Module Specification

PA1120 Light and Matter

Student Workload (hours)

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

Period: Semester 2
Occurrence: E
Coordinator: Rhaana Starling

UG Module Mark Scheme

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<th>Qual Mark</th>
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Period: Semester 2
Occurrence: E1
Coordinator: Rhaana Starling

UG Module Mark Scheme

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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

Last Published: 5 July 2020
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

PA1140  Waves and Quanta

Academic Year: 2020/1
Module Level: Year 1
Scheme: UG
Department: Physics and Astronomy
Credits: 15

Student Workload (hours)

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<th>Practical Classes &amp; Workshops</th>
<th>Tutorials</th>
<th>Fieldwork</th>
<th>Project Supervision</th>
<th>Guided Independent Study</th>
<th>Demonstration</th>
<th>Supervised time in studio/workshop</th>
<th>Work Based Learning</th>
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Period: Semester 2
Occurrence: 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          2          
004 Coursework                  30          

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

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: 2020/1
Module Level: Year 1
Scheme: UG
Department: Physics and Astronomy
Credits: 15

Student Workload (hours)

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<th>Seminars</th>
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Period: Semester 2
Occurrence: E
Coordinator: Emma Bunce

Mark Scheme: UG Module Mark Scheme

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Period: Semester 2
Occurrence: E1
Coordinator: Emma Bunce

Mark Scheme: UG Module Mark Scheme

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Intended Learning Outcomes

On successful completion of the module, students should:

- Be able to compute partial derivatives for multivariate functions, use Taylor series and find stationary points for multivariate functions, and be able to calculate gradient, divergence and curl.
- Recognise types of differential equation, select and apply basic methods for solving first and second order ordinary differential equations with real or complex coefficients, including applying boundary conditions.
- Manipulate complex numbers, express complex numbers in terms of their modulus and argument, and interpret these geometrically using the Argand diagram, use complex numbers to simplify trigonometric identities.
- Manipulate simple matrices, use matrices to solve systems of linear equations, recognise symmetric and antisymmetric matrices and identity matrices, compute matrix inverses and determinants for 2x2 and 3x3 matrices, find eigenvalues and eigenvectors for 3x3 matrices.
- Understand how simple AC circuits can be modelled mathematically using differential equations and complex numbers, use phasors and complex impedance to study simple circuits, recognise and compute the basic properties of a resonance.
- Be able to organise appropriate private study time, clearly set out solutions to mathematical problems, obtain new information from text books, communicate mathematical ideas to your peers and to staff.

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

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

PA2230  Condensed Matter Physics

Academic Year: 2020/1
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
Occurrence: E
Coordinator: Steve Baker
Mark Scheme: UG Module Mark Scheme

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

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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 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

## PA2601 Intermediate Astrophysics and Modern Physics

**Academic Year:** 2020/1  
**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

### Occurrence:
- E

### Coordinator:
- Michael Goad

### Mark Scheme:
- UG Module Mark Scheme

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### 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: 2020/1
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
Occurrence: E
Coordinator: Steve Baker
Mark Scheme: UG Module Mark Scheme

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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.
Module Specification

PA2603 Intermediate Astrophysics and Space Science

Academic Year: 2020/1
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
Occurrence: 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: 2020/1
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
Occurrence: E
Coordinator: Stephen Milan
Mark Scheme: UG Module Mark Scheme

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.

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

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 |
Module Specification

PA2605  Intermediate Applied Physics and Space Science

Student Workload (hours)

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<td>Total Module Hours</td>
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Period: Semester 2
Occurence: E
Coordinator: Steve Baker
Mark Scheme: UG Module Mark Scheme

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: 2020/1
Module Level: Year 2
Scheme: UG
Department: Physics and Astronomy
Credits: 15

Student Workload (hours)

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<td>Tutorials</td>
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Period: Semester 2
Occurrence: E
Coordinator: Steve Baker

Mark Scheme: UG Module Mark Scheme

<table>
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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.
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

-
PA2720 Statistical Physics

**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.
Module Specification

PA3230 Radiation and Matter

Academic Year: 2020/1
Module Level: Year 3
Scheme: UG
Department: Physics and Astronomy
Credits: 15

Student Workload (hours)

<table>
<thead>
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<th>Lectures</th>
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<th>Tutorials</th>
<th>Fieldwork</th>
<th>Project Supervision</th>
<th>Guided Independent Study</th>
<th>Demonstration</th>
<th>Supervised time in studio/workshop</th>
<th>Work Based Learning</th>
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Period: Semester 2
Occurrence: E
Coordinator: Michael Goad

Mark Scheme: UG Module Mark Scheme

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Period: Semester 2
Occurrence: E1
Coordinator: Michael Goad

Mark Scheme: UG Module Mark Scheme

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</table>

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

-
## Module Specification

**PA3602  Stellar Astrophysics**

### Student Workload (hours)

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<tr>
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<td>Synchronous Small Group Teaching</td>
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### Academic Year: 2020/1

