
Coordinator: Nial Tanvir
Mark Scheme: UG Module Mark Scheme

No.	Assessment Description	Weight %	Qual Mark	Exam Hours	Ass't Group	Alt Reass't
001	Coursework	30				
002	Examination (Final)	70		2		

Period: Semester 2
Occurence: E1
Coordinator: Nial Tanvir
Mark Scheme: UG Module Mark Scheme

No.	Assessment Description	Weight %	Qual Mark	Exam Hours	Ass't Group	Alt Reass't
001	Coursework	100				

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

Teaching and Learning Methods

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

Assessment Methods

Coursework and Examination (final)

Pre-Requisites

-

Co-Requisites

-

Excluded Combinations

-

Guided Independent Study: Indicative Activities

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

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Module Specification

PA3606 Planetary Physics

Academic Year: 2019/0
Module Level: Year 3
Scheme: UG
Department: Physics and Astronomy
Credits: 15

Student Workload (hours)

Lectures	30
Seminars	
Practical Classes & Workshops	2
Tutorials	
Fieldwork	
Project Supervision	
Guided Independent Study	118
Demonstration	
Supervised time in studio/workshop	
Work Based Learning	
Placement	
Year Abroad	
Total Module Hours	150

Period: Semester 2
Occurence: E
Coordinator: John Bridges
Mark Scheme: UG Module Mark Scheme

No.	Assessment Description	Weight %	Qual Mark	Exam Hours	Ass't Group	Alt Reass't
001	Coursework	30				
002	Examination (Final)	70		2		

Period: Semester 2
Occurence: E1
Coordinator: John Bridges
Mark Scheme: UG Module Mark Scheme

No.	Assessment Description	Weight %	Qual Mark	Exam Hours	Ass't Group	Alt Reass't
001	Coursework	100				

Intended Learning Outcomes

On successful completion of the module, students should be able to:
- Demonstrate a working knowledge of physics as applied to specialist fields in planetary physics.
- Use your physical and mathematical knowledge to describe the observed behaviour of planetary systems, climate systems and 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.

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.

Assessment Methods

Coursework and Examination (final)

Pre-Requisites

-

Co-Requisites

-

Excluded Combinations

-

Guided Independent Study: Indicative Activities

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

Module Specification

PA4440 Literature Review Project

Academic Year: 2019/0
Module Level: Year 4
Scheme: UG
Department: Physics and Astronomy
Credits: 15

Student Workload (hours)

Lectures	1
Seminars	
Practical Classes & Workshops	
Tutorials	
Fieldwork	
Project Supervision	9
Guided Independent Study	138
Demonstration	
Supervised time in studio/workshop	2
Work Based Learning	
Placement	
Year Abroad	
Total Module Hours	150

Period: Academic Year
Occurence: E
Coordinator: Paul O'Brien
Mark Scheme: UG Module Mark Scheme

No.	Assessment Description	Weight %	Qual Mark	Exam Hours	Ass't Group	Alt Reass't
001	Report (Final)	50				
002	Presentation	50				

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

Teaching and Learning Methods

Introductory lecture; individual guidance via supervisor

Assessment Methods

Report - 50%
Presentation - 50%

Pre-Requisites

-

Co-Requisites

-

Excluded Combinations

-

Guided Independent Study: 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.

UNIVERSITY OF LEICESTER

Module Specification

PA4601 Quantum Theory of Solids

Academic Year: 2019/0
Module Level: Year 4
Scheme: UG
Department: Physics and Astronomy
Credits: 15

Student Workload (hours)

Lectures	20
Seminars	
Practical Classes & Workshops	12
Tutorials	
Fieldwork	
Project Supervision	
Guided Independent Study	118
Demonstration	
Supervised time in studio/workshop	
Work Based Learning	
Placement	
Year Abroad	
Total Module Hours	150

Period: Semester 2
Occurence: E
Coordinator: Mervyn Roy
Mark Scheme: UG Module Mark Scheme

No.	Assessment Description	Weight %	Qual Mark	Exam Hours	Ass't Group	Alt Reass't
001	Examination (Final)	50		2		
002	Coursework	50				

Period: Semester 2
Occurence: E1
Coordinator: Mervyn Roy
Mark Scheme: UG Module Mark Scheme

No.	Assessment Description	Weight %	Qual Mark	Exam Hours	Ass't Group	Alt Reass't
001	Coursework (Final)	100				

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.

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

Assessment Methods

Courswork50%
Examination (Final)50%

Pre-Requisites

-

UNIVERSITY OF LEICESTER

Module Specification

PA4601 Quantum Theory of Solids

Co-Requisites

-

Excluded Combinations

-

Guided Independent Study: 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.

UNIVERSITY OF LEICESTER

Module Specification

PA4602 Scientific Data Analysis

Academic Year: 2019/0
Module Level: Year 4
Scheme: UG
Department: Physics and Astronomy
Credits: 15

Student Workload (hours)

Lectures	20
Seminars	
Practical Classes & Workshops	12
Tutorials	
Fieldwork	
Project Supervision	
Guided Independent Study	118
Demonstration	
Supervised time in studio/workshop	
Work Based Learning	
Placement	
Year Abroad	
Total Module Hours	150

Period: Semester 1
Occurence: E
Coordinator: Simon Vaughan
Mark Scheme: UG Module Mark Scheme

No.	Assessment Description	Weight %	Qual Mark	Exam Hours	Ass't Group	Alt Reass't
001	Coursework	50				
002	Exam (Final)	50		2		

Period: Semester 1
Occurence: E1
Coordinator: Simon Vaughan
Mark Scheme: UG Module Mark Scheme

No.	Assessment Description	Weight %	Qual Mark	Exam Hours	Ass't Group	Alt Reass't
001	Coursework	100				

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

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.

Assessment Methods

Coursework and Examination

Pre-Requisites

-

Co-Requisites

-

Excluded Combinations

-

PA4602 Scientific Data Analysis

Guided Independent Study: 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.

UNIVERSITY OF LEICESTER

Module Specification

PA4603 Space Plasmas

Academic Year: 2019/0
Module Level: Year 4
Scheme: UG
Department: Physics and Astronomy
Credits: 15

Student Workload (hours)

Lectures	30
Seminars	
Practical Classes & Workshops	2
Tutorials	
Fieldwork	
Project Supervision	
Guided Independent Study	118
Demonstration	
Supervised time in studio/workshop	
Work Based Learning	
Placement	
Year Abroad	
Total Module Hours	150

Period: Semester 1
Occurence: E
Coordinator: STEPHEN MILAN
Mark Scheme: UG Module Mark Scheme

No.	Assessment Description	Weight %	Qual Mark	Exam Hours	Ass't Group	Alt Reass't
001	Coursework	30				
002	Exam (Final)	70		2		

Period: Semester 1
Occurence: E1
Coordinator: STEPHEN MILAN
Mark Scheme: UG Module Mark Scheme

No.	Assessment Description	Weight %	Qual Mark	Exam Hours	Ass't Group	Alt Reass't
001	Coursework	100				

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

Teaching and Learning Methods

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

Assessment Methods

Coursework and Examination

Pre-Requisites

-

Co-Requisites

-

Excluded Combinations

-

PA4603 Space Plasmas

Guided Independent Study: 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 Specification

PA4604 Radiative Processes

Academic Year: 2019/0
Module Level: Year 4
Scheme: UG
Department: Physics and Astronomy
Credits: 15

Student Workload (hours)

Lectures	30
Seminars	
Practical Classes & Workshops	2
Tutorials	
Fieldwork	
Project Supervision	
Guided Independent Study	118
Demonstration	
Supervised time in studio/workshop	
Work Based Learning	
Placement	
Year Abroad	
Total Module Hours	150

Period: Semester 1
Occurence: E
Coordinator: GRAHAM WYNN
Mark Scheme: UG Module Mark Scheme

No.	Assessment Description	Weight %	Qual Mark	Exam Hours	Ass't Group	Alt Reass't
001	Coursework	30				
002	Exam (Final)	70		2		

Period: Semester 1
Occurence: E1
Coordinator: GRAHAM WYNN
Mark Scheme: UG Module Mark Scheme

No.	Assessment Description	Weight %	Qual Mark	Exam Hours	Ass't Group	Alt Reass't
001	Coursework	100				

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.

Teaching and Learning Methods

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

Assessment Methods

Coursework and Examination

Pre-Requisites

-

Co-Requisites

-

Excluded Combinations

-

Guided Independent Study: 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 Specification

PA4605 Nanotechnology: Techniques and Devices

Academic Year: 2019/0
Module Level: Year 4
Scheme: UG
Department: Physics and Astronomy
Credits: 15

Student Workload (hours)

Lectures	30
Seminars	
Practical Classes & Workshops	2
Tutorials	
Fieldwork	
Project Supervision	
Guided Independent Study	118
Demonstration	
Supervised time in studio/workshop	
Work Based Learning	
Placement	
Year Abroad	
Total Module Hours	150

Period: Semester 2
Occurence: E
Coordinator: Steve Baker
Mark Scheme: UG Module Mark Scheme

No.	Assessment Description	Weight %	Qual Mark	Exam Hours	Ass't Group	Alt Reass't
001	Coursework	30				
002	Exam (Final)	70		2		

Period: Semester 2
Occurence: E1
Coordinator: Steve Baker
Mark Scheme: UG Module Mark Scheme

No.	Assessment Description	Weight %	Qual Mark	Exam Hours	Ass't Group	Alt Reass't
001	Coursework	100				

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.

Teaching and Learning Methods

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

Assessment Methods

Coursework and Examination

Pre-Requisites

-

Co-Requisites

-

PA4605 Nanotechnology: Techniques and Devices

Excluded Combinations

-

Guided Independent Study: 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 Specification

PA4607 Advanced Space Science

Academic Year: 2019/0
Module Level: Year 4
Scheme: UG
Department: Physics and Astronomy
Credits: 15

Student Workload (hours)

Lectures	30
Seminars	
Practical Classes & Workshops	2
Tutorials	
Fieldwork	
Project Supervision	
Guided Independent Study	118
Demonstration	
Supervised time in studio/workshop	
Work Based Learning	
Placement	
Year Abroad	
Total Module Hours	150

Period: Semester 2
Occurence: E
Coordinator: Jon Lapington
Mark Scheme: UG Module Mark Scheme

No.	Assessment Description	Weight %	Qual Mark	Exam Hours	Ass't Group	Alt Reass't
001	Coursework	30				
002	Exam (Final)	70		2		

Period: Semester 2
Occurence: E1
Coordinator:
Mark Scheme: UG Module Mark Scheme

No.	Assessment Description	Weight %	Qual Mark	Exam Hours	Ass't Group	Alt Reass't
001	Coursework	100				

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, solving advanced applied problems and compiling written reports
- Breakdown a 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 a solution and reflect upon it
- Critically evaluate research papers and results
- 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.

Teaching and Learning Methods

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

Assessment Methods

Coursework and Examination

Pre-Requisites

-

Co-Requisites

-

Excluded Combinations

-

PA4607 Advanced Space Science

Guided Independent Study: 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 Specification

PA4608 Supermassive Black Holes and Large-Scale Structure

Academic Year: 2019/0
Module Level: Year 4
Scheme: UG
Department: Physics and Astronomy
Credits: 15

Student Workload (hours)

Lectures	30
Seminars	
Practical Classes & Workshops	2
Tutorials	
Fieldwork	
Project Supervision	
Guided Independent Study	118
Demonstration	
Supervised time in studio/workshop	
Work Based Learning	
Placement	
Year Abroad	
Total Module Hours	150

Period: Semester 2
Occurence: E
Coordinator: Christopher Nixon
Mark Scheme: UG Module Mark Scheme

No.	Assessment Description	Weight %	Qual Mark	Exam Hours	Ass't Group	Alt Reass't
001	Coursework	30				
002	Exam (FInal)	70		2		

Period: Semester 2
Occurence: E1
Coordinator: Christopher Nixon
Mark Scheme: UG Module Mark Scheme

No.	Assessment Description	Weight %	Qual Mark	Exam Hours	Ass't Group	Alt Reass't
001	Coursework	100				

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 astrophysical objects including planets and black holes
- 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
- Quantitatively describe the observed properties and time evolution of accreting sources
- State and manipulate the equations for the evolution of various astrophysical flows and demonstrate a quantitative understanding of the similarities and differences of accretion processes on different scales

Teaching and Learning Methods

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

Assessment Methods

Coursework and Examination

Pre-Requisites

-

Co-Requisites

-

Excluded Combinations

-

PA4608 Supermassive Black Holes and Large-Scale Structure

Guided Independent Study: 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 Specification

PA4609 General Relativity and Quantum Fields

Academic Year:	2019/0
Module Level:	Year 4
Scheme:	UG
Department:	Physics and Astronomy
Credits:	15

Student Workload (hours)

Lectures	30
Seminars	
Practical Classes & Workshops	2
Tutorials	
Fieldwork	
Project Supervision	
Guided Independent Study	118
Demonstration	
Supervised time in studio/workshop	
Work Based Learning	
Placement	
Year Abroad	
Total Module Hours	150

Period:	Semester 1
Occurence:	E
Coordinator:	Paul Abel
Mark Scheme:	UG Module Mark Scheme

No.	Assessment Description	Weight %	Qual Mark	Exam Hours	Ass't Group	Alt Reass't
001	Coursework	30				
002	Exam (Final)	70		2		

Period:	Semester 1
Occurence:	E1
Coordinator:	Paul Abel
Mark Scheme:	UG Module Mark Scheme

No.	Assessment Description	Weight %	Qual Mark	Exam Hours	Ass't Group	Alt Reass't
001	Coursework	100				

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.

Teaching and Learning Methods

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

Assessment Methods

Coursework and Examination

Pre-Requisites

-

PA4609 General Relativity and Quantum Fields

Co-Requisites

-

Excluded Combinations

-

Guided Independent Study: 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 Specification

PA4900 Specialist Research Project

Academic Year: 2019/0
Module Level: Year 4
Scheme: UG
Department: Physics and Astronomy
Credits: 30

Student Workload (hours)

Lectures	1
Seminars	
Practical Classes & Workshops	
Tutorials	
Fieldwork	
Project Supervision	15
Guided Independent Study	284
Demonstration	
Supervised time in studio/workshop	
Work Based Learning	
Placement	
Year Abroad	
Total Module Hours	300

Period: Academic Year
Occurence: E
Coordinator: Matthew Burleigh
Mark Scheme: UG Module Mark Scheme

No.	Assessment Description	Weight %	Qual Mark	Exam Hours	Ass't Group	Alt Reass't
001	Progress	30				
002	Poster Presentation	20				
003	Written Report (Final)	50				

Assessment Methods
Assessed project report and presentation, task-based.

Pre-Requisites
PA3900 or equivalent

Co-Requisites
-

Excluded Combinations
-

Guided Independent Study: Indicative Activities
-

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.

Teaching and Learning Methods
Supervised activity. Induction session, handbooks, interactive supervision.