Swansea University
Prifysgol Abertawe

FACULTY OF SCIENCE AND ENGINEERING

UNDERGRADUATE STUDENT HANDBOOK

YEAR 1 (FHEQ LEVEL 4)

BSC PHYSICS

DEGREE PROGRAMMES

SUBJECT SPECIFIC
PART TWO OF TWO
MODULE AND COURSE STRUCTURE
2023-24

DISCLAIMER

The Faculty of Science and Engineering has made all reasonable efforts to ensure that the information contained within this publication is accurate and up-to-date when published but can accept no responsibility for any errors or omissions.

The Faculty of Science and Engineering reserves the right to revise, alter or discontinue degree programmes or modules and to amend regulations and procedures at any time, but every effort will be made to notify interested parties.

It should be noted that not every module listed in this handbook may be available every year, and changes may be made to the details of the modules. You are advised to contact the Faculty of Science and Engineering directly if you require further information.

The 23-24 academic year begins on 25 September 2023

Full term dates can be found here

DATES OF 23-24 TERMS

25 September 2023 – 15 December 2023

8 January 2024 – 22 March 2024

15 April 2024 – 07 June 2024

SEMESTER 1

25 September 2023 – 29 January 2024

SEMESTER 2

29 January 2024 – 07 June 2024

SUMMER

10 June 2024 – 20 September 2024

IMPORTANT

Swansea University and the Faculty of Science of Engineering takes any form of **academic misconduct** very seriously. In order to maintain academic integrity and ensure that the quality of an Award from Swansea University is not diminished, it is important to ensure that all students are judged on their ability. No student should have an unfair advantage over another as a result of academic misconduct - whether this is in the form of **Plagiarism**, **Collusion** or **Commissioning**.

It is important that you are aware of the **guidelines** governing Academic Misconduct within the University/Faculty of Science and Engineering and the possible implications. The Faculty of Science and Engineering will not take intent into consideration and in relation to an allegation of academic misconduct - there can be no defence that the offence was committed unintentionally or accidentally.

Please ensure that you read the University webpages covering the topic – procedural guidance here and further information here. You should also read the Faculty Part One handbook fully, in particular the pages that concern Academic Misconduct/Academic Integrity.

Welcome to the Faculty of Science and Engineering!

Whether you are a new or a returning student, we could not be happier to be on this journey with you.

At Swansea University and in the Faculty of Science and Engineering, we believe in working in partnership with students. We work hard to break down barriers and value the contribution of everyone.

Our goal is an inclusive community where everyone is respected, and everyone's contributions are valued. Always feel free to talk to academic, technical and administrative staff, administrators - I'm sure you will find many friendly helping hands ready to assist you. And make the most of living and working alongside your fellow students.

During your time with us, please learn, create, collaborate, and most of all – enjoy yourself!

Professor David Smith
Pro-Vice-Chancellor and Executive Dean
Faculty of Science and Engineering

Faculty of Science and Engineering	
Pro-Vice-Chancellor and Executive Dean	Professor David Smith
Director of Faculty Operations	Mrs Ruth Bunting
Associate Dean – Student Learning and Experience (SLE)	Dr Laura Roberts
School of Biosciences, Geography and Physics	
Head of School	Dr Kevin Rees
School Education Lead	Dr Wendy Harris and Dr Sarah Roberts
Head of Physics	Dr Daniel Thompson and Professor Prem Kumar
Physics Programme Director	Dr Tim Burns
Year Coordinators	Head of Foundation Year: Dr Warren Perkins Head of Level 1: Dr Aled Isaac Head of Level 2: Dr Dave Dunbar Head of Level 3: Dr Sophie Shermer Head of Level M: Dr Kevin O'Keeffe

STUDENT SUPPORT

The Faculty of Science and Engineering has two **Reception** areas - Engineering Central (Bay Campus) and Wallace 223c (Singleton Park Campus).

Standard Reception opening hours are Monday-Friday 8.30am-4pm.

The **Student Support Team** provides dedicated and professional support to all students in the Faculty of Science and Engineering. Should you require assistance, have any questions, be unsure what to do or are experiencing difficulties with your studies or in your personal life, our team can offer direct help and advice, plus signpost you to further sources of support within the University. There are lots of ways to get information and contact the team:

Email: studentsupport-scienceengineering@swansea.ac.uk (Monday–Friday, 9am–5pm)

Call: +44 (0) 1792 295514 (Monday-Friday, 10am–12pm, 2–4pm).

Zoom: By appointment. Students can email, and if appropriate we will share a link to our Zoom calendar for students to select a date/time to meet.

The current student **webpages** also contain useful information and links to other resources:

https://myuni.swansea.ac.uk/fse/

READING LISTS

Reading lists for each module are available on the course Canvas page and are also accessible via http://ifindreading.swan.ac.uk/. We've removed reading lists from the 23-24 handbooks to ensure that you have access to the most up-to-date versions.
We do not expect you to purchase textbooks, unless it is a specified key text for the course.

THE DIFFERENCE BETWEEN COMPULSORY AND CORE MODULES

Compulsory modules must be **pursued** by a student.

Core modules must not only be **pursued**, but also **passed** before a student can proceed to the next level of study or qualify for an award. Failures in core modules must be redeemed.

Further information can be found under "Modular Terminology" on the following link - https://myuni.swansea.ac.uk/academic-life/academic-regulations/taught-guidance/essential-

info-taught-students/your-programme-explained/

Year 1 (FHEQ Level 4) 2023/24
Physics

BSc Physics[F300,F301]
BSc Physics with a Year Abroad[F302]
BSc Physics with a Year in Industry[F478]
MPhys Physics[F303]
MPhys Physics with a Year Abroad[F304]
MPhys Physics with a Year in Industry[F30Y]

Compulsory Modules

Semester 1 Modules	Semester 2 Modules
PH-100 **Classical Mechanics** **20 Credits** **Prof PR Dunstan** **CORE**	**PH-115** **Quantum Mechanics I** **20 Credits** **Dr T Burns** **CORE**
PH-104 **Astronomy and Cosmology** **10 Credits** **Dr SG Roberts** **CORE**	**PH-116** **Special Relativity** **10 Credits** **Dr EI Zavala Carrasco** **CORE**
PH-132 **Mathematics for Physicists I** **20 Credits** **Dr T Burns** **CORE**	**PH-133** **Mathematics for Physicists II** **20 Credits** **Prof CR Allton** **CORE**
Total 120 Credits	

Optional Modules

Choose exactly 10 credits
Select one option

PH-109	Practical Physics 1	Dr CA Isaac	TB1	10 (CORE)
PH-109C	Ffiseg Ymarferol 1	Dr CA Isaac	TB1	10 (CORE)

And

Choose exactly 10 credits
Select one option

PH-110	Practical Physics 2	Dr CA Isaac	TB2	10 (CORE)
PH-110C	Ffiseg Ymarferol 2	Dr CA Isaac	TB2	10 (CORE)

PH-100 Classical Mechanics

Credits: 20 Session: 2023/24 September-January

Pre-requisite Modules:

Co-requisite Modules:

Lecturer(s): Prof PR Dunstan

Format: Teaching - 33 hours (3 per week);
Workshop - 22 hours (2 per week)

Delivery Method: Lectures and workshop will be delivered in-person on campus.

Module Aims: In this module we will explore the basic concepts of classical dynamics, namely force, energy, momentum, and angular momentum are introduced and applied in a variety of physically important situations such as particle collisions and planetary motion. The module will then introduce the principles of oscillations and introductory concepts of waves.

Module Content: 1. Introduction to vectors: addition, dot and cross products.
2. Force and Motion: Newton's laws and inertial frames.
3. Fundamental and pnenomenological forces: gravitational, electromagnetic applied forces, friction and gravity near the earth.
4. Projectile motion: vector and non-vector methods.
5. Energy: kinetic, potential, conservation, work and energy.
6. The Two-Body problem: centr of mass, gravity in the centre of mass frame, conservation of angular momentum and energy, and the orbit equation.
7. Trajectories and orbits: consequences of the orbit equation, open and closed orbits, Kepler's laws, impact parameter and deflection angle.
8. Conservation laws: conservative and non-conservative forces, force and potential, energy conservation.
9. Collisions: conservation of linear momentum and kinetic energy in elastic collisions.
10. Solid bodies: centre of mass, angular velocity, velocity, rotational kinetic energy, moment of inertia, angular momentum, torque and acceleration.

Oscillations:
1. Simple Harmonic Motion.
2. Superpositions of oscillations.
3. Forced and damped oscillations.

Waves:
1. Wave motion: wavelength and frequency, mathematical description of transverse waves, relation with SHM, wave equation, energy transmission, wave speed.
2. Longitudinal waves and sound.
3. Superpositions of waves with the same frequency: interference, standing waves.
4. Superpositions of waves with different frequencies: wave packets.

Intended Learning Outcomes: At the end of this module, the students should have:

An essential understanding of the fundamental laws of dynamics, including applications to oscillating and rotating systems and including the ability to apply these laws to solve practical problems.
An understanding of the universal principles underlying wave motion in nature, including the ability to apply the mathematical theory of waves to a variety of physical applications including electromagnetic waves;
Mathematical skills associated with problem-solving.
Students will be able to perform calculations and solve problems based on the content of this module taking the form of analytical and/or numerical calculations without the use of text books or other sources.
Students will be able to demonstrate that they have mastered the content of the module by being able to define and summarize important terms and concepts, recall key formulae without the aid of text books or other sources.

Assessment: Examination 1 (50%)
Coursework 1 (50%)

Resit Assessment: Examination (Resit instrument) (100%)

Assessment Description: Examination - 50%
Coursework - 50%

Moderation approach to main assessment: Moderation by sampling of the cohort

Assessment Feedback: Students receive assessed work back with the point of error indicated.
Students will be provided with a work through of the solutions to the problems (either via a live feedback session which may also include a peer-marking element or a recorded video feedback session)
Students can arrange with lecturer to have personal feedback on their assessments

Failure Redemption: Re-sit if applicable.

Reading List: Tipler, Paul Allen, 1933- author., Mosca, Gene, author., Physics for scientists and engineers with modern physics, W.H. Freeman and Company, 2008 - 2008.ISBN: 9781319155988

Additional Notes: In-person teaching will be delivered on campus via weekly lectures and weekly assessed workshops. Resource materials will be provided on Canvas to supplement the in-person activities and support additional self-directed learning. Non-engagement with assessed workshops will greatly affect the coursework component mark and thus engagement is viewed as compulsory.

Students are reminded that the course will run for the entire term and final sessions will include revision reviews that are geared to supporting focussed exam preparation.

Available to visiting and exchange students.

PH-104 Astronomy and Cosmology

Credits: 10 Session: 2023/24 September-January

Pre-requisite Modules:

Co-requisite Modules:

Lecturer(s): Dr SG Roberts

Format: 22 lectures, 3 feedback sessions

Delivery Method: Lectures and feedback sessions.

Module Aims: This module is a basic introduction to Observational Astronomy and Cosmology. It will be given in a non-mathematical style and is intended to inspire and motivate students of any discipline at an early stage in their studies. Opportunities will be given for making practical astronomical observations.

Module Content: Basic astronomical concepts: Magnitude system, temperature and temperature scales, gravity and orbital motion, distance scales, the distance ladder, coordinate systems

Introduction to the Electromagnetic Spectrum: Blackbody radiation, Kirchoff's Laws, introduction to spectroscopy, Doppler effect, filters and colour in astronomy, the Universe at different wavelengths

Tools and techniques of modern astronomy: Planning observations, astronomical databases, photometry, astrometry

Contents of the Universe: Stars, planets and solar system bodies, galaxies, Cosmic Microwave Background

Intended Learning Outcomes: An understanding of modern astronomy.
Students will be able to perform calculations and solve problems based on the content of this module taking the form of analytical and/or numerical calculations without the use of text books or other sources.
Students will be able to demonstrate that they have mastered the content of the module by being able to define and summarize important terms and concepts, recall key formulae without the aid of text books or other sources.

Assessment: Examination 1 (70%)
Coursework 1 (30%)
Resit Assessment: Examination (Resit instrument) (100%)

Assessment Description: Examination (70%): 2 hour written exam.
Continuous Assessment (30%): Coursework

Moderation approach to main assessment: Moderation by sampling of the cohort

Assessment Feedback: Students receive assessed work back with the point of error indicated.
Students have a feedback session to go through solutions to the problems.
Students can arrange with lecturer to have personal feedback on their assessments.

Failure Redemption: Re-sit if applicable.

Reading List: Geller, Robert M., author., Freedman, Roger A., author.; Kaufmann, William J., author., Universe, Macmillan International Higher Education, 2019.ISBN: 1319248659
Freedman, Roger A.Geller, Robert M., Kaufmann, William J., Universe, 2014.ISBN: 1464124922
Roger A. Freedman, Robert M Geller; William J Kaufmann, Universe / Roger A. Freedman, Robert M. Geller, William J. Kaufmann, III., W.H. Freeman and Co., 2011.ISBN: 9781429231534
Weinberg, Steven,, The first three minutes : a modern view of the origin of the universe / Steven Weinberg., Basic Books,, c1993..ISBN: 0465024378
Comins, Neil, author., Discovering the universe, W.H. Freeman and Company, 2019.ISBN: 9781319248604

Additional Notes: Delivery of both teaching and assessment will be blended including live and self-directed activities online and on-campus.

Available to visiting and exchange students.

PH-109 Practical Physics 1

Credits: 10 Session: 2023/24 September-January

Pre-requisite Modules:

Co-requisite Modules:

Lecturer(s): Dr CA Isaac

Format: Lectures and workshops (4 hours per week)
4 hours introduction, 40 hours lab sessions, 20 hours prep, 25 hours report writing

Delivery Method: In person Laboratory sessions. Lectures and Feedback session delivered by a blended approach using where appropriate a combination of asynchronous and synchronous delivery. Synchronous delivery typically online and, where appropriate, in-person.

Module Aims: This module combines experience of experimental physics with other practical skills required to be educated effectively in Physics at an undergraduate level. The module's approach is via the completion of a series of experiments and via student engagement in a series of intensive, staff-led activities.

Module Content: Introduction to experimental uncertainties and their analysis.
Experiments from a range of areas. Examples:
- The simple pendulum
- Hooke's Law and simple harmonic motions
- Diffraction
- Oscillations in mechanical and electronic systems
- Radial forces
- The torsion pendulum
- Speed of light
- Lenses and mirrors
- The linear thermal expansion of metals - Induction (Lenz's Law)

Students will receive
- workshops on ethics and effective working in groups addressing aspects such as diversity, and the use of Blackboard and Turnitin including defining of academic integrity.
- seminars on internships, careers and a workshop on CV writing which will be assessed by peer marking and be the basis of activities in future years, building a portfolio of experience.
- workshops on statistics, numerical analysis and graphical display of data supporting PH-129
- activities relating to project and group management
- logic problem solving activities as novel approach to numerical problems
- computational sessions introducing key computation tools, namely Python and Mathematica, elements of which are developed significantly in following academic sessions.
- exercises on writing scientific
- support and feedback sessions giving constructive one-to-one advice on writing scientific reports, covering document formatting, grammar and context of the experiment, proper description of scientific methods, numerical analysis and graph plotting, the estimation of uncertainties and drawing meaningful conclusions supported by findings. (linked to PH-129 and ensuring students engage in reflective feedback on scientific report writing)

Intended Learning Outcomes: Over the course of this module, students will:

-be able to apply basic theory in a practical setting
-be able to perform basic laboratory experiments in Physics
-be able to perform basic analyses of experimental data and uncertainties
-be able to keep a laboratory diary and write experimental reports
-be able to test and challenge their ability to develop effective study, revision and research methods which apply broadly to all modules throughout their degree
-be able to explain and demonstrate their understanding of the relevance of plagiarism, how to work effectively in a group including comprehension of issues of ethics and diversity.
- apply their training in instrumentation methods to demonstrate their ability to use common scientific equipment.
- Apply training in scientific writing to demonstrate the ability to produce suitable responses to scientific writing tasks.
- begin the development of employability-relevant materials such as producing a suitable CV and demonstrate an understanding of routes to gain internship funding
- strengthen their critical understanding of statistics and its relevance to physics, and demonstrate an understanding how uncertainties are estimated, quantified and evaluated, vital for later modules
- apply computation methods and be able to demonstrate their ability in some basic coding.

Assessment: all (100%)
Resit Assessment: Coursework reassessment instrument (100%)

Assessment Description: Continuous Assessment

Moderation approach to main assessment: Moderation by sampling of the cohort

Assessment Feedback: The feedback mechanisms for this course are through the regular assessment of a laboratory diary, discussions
with staff and postgraduate demonstrators during the practical sessions and a detailed breakdown of two scientific
reports.

Students receive assessed work back with the point of error indicated.
Students have a feedback session to go through solutions to the problems.
Students can arrange with lecturer to have personal feedback on their assessments.

Failure Redemption: Given the nature of the work there is no redemption of failure possible if the necessary hands-on material (experimental work) has not been completed by the end of term.
If sufficient lab work has been completed, failure would be redeemed by resubmission of the lab report.

Additional Notes: Delivery of both teaching and assessment will be blended including live and self-directed activities online and on-campus.

Not available to visiting and exchange students.

PH-109C Ffiseg Ymarferol 1

Credits: 10 Session: 2023/24 September-January

Pre-requisite Modules:

Co-requisite Modules:

Lecturer(s): Dr CA Isaac

Format: Lectures and workshops (4 hours per week)
4 hours introduction, 40 hours lab sessions, 20 hours prep, 25 hours report writing

Delivery Method: In person Laboratory sessions. Lectures and Feedback session delivered by a blended approach using where appropriate a combination of asynchronous and synchronous delivery. Synchronous delivery typically online and, where appropriate, in-person.

Module Aims: This module combines experience of experimental physics with other practical skills required to be educated effectively in Physics at an undergraduate level. The module's approach is via the completion of a series of experiments and via student engagement in a series of intensive, staff-led activities.

Module Content: Introduction to experimental uncertainties and their analysis.
Experiments from a range of areas. Examples:
- The simple pendulum
- Hooke's Law and simple harmonic motions
- Diffraction
- Oscillations in mechanical and electronic systems
- Radial forces
- The torsion pendulum
- Speed of light
- Lenses and mirrors
- The linear thermal expansion of metals - Induction (Lenz's Law)

Students will receive
- workshops on ethics and effective working in groups addressing aspects such as diversity, and the use of Blackboard and Turnitin including defining of academic integrity.
- seminars on internships, careers and a workshop on CV writing which will be assessed by peer marking and be the basis of activities in future years, building a portfolio of experience.
- workshops on statistics, numerical analysis and graphical display of data supporting PH-129
- activities relating to project and group management
- logic problem solving activities as novel approach to numerical problems
- computational sessions introducing key computation tools, namely Python and Mathematica, elements of which are developed significantly in following academic sessions.
- exercises on writing scientific
- support and feedback sessions giving constructive one-to-one advice on writing scientific reports, covering document formatting, grammar and context of the experiment, proper description of scientific methods, numerical analysis and graph plotting, the estimation of uncertainties and drawing meaningful conclusions supported by findings. (linked to PH-129 and ensuring students engage in reflective feedback on scientific report writing)

Intended Learning Outcomes: Over the course of this module, students will:

-be able to apply basic theory in a practical setting
-be able to perform basic laboratory experiments in Physics
-be able to perform basic analyses of experimental data and uncertainties
-be able to keep a laboratory diary and write experimental reports
-be able to test and challenge their ability to develop effective study, revision and research methods which apply broadly to all modules throughout their degree
-be able to explain and demonstrate their understanding of the relevance of plagiarism, how to work effectively in a group including comprehension of issues of ethics and diversity.
- apply their training in instrumentation methods to demonstrate their ability to use common scientific equipment.
- Apply training in scientific writing to demonstrate the ability to produce suitable responses to scientific writing tasks.
- begin the development of employability-relevant materials such as producing a suitable CV and demonstrate an understanding of routes to gain internship funding
- strengthen their critical understanding of statistics and its relevance to physics, and demonstrate an understanding how uncertainties are estimated, quantified and evaluated, vital for later modules
- apply computation methods and be able to demonstrate their ability in some basic coding.

Assessment: all (100%)
Resit Assessment: Coursework reassessment instrument (100%)

Assessment Description: Continuous Assessment

Moderation approach to main assessment: Moderation by sampling of the cohort

Assessment Feedback: The feedback mechanisms for this course are through the regular assessment of a laboratory diary, discussions
with staff and postgraduate demonstrators during the practical sessions and a detailed breakdown of two scientific
reports.

Students receive assessed work back with the point of error indicated.
Students have a feedback session to go through solutions to the problems.
Students can arrange with lecturer to have personal feedback on their assessments.

Failure Redemption: Given the nature of the work there is no redemption of failure possible if the necessary hands-on material (experimental work) has not been completed by the end of term.
If sufficient lab work has been completed, failure would be redeemed by resubmission of the lab report.

Additional Notes: Delivery of both teaching and assessment will be blended including live and self-directed activities online and on-campus.

Not available to visiting and exchange students.

PH-110 Practical Physics 2

Credits: 10 Session: 2023/24 January-June

Pre-requisite Modules:

Co-requisite Modules:

Lecturer(s): Dr CA Isaac

Format: Lectures and workshops (4 hours per week)
4 hours introduction, 40 hours lab sessions, 20 hours prep, 25 hours report writing

Delivery Method: In person Laboratory sessions. Lectures and Feedback session delivered by a blended approach using where appropriate a combination of asynchronous and synchronous delivery. Synchronous delivery typically online and, where appropriate, in-person.

Module Aims: This module combines experience of experimental physics with other practical skills required to be educated effectively in Physics at an undergraduate level. The module's approach is via the completion of a series of experiments and via student engagement in a series of intensive, staff-led activities.

Module Content: Introduction to experimental uncertainties and their analysis.
Experiments from a range of areas. Examples:
- The simple pendulum
- Hooke's Law and simple harmonic motions
- Diffraction
- Oscillations in mechanical and electronic systems
- Radial forces
- The torsion pendulum
- Speed of light
- Lenses and mirrors
- The linear thermal expansion of metals - Induction (Lenz's Law)

Students will receive
- workshops on ethics and effective working in groups addressing aspects such as diversity, and the use of Blackboard and Turnitin including defining of academic integrity.
- seminars on internships, careers and a workshop on CV writing which will be assessed by peer marking and be the basis of activities in future years, building a portfolio of experience.
- workshops on statistics, numerical analysis and graphical display of data supporting PH-129
- activities relating to project and group management
- logic problem solving activities as novel approach to numerical problems
- computational sessions introducing key computation tools, namely Python and Mathematica, elements of which are developed significantly in following academic sessions.
- exercises on writing scientific
- support and feedback sessions giving constructive one-to-one advice on writing scientific reports, covering document formatting, grammar and context of the experiment, proper description of scientific methods, numerical analysis and graph plotting, the estimation of uncertainties and drawing meaningful conclusions supported by findings. (linked to PH-129 and ensuring students engage in reflective feedback on scientific report writing)

Intended Learning Outcomes: Over the course of this module, students will:

-be able to apply basic theory in a practical setting
-be able to perform basic laboratory experiments in Physics
-be able to perform basic analyses of experimental data and uncertainties
-be able to keep a laboratory diary and write experimental reports
-be able to test and challenge their ability to develop effective study, revision and research methods which apply broadly to all modules throughout their degree
-be able to explain and demonstrate their understanding of the relevance of plagiarism, how to work effectively in a group including comprehension of issues of ethics and diversity.
- apply their training in instrumentation methods to demonstrate their ability to use common scientific equipment.
- Apply training in scientific writing to demonstrate the ability to produce suitable responses to scientific writing tasks.
- begin the development of employability-relevant materials such as producing a suitable CV and demonstrate an understanding of routes to gain internship funding
- strengthen their critical understanding of statistics and its relevance to physics, and demonstrate an understanding how uncertainties are estimated, quantified and evaluated, vital for later modules
- apply computation methods and be able to demonstrate their ability in some basic coding.

Assessment: all (100%)
Resit Assessment: Coursework reassessment instrument (100%)

Assessment Description: Continuous Assessment

Moderation approach to main assessment: Moderation by sampling of the cohort

Assessment Feedback: The feedback mechanisms for this course are through the regular assessment of a laboratory diary, discussions
with staff and postgraduate demonstrators during the practical sessions and a detailed breakdown of two scientific
reports.

Students receive assessed work back with the point of error indicated.
Students have a feedback session to go through solutions to the problems.
Students can arrange with lecturer to have personal feedback on their assessments.

Failure Redemption: Given the nature of the work there is no redemption of failure possible if the necessary hands-on material (experimental work) has not been completed by the end of term.
If sufficient lab work has been completed, failure would be redeemed by resubmission of the lab report.

Additional Notes: Delivery of both teaching and assessment will be blended including live and self-directed activities online and on-campus.

Not available to visiting and exchange students.

PH-110C Ffiseg Ymarferol 2

Credits: 10 Session: 2023/24 January-June

Pre-requisite Modules:

Co-requisite Modules:

Lecturer(s): Dr CA Isaac

Format: Lectures and workshops (4 hours per week)

Delivery Method: In person Laboratory sessions. Lectures and Feedback session delivered by a blended approach using where appropriate a combination of asynchronous and synchronous delivery. Synchronous delivery typically online and, where appropriate, in-person.

Module Aims: This module combines experience of experimental physics with other practical skills required to be educated effectively in Physics at an undergraduate level. The module's approach is via the completion of a series of experiments and via student engagement in a series of intensive, staff-led activities.

Module Content: Introduction to experimental uncertainties and their analysis.
Experiments from a range of areas. Examples:
- The simple pendulum
- Hooke's Law and simple harmonic motions
- Diffraction
- Oscillations in mechanical and electronic systems
- Radial forces
- The torsion pendulum
- Speed of light
- Lenses and mirrors
- The linear thermal expansion of metals - Induction (Lenz's Law)

Students will receive
- workshops on ethics and effective working in groups addressing aspects such as diversity, and the use of Blackboard and Turnitin including defining of academic integrity.
- seminars on internships, careers and a workshop on CV writing which will be assessed by peer marking and be the basis of activities in future years, building a portfolio of experience.
- workshops on statistics, numerical analysis and graphical display of data supporting PH-129
- activities relating to project and group management
- logic problem solving activities as novel approach to numerical problems
- computational sessions introducing key computation tools, namely Python and Mathematica, elements of which are developed significantly in following academic sessions.
- exercises on writing scientific
- support and feedback sessions giving constructive one-to-one advice on writing scientific reports, covering document formatting, grammar and context of the experiment, proper description of scientific methods, numerical analysis and graph plotting, the estimation of uncertainties and drawing meaningful conclusions supported by findings. (linked to PH-129 and ensuring students engage in reflective feedback on scientific report writing)

Intended Learning Outcomes: Over the course of this module, students will:

-be able to apply basic theory in a practical setting
-be able to perform basic laboratory experiments in Physics
-be able to perform basic analyses of experimental data and uncertainties
-be able to keep a laboratory diary and write experimental reports
-be able to test and challenge their ability to develop effective study, revision and research methods which apply broadly to all modules throughout their degree
-be able to explain and demonstrate their understanding of the relevance of plagiarism, how to work effectively in a group including comprehension of issues of ethics and diversity.
- apply their training in instrumentation methods to demonstrate their ability to use common scientific equipment.
- Apply training in scientific writing to demonstrate the ability to produce suitable responses to scientific writing tasks.
- begin the development of employability-relevant materials such as producing a suitable CV and demonstrate an understanding of routes to gain internship funding
- strengthen their critical understanding of statistics and its relevance to physics, and demonstrate an understanding how uncertainties are estimated, quantified and evaluated, vital for later modules
- apply computation methods and be able to demonstrate their ability in some basic coding.

Assessment: all (100%)
Resit Assessment: Coursework reassessment instrument (100%)

Assessment Description: Continuous Assessment

Moderation approach to main assessment: Moderation by sampling of the cohort

Assessment Feedback: The feedback mechanisms for this course are through the regular assessment of a laboratory diary, discussions
with staff and postgraduate demonstrators during the practical sessions and a detailed breakdown of two scientific
reports.

Students receive assessed work back with the point of error indicated.
Students have a feedback session to go through solutions to the problems.
Students can arrange with lecturer to have personal feedback on their assessments.

Failure Redemption: Given the nature of the work there is no redemption of failure possible if the necessary hands-on material (experimental work) has not been completed by the end of term.
If sufficient lab work has been completed, failure would be redeemed by resubmission of the lab report.

Additional Notes: Delivery of both teaching and assessment will be blended including live and self-directed activities online and on-campus.

Not available to visiting and exchange students.

PH-115 Quantum Mechanics I

Credits: 20 Session: 2023/24 January-June

Pre-requisite Modules:

Co-requisite Modules:

Lecturer(s): Dr T Burns

Format: Teaching - 33 hours (3 per week); Workshop - 22 hours (2 per week)

Delivery Method: Lectures and workshops

Module Aims: This module walks through the conceptual problems that led to the development of quantum mechanics, the early revolutionary ideas emerging from physics of black body radiation, the photoelectric effect, wave particle duality and the mathematical rules of quantum mechanics and its applications to physical problems in one dimension.

Module Content: 1. Wave-particle duality: double slit experiment, photo-electric effect, Compton scattering, de Broglie wavelength.
2. Schrodinger equation, energy and Hamiltonian, quantization rules.
3. Probability interpretation, superposition principle, collapse of the wave function, measurement problem, uncertainty principle.
4. Energy levels, energy quantization, hydrogen atom, Bohr's model of hydrogen.
5. Solutions of the schrodinger equation: particle in a harmonic well (harmonic oscillator), hydrogen atom, periodic table.
6. Cryptography, quantum computing.

Intended Learning Outcomes: At the end of this module, the students should:

understand the key concepts of quantum mechanics, especially wave-particle duality;
understand the Schrodinger equation and be able to apply it to simple QM problems.

Students will be able to perform calculations and solve problems based on the content of this module taking the form of analytical and/or numerical calculations without the use of text books or other sources.

Students will be able to demonstrate that they have mastered the content of the module by being able to define and summarize important terms and concepts, recall key formulae without the aid of text books or other sources.

Assessment:	Examination 1 (70%) Coursework 1 (3%) Coursework 2 (3%) Coursework 3 (3%) Coursework 4 (3%) Coursework 5 (3%) Coursework 6 (3%) Coursework 7 (3%) Coursework 8 (3%) Coursework 9 (3%) Coursework 10 (3%)
Resit Assessment:	Examination (Resit instrument) (100%)

Assessment Description: Workshops (30%) and Examination (70%) (Workshops will be listed under Coursework 1-10)

Moderation approach to main assessment: Moderation by sampling of the cohort

Assessment Feedback: Students receive assessed work back with the point of error indicated.
Students have a feedback session to go through solutions to the problems.
Students can arrange with lecturer to have personal feedback on their assessments.

Failure Redemption: Re-sit of exam component

Additional Notes: Normally available only to students on Physics degree programmes. Available to visiting and exchange students

PH-116 Special Relativity

Credits: 10 Session: 2023/24 January-June

Pre-requisite Modules:

Co-requisite Modules:

Lecturer(s): Dr EI Zavala Carrasco

Format: 22 lectures, 3 feedback sessions

Delivery Method: Lectures and feedback sessions.

Module Aims: This module introduces the fundamental principles of special relativity and applies them to relativistic particle dynamics.

Module Content: 1. Fundamental postulates of special relativity; Lorentz transformations.
2. Measurements of space and time: simultaneity, time dilation, length contraction, twin paradox.
3. Minkowski spacetime: 4-vectors and Lorentz transformations.
4. Relativistic dynamics: 4-velocity, 4-momentum, energy-momentum relation and mass.
5. Scattering and Collisions: relativistic scattering and decays, conservation of 4-momentum; high-energy accelerators and collisions.

Intended Learning Outcomes: At the end of this module, the students should:
have developed a thorough understanding of the principles of special relativity;
be able to apply relativistic dynamics in particle collisions and in other contexts.
Students will be able to perform calculations and solve problems based on the content of this module taking the
form of analytical and/or numerical calculations without the use of text books or other sources.
Students will be able to demonstrate that they have mastered the content of the module by being able to define and
summarize important terms and concepts, recall key formulae without the aid of text books or other sources.

Assessment:	Examination 1 (70%) Assignment 1 (10%) Assignment 2 (10%) Assignment 3 (10%)
Resit Assessment:	Examination (Resit instrument) (100%)

Assessment Description: Assignments (30%) and Examination (70%)

Moderation approach to main assessment: Moderation by sampling of the cohort

Assessment Feedback: Students receive assessed work back with the point of error indicated.
Students have a feedback session to go through solutions to the problems.
Students can arrange with lecturer to have personal feedback on their assessments.

Failure Redemption: Re-sit if applicable.

Reading List: Resnick, Robert., Introduction to special relativity, Wiley, 1968.
French, A. P. (Anthony Philip), 1920-, Special relativity, Chapman and Hall, 1968.ISBN: 0412343207
Einstein, Albert 1879-1955 Author, Lawson, Robert W. (Robert William) Translator, Relativity : the Special and General Theory, Project Gutenberg, 1920.

Additional Notes: Available to visiting and exchange students.

PH-132 Mathematics for Physicists I

Credits: 20 Session: 2023/24 September-January

Pre-requisite Modules:

Co-requisite Modules:

Lecturer(s): Dr T Burns

Format: Teaching - 33 hours (3 per week); Workshop - 22 hours (2 per week)

Delivery Method: Lectures and problem-solving workshops

Module Aims: Provides essential mathematics underpinning undergraduate level physics.
Aimed at students who have taken A level mathematics or equivalent.

Module Content: Vectors
- Scalars and vectors
- Products of vectors

Basic functions and equations
- Algebraic functions and methods
- Trigonometric functions
- Logarithms and exponentials

Differential calculus
- Methods of differentiation
- Higher derivatives and stationary points
- Differentiation of vectors

Coordinate geometry and curves
- Conic sections
- Plane polar coordinates
- Curve sketching

Integral calculus
- Definite and indefinite integrals
- Methods of integration
- Integration of vectors

Ordinary differential equations (ODEs)
- Classification and general properties
- Second order linear ODEs with constant coefficients
- Non-linear first order ODEs

Partial differentiation
- Basics of partial differentiation
- Partial differential equations (PDEs)
- Separation of variables for PDEs

Intended Learning Outcomes: At the end of this module, students should be able to:
- Formulate and solve problems with vectors
- Manipulate algebraic and transcendental functions
- Differentiate scalar and vector functions
- Integrate scalar and vector functions
- Sketch curves and identify turning points
- Classify and solve certain ordinary and partial differential equations

Students will be able to perform calculations and solve problems based on the content of this module taking the form of analytical and/or numerical calculations without the use of text books or other sources.

Assessment: Examination 1 (50%)
Coursework 1 (50%)

Resit Assessment: Examination (Resit instrument) (100%)

Assessment Description: 50% Exam / Final assessment (January)

50% Coursework
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Moderation approach to main assessment: Moderation by sampling of the cohort

Assessment Feedback: Students receive assessed work back with the point of error indicated.
Students have a feedback session to go through solutions to the problems.
Students can arrange with lecturer to have personal feedback on their assessments.

Failure Redemption: Re-sit if applicable.

Reading List: B. R. Martin (Brian Robert), author., G Shaw (Graham), 1942- author., Mathematics for physicists / B.R. Martin (Department of Physics and Astronomy, University College, London), G. Shaw (Department of Physics and Astronomy, Manchester University)., Chichester, West Sussex : John Wiley & Sons Ltd, 2015.ISBN: 9780470660232
D.W. Jordan and P. Smith., Mathematical techniques : an introduction for the engineering, physical, and mathematical sciences, Oxford University Press, 2008.ISBN: 9780199282012
Martin, B.R. and Shaw, G., Martin, B.R. and Shaw, G., Mathematics for physicists, Wiley, 2015.ISBN: 9780470660225
Riley, K. F. (Kenneth Franklin); Hobson, M. P. (Michael Paul), Foundation mathematics for the physical sciences, Cambridge University Press, 2011.ISBN: 9780521192736
Jordan, D. W. (Dominic William); Smith, Peter, Mathematical techniques : an introduction for the engineering, physical, and mathematical sciences, Oxford University Press, 2008.ISBN: 9780199282012

Additional Notes: Normally available only to students on Physics degree programmes. Available to visiting and exchange students.

PH-133 Mathematics for Physicists II

Credits: 20 Session: 2023/24 January-June

Pre-requisite Modules: PH-132

Co-requisite Modules:

Lecturer(s): Prof CR Allton

Format: Teaching - 33 hours (3 per week); Workshop - 22 hours (2 per week)

Delivery Method: Lectures, workshops and feedback sessions.

Module Aims: Provides essential mathematics underpinning undergraduate level physics.
Aimed at students who have taken A level mathematics or equivalent.

Module Content: Series' and limits
- Summation and convergence
- Taylor and Maclaurin series
- Limits

Complex numbers
- Algebra and the Argand diagram
- Polar form
- de Moivre's theorem

Hyperbolic functions
- Basic properties
- Calculus of hyperbolics

Matrices
- Matrix algebra
- Matrix solution of simultaneous equations
- Eigenvalues and eigenvectors

Geometric problems
- Surfaces and solids of revolutions
- Equations of planes and spheres

Intended Learning Outcomes: At the end of this module, students should be able to:
- Compute Taylor series expansions of various functions
- Determine the limits of simple functions
- Manipulate complex numbers in standard and polar form
- Perform calculations using hyperbolic functions
- Manipulate matrices and find their eigenvalues and eigenvectors
- Sketch curves and identify turning points
- Solve geometric problems using vectors and calculus

Students will be able to perform calculations and solve problems based on the content of this module taking the form of analytical and/or numerical calculations without the use of text books or other sources.

Assessment:	Examination 1 (70%)
	Coursework 1 (3%)
	Coursework 2 (3%)
	Coursework 3 (3%)
	Coursework 4 (3%)
	Coursework 5 (3%)
	Coursework 6 (3%)
	Coursework 7 (3%)
	Coursework 8 (3%)
	Coursework 9 (3%)
	Coursework 10 (3%)
Resit Assessment:	Examination (Resit instrument) (100%)

Assessment Description: Workshops (30%) and Examination (70%) (Workshops will be listed under Coursework 1-10)

Written exam, coursework consisting of weekly workshop material and assessed problem sheets.

Moderation approach to main assessment: Moderation by sampling of the cohort

Assessment Feedback: Students receive assessed work back with the point of error indicated.
Students have a feedback session to go through solutions to the problems.
Students can arrange with lecturer to have personal feedback on their assessments.

Failure Redemption: Re-sit of Exam component

Reading List: B. R. Martin (Brian Robert), author., G Shaw (Graham), 1942- author., Mathematics for physicists / B.R. Martin, G. Shaw., Chichester : John Wiley & Sons, Ltd, 2015.ISBN: 9781118676639
B. R. Martin (Brian Robert), author., G Shaw (Graham), 1942- author., Mathematics for physicists / B.R. Martin, G. Shaw., Chichester : John Wiley & Sons, Ltd, 2015.ISBN: 9780470660232
P. M. Cohn (Paul Moritz), author., Elements of linear algebra / P.M. Cohn., Abingdon, Oxon : CRC Press, 1999.ISBN: 9781351452830
P. M. Cohn (Paul Moritz), Elements of linear algebra / P.M.Cohn., Chapman & Hall, 1994.ISBN: 9780412552809
Riley, K. F. (Kenneth Franklin); Hobson, M. P. (Michael Paul), Foundation mathematics for the physical sciences / K.F. Riley, M.P. Hobson., Cambridge University Press, 2011.ISBN: 9780521192736
Seymour Lipschutz author., Marc Lipson author., Linear algebra / Seymour Lipschutz, Marc Lars Lipson., New York, NY : McGraw-Hill Education, 2018.ISBN: 9781260011456
Seymour Lipschutz author., Marc Lipson author., Linear algebra / Seymour Lipschutz, Marc Lars Lipson., McGraw-Hill Education, 2013.ISBN: 9780071794565
Anton, Howard, Elementary linear algebra / Howard Anton., Wiley, 1994.
D.W. Jordan and P. Smith., Mathematical Techniques. An introduction for the engineering, physical and mathematical sciences., Oxford University Press, 2008.ISBN: 9780199282012
Martin, B. R. (Brian Robert), Martin, B.R. and Shaw, G., Mathematics for physicists, Wiley, 2015.ISBN: 9780470660225

Additional Notes: Normally available only to students on Physics degree programmes. Available to visiting and exchange students