### Module Level: Year 3

### Scheme: UG

### Department: Physics and Astronomy

### Credits: 15

### Period: Semester 2

### Occurrence: A

### Coordinator: Graham Wynn

### Mark Scheme: UG Module Mark Scheme

### 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.
PA3230 Radiation and Matter

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

### PA3604 Elementary Particles, The Standard Model and Beyond

<table>
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<th>2020/1</th>
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<td>Module Level:</td>
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<td>Department:</td>
<td>Physics and Astronomy</td>
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<tr>
<td>Credits:</td>
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</table>

**Student Workload (hours)**

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

**Total Module Hours:** 150

### Period:

- Semester 2

### Occurrence:

- E

### Coordinator:

- Andrew Blain

### Mark Scheme:

- UG Module Mark Scheme

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<th>Exam Hours</th>
<th>Ass't Group</th>
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</table>

### 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.
PA3606 Planetary Physics

Student Workload (hours)

<table>
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<tr>
<th>Activity</th>
<th>Hours</th>
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</thead>
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<td>Demonstration</td>
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<td>Year Abroad</td>
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Period: Semester 2

Occurrence: 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

Occurrence: 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 multidisciplinary fields centred around planetary physics. This includes some multidisciplinary topics, geophysics, planetary geology and astrobiology, though no prior knowledge of these are required.
- Use your physical and mathematical knowledge to describe the observed behaviour of planetary systems, planetary structure, formation and differentiation, climate systems, conditions for habitability, and to solve problems related to these areas.
- Demonstrate this knowledge by describing and discussing key principles, solving applied problems and compiling written reports.
- Organise appropriate private study time, obtain new information from text books, communicate areas of specialist physics to your peers and to staff.

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.
PA4601  Quantum Theory of Solids

Academic Year: 2020/1
Module Level: Year 4
Scheme: UG
Department: Physics and Astronomy
Credits: 15

Student Workload (hours)

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Period: Semester 2
Occurrence: E
Coordinator: Mervyn Roy

Mark Scheme: UG Module Mark Scheme

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Period: Semester 2
Occurrence: E1
Coordinator: Mervyn Roy

Mark Scheme: UG Module Mark Scheme

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</table>

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
Coursework 50%
Examination (Final) 50%

Pre-Requisites

Co-Requisites

Last Published: 5 July 2020
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.
PA4605 Nanotechnology: Techniques and Devices

Academic Year: 2020/1  
Module Level: Year 4  
Scheme: UG  
Department: Physics and Astronomy  
Credits: 15

Student Workload (hours)

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<th>Workload Type</th>
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<td>Year Abroad</td>
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Period: Semester 2  
Occurrence: E  
Coordinator: Steve Baker  
Mark Scheme: UG Module Mark Scheme

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

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<td>Coursework</td>
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</table>

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

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**

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<td>Credits:</td>
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## Student Workload (hours)

<table>
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<td>Guided Independent Study</td>
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<tr>
<td>Demonstration</td>
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<tr>
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<td>Year Abroad</td>
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### Period:
- Semester 2

### Occurrence:
- E

### Coordinator:
- Jon Lapington

### Mark Scheme:
- UG Module Mark Scheme

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### Period:
- Semester 2

### Occurrence:
- E1

### Coordinator:
- Jon Lapington

### Mark Scheme:
- UG Module Mark Scheme

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## Intended Learning Outcomes

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

- Demonstrate a working knowledge of advanced space science by clearly describing and discussing key principles of detectors, instrumentation and analytical techniques, solving advanced applied problems relating to them and compiling written reports. The latter includes a New Scientist style article.
- Students should be able to breakdown complex problems in space science in order to identify their essential elements, apply prior knowledge to analyse a problem, implement a planned solution that addresses a problem, evaluate the solution and then reflect upon it.
- Topics covered in this course include X-ray and other photon detectors for space telescopes notably the Mercury Imaging X-ray Spectrometer MIXS built at Leicester, the Cherenkov Telescope Array; X-ray diffraction with Mars Science Laboratory, electron microscopy of material returned from asteroids and comets and remote analysis of planetary surfaces. Most of the topics covered are areas of active research in the School of Physics and Astronomy.
- Critically evaluate research papers and results on these space science topics.
- Organise private study time, obtain new information from text books and the research literature, clearly communicate areas of advanced space science to peers and to staff.

## 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

PA4608  Supermassive Black Holes and Large-Scale Structure

Academic Year: 2020/1
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
Occurrence: E
Coordinator: Christopher Nixon

Mark Scheme: UG Module Mark Scheme

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Period: Semester 2
Occurrence: E1
Coordinator: Christopher Nixon

Mark Scheme: UG Module Mark Scheme

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Intended Learning Outcomes

On successful completion of the module, students should be able to:
- discuss, quantitatively describe and solve problems involving the physics of accretion on to supermassive black holes;
- quantitatively describe the evolution of supermassive black holes in the Universe;
- describe the most important processes shaping galaxies and larger-scale structures, and apply this knowledge to interpret observations;
- break down a complex problem in order to identify its essential elements, apply prior knowledge to analyse a problem, implement a planned solution that addresses a problem, evaluate a solution and reflect upon it;
- critically evaluate current research papers and results.

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.