Swansea University
Prifysgol Abertawe

FACULTY OF SCIENCE AND ENGINEERING

UNDERGRADUATE STUDENT HANDBOOK

FOUNDATION (FHEQ LEVEL 3)

FOUNDATION PHYSICS

DEGREE PROGRAMMES

SUBJECT SPECIFIC
PART TWO OF TWO
MODULE AND COURSE STRUCTURE
2022-23

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 22-23 academic year begins on 19 September 2022

Full term dates can be found here

DATES OF 22-23 TERMS

19 September 2022 – 16 December 2022

9 January 2023 – 31 March 2023

24 April 2023 – 09 June 2023

SEMESTER 1

19 September 2022 – 27 January 2023

SEMESTER 2

30 January 2023 – 09 June 2023

SUMMER

12 June 2023 – 22 September 2023

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. You should also refer to the Faculty of Science and Engineering proof-reading policy and this can be found on the Community HUB on Canvas, under Course Documents.

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.

This has been a challenging period for everyone. The COVID-19 pandemic has prompted a huge change in society as well as how we deliver our programmes at Swansea University and the way in which you study, research, learn and collaborate. We have been working hard to make sure you will have or continue to having an excellent experience with us.

We have further developed some exciting new approaches that I know you will enjoy, both on campus and online, and we cannot wait to share these with you.

At Swansea University and in the Faculty of Science & 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 staff, administrators, and your fellow students - I'm sure you will find many friendly helping hands ready to assist you.

We all know this period of change will continue and we will need to adapt and innovate to continue to be supportive and successful. At Swansea we are committed to making sure our students are fully involved in and informed about our response to challenges.

In the meantime, learn, create, collaborate, and most of all – enjoy yourself!

Professor Johann (Hans) Sienz
Interim Pro-Vice Chancellor/Interim Executive Dean
Faculty of Science and Engineering

Faculty of Science and Engineering	
Interim Pro-Vice Chancellor/Interim Executive Dean	Professor Johann Sienz
Head of Operations	Mrs Ruth Bunting
Associate Dean – Student Learning and Experience (SLE)	Professor Paul Holland
School of Biosciences, Geography and Physics **Head of School: Siwan Davies**	
School Education Lead	Dr Laura Roberts
Head of Physics	Dr Daniel Thompson and Professor Prem Kumar
Physics Programme Director	Professor David Dunbar
Year Coordinators	Year 0 – Dr Warren Perkins Year 1 – Dr Timothy Burns Year 2 – Professor Ardalan Armin Year 3 – Professor Timothy Hollowood Year 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 9am-5pm.

The **Student Support Team** provides dedicated and professional support to all studentsin 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 and 01792 6062522 (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 otherresources:

https://myuni.swansea.ac.uk/fse/coe-student-info/

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 22-23 handbooks to ensure that you have access to the most up-to-date versions. Access to print material in the library may be limited due to CV-19; your reading lists will link to on-line material whenever possible. 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 0 (FHEQ Level 3) 2022/23
Physics
BSc Physics[F301]

Semester 1 Modules	Semester 2 Modules
PH-021 **Mechanics** **20 Credits** **Dr WA Bryan**	**PH-024** **Waves, Optics and Thermal Physics** **20 Credits** **Dr EI Zavala Carrasco**
PH-022 **Electricity and Magnetism** **20 Credits** **Dr S Basiri Esfahani/Prof G Tasinato**	**PH-025** **Atoms, Nuclei and Particles** **20 Credits** **Dr S Basiri Esfahani/Prof N Madsen**
PH-023 **Foundation Mathematics for Physicists I** **20 Credits** **Dr WB Perkins/Dr AM Jones**	**PH-026** **Foundation Mathematics for Physicists II** **20 Credits** **Dr SG Roberts**
Total 120 Credits	

PH-021 Mechanics

Credits: 20 Session: 2022/23 September-January

Pre-requisite Modules:

Co-requisite Modules:

Lecturer(s): Dr WA Bryan

Format: Lectures - 22 hours (2 x 1 hour per week); Workshops - 22 hours (1 x 2 hours per week)

Delivery Method: 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: An introduction to forces, motion and Newton's Laws, without calculus.

Module Content: Basics
- Units
- Homogeneity of equations
- Significant figures

Forces
- Types of forces
- Dissipative forces
- Lift
- Free-body diagrams
- Pressure

Turning effects of forces
- Moments
- Equilibrium
- Couples
- Centre of mass

Motion
- Speed, velocity and acceleration
- Displacement-time graphs
- Velocity-time graphs
- Equations of motion
- Falling under gravity
- Terminal velocity
- Projectile motion

Newton's Laws and momentum
- First Law, inertia
- Second Law, momentum
- Third Law, pairs of forces
- Impulse
- Conservation of momentum

Work, energy and power
- Kinetic and potential energy
- Conservation of energy
- Efficiency
- Kinetic energy and momentum
- Elastic and inelastic collisions

Circular motion
- Radians
- Centripetal force and acceleration
- Horizontal and vertical circular motion

Gravitational forces and fields
- Inverse-square law
- Gravitational field, satellites
- Gravitational potential
- Kepler's laws
- Escape velocity

Simple harmonic motion
- Oscillations, period, frequency
- Simple pendulum
- Mass on a spring
- Damping
- Resonance

Materials
- Density
- Crystal structure
- Size of atoms
- Hooke's law
- Elastic potential energy
- Stress and strain
- Young modulus
- Stress-strain graphs
- Yielding and breaking
- Polymers
- Tension and compression

Intended Learning Outcomes: Understanding the physical laws of forces and motion.

Ability to perform calculations and solve problems based on the content of this module. In particular:

- Forces
- Algebraic and graphical methods for motion
- Collisions and Newton's Laws
- Work, energy and power
- Circular motion
- Gravitational force
- Simple harmonic motion
- Elastic properties of materials

Students will be capable of explaining important terms and concepts, and recalling 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: Coursework 1 50% weekly continuous assessment including workshop exercises

Examination 50% Final Assessment/Exam

Moderation approach to main assessment: Second marking as sampling or moderation

Assessment Feedback: Written work marked by the lecturer: work is returned to student with written feedback.
Peer-marked work: students mark each-other's work, according to a marking scheme prepared by the lecturer.
Electronic assessments: work is marked electronically.
Workshops: marks and individual verbal feedback are given during the workshop.
All assessments: students can request more detailed feedback by contact the lecturer, for example during office hours.

Failure Redemption: Re-sit if applicable.

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-022 Electricity and Magnetism

Credits: 20 Session: 2022/23 September-January

Pre-requisite Modules:

Co-requisite Modules:

Lecturer(s): Dr S Basiri Esfahani, Prof G Tasinato

Format: Lectures - 22 hours (2 x 1 hour per week); Workshops - 22 hours (1 x 2 hours per week)

Delivery Method: 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: Introduction to basic concepts in electricity and magnetism, including electrostatics, magnetostatics, electromagnetic induction, and electrical circuits.

Module Content: Current and charge
- Conductors and insulators
- Electric current
- Energy and potential difference
- Resistance
- Resistivity
- Electrical power

Electrical circuits
- Resistors in series and parallel
- Kirchhoff's Laws
- Potential divider
- Variable resistors and potentiometers
- e.m.f.~and internal resistance

Magnetic Fields
- Magnetic field of a current
- Magnetic materials
- Magnetic flux density
- Coils, solenoids, electromagnets
- Magnetic force on a wire
- Magnetic force on moving charges
- Magnetic force between currents

Electromagnetic induction
- Induction from coils
- Magnetic flux
- Faraday's Law
- Lenz's Law
- A.C. generator

Alternating current
- r.m.s values
- Oscilloscopes
- Transformers
- Rectifiers and diodes

Electric Fields
- Static charge
- Coulomb's Law
- Comparison to gravitational force
- Electric field
- Electric potential

Capacitors
- Capacitance
- Energy in a charged capacitor
- Capacitors in series and parallel
- Charge and discharge
- Time constant

Intended Learning Outcomes: Demonstrate an understanding of the physical laws of electricity and magnetism.

Ability to perform calculations and solve problems based on the content of this module. In particular:

- Current and resistance
- A.C. and D.C. circuits
- Magnetic fields
- Electric fields
- Electromagnetic induction
- Capacitance

Students will be capable of explaining important terms and concepts, and recalling 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: Coursework 1 50% weekly continuous assessment including workshop exercises

Examination 50% Final Assessment/Exam

Moderation approach to main assessment: Second marking as sampling or moderation

Assessment Feedback: Written work marked by the lecturer: work is returned to student with written feedback.
Peer-marked work: students mark each-other's work, according to a marking scheme prepared by the lecturer.
Electronic assessments: work is marked electronically.
Workshops: marks and individual verbal feedback are given during the workshop.
All assessments: students can request more detailed feedback by contact the lecturer, for example during office hours.

Failure Redemption: Re-sit if applicable.

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-023 Foundation Mathematics for Physicists I

Credits: 20 Session: 2022/23 September-January

Pre-requisite Modules:

Co-requisite Modules:

Lecturer(s): Dr WB Perkins, Dr AM Jones

Format: Lectures - 22 hours (3 x 1 hour per week); Workshops - 22 hours (1 x 2 hours per week)

Delivery Method: 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: Mathematics skills to complement the Foundation Year physics curriculum and prepare students for Level 1 physics.

Module Content: Vectors
Algebraic manipulation
Trigonometry
Coordinate geometry
Series
Exponentials and logarithms

Intended Learning Outcomes: Understanding of the fundamental mathematics required for introductory physics studies.

Ability to perform calculations and solve problems based on the content of this module.

Students will be capable of explaining important terms and concepts, and recalling 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: Coursework 1 – 50%
Examination – 50% - January - Final Assessment/Exam

Moderation approach to main assessment: Second marking as sampling or moderation

Assessment Feedback: Written work marked by the lecturer: work is returned to student with written feedback.
Peer-marked work: students mark each-other's work, according to a marking scheme prepared by the lecturer.
Electronic assessments: work is marked electronically.
Workshops: marks and individual verbal feedback are given during the workshop.
All assessments: students can request more detailed feedback by contact the lecturer, for example during office hours.

Failure Redemption: Re-sit if applicable.

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-024 Waves, Optics and Thermal Physics

Credits: 20 Session: 2022/23 January-June

Pre-requisite Modules:

Co-requisite Modules:

Lecturer(s): Dr EI Zavala Carrasco

Format: Lectures - 22 hours (2 x 1 hour per week); Workshops - 22 hours (1 x 2 hours per week)

Delivery Method: Lectures and workshops (problem-solving sessions, experimental labs, computing labs, or skills sessions).

Module Aims: Introduction to wave motion, physical and ray optics, thermodynamics, and kinetic theory.

Module Content: Wave motion
- Wavelength, period, frequency
- Amplitude, energy, phase
- Longitudinal and transverse waves
- Electromagnetic radiation, speed of light
- Polarisation
- Sound and the decibel scale

Reflection and refraction
- Reflection of waves
- Ray diagrams
- Snell's law
- Refractive index and wave speed
- Critical angle and total internal reflection
- Optical fibres
- Lenses
- Magnification
- Refracting telescope
- Human eye, defects and their correction

Interference and diffraction
- Superposition, phase, path difference
- Stationary waves
- Standing waves on a string and in pipes
- Diffraction, resolution
- Interference
- Young's double slit experiment
- Diffraction gratings

Thermodynamics
- Internal energy
- Heat and temperature
- Zeroth Law of Thermodynamics
- First Law of Thermodynamics
- Temperature scales
- Measuring temperature
- Specific heat capacity
- Latent heat

Gases and kinetic theory
- Gas pressure and work
- Boyle's Law, Pressure Law, Charles' Law
- Absolute zero
- Avogadro's constant
- Ideal gas law
- Kinetic theory

Intended Learning Outcomes: Demonstrate an understanding of the physical laws describing wave motion, optics, and thermal physics.

Ability to perform calculations and solve problems based on the content of this module. In particular:

- Wave motion
- Reflection and refraction
- Interference and diffraction
- Thermodynamics
- Gases and kinetic theory

Students will be capable of explaining important terms and concepts, and recalling key formulae, without the aid of text books or other sources.

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

Assessment Description: Coursework 1 30% weekly continuous assessment including workshop exercises

Examination 70% Final Assessment/Exam

Moderation approach to main assessment: Second marking as sampling or moderation

Assessment Feedback: Written work marked by the lecturer: work is returned to student with written feedback.
Peer-marked work: students mark each-other's work, according to a marking scheme prepared by the lecturer.
Electronic assessments: work is marked electronically.
Workshops: marks and individual verbal feedback are given during the workshop.
All assessments: students can request more detailed feedback by contact the lecturer, for example during office hours.

Failure Redemption: Re-sit if applicable.

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-025 Atoms, Nuclei and Particles

Credits: 20 Session: 2022/23 January-June

Pre-requisite Modules:

Co-requisite Modules:

Lecturer(s): Dr S Basiri Esfahani, Prof N Madsen

Format: Lectures - 22 hours (2 x 1 hour per week); Workshops - 22 hours (1 x 2 hours per week)

Delivery Method: Lectures and workshops (problem-solving sessions, experimental labs, computing labs, or skills sessions).

Module Aims: Introduction to atomic physics, nuclear physics, and particle physics.

Module Content: Electrons and photons
- Thermionic emission
- Electron kinetic energy
- Thomson's experiment
- Millikan's experiment
- Photoelectric effect
- Planck's equation
- Work function
- Wave-particle duality
- de Broglie's equation

Spectra and energy levels
- Electromagnetic spectrum
- Heat radiation
- Black-body radiation and Wien's Law
- Luminosity of stars and Stefan's Law
- Continuous and line spectra
- Energy levels and quanta
- Absorption spectra
- Lasers

Radioactivity
- Alpha particle scattering
- Nuclear model of the atom
- Atomic structure
- Isotopes
- Radioactivity
- Detecting radioactivity
- α, β and γ radiation
- Radioactive decay
- Nuclear stability
- Exponential decay and half-life

Nuclear energy
- Mass defect
- $E=mc^2$
- Binding energy
- Fission
- Fusion
- Nuclear power stations

Particle Physics
- Matter and anti-matter
- Quarks and leptons
- Hadrons
- Conservation laws
- Fundamental forces and particle exchange
- Feynman diagrams

OPTIONAL TOPICS:

Special relativity
- Michelson-Morley experiment
- Time dilation
- Muon decay
- Length contraction
- Relativistic mass

Medical imaging

- X-ray imaging
- Attenuation coefficient
- Radioactive tracers
- Positron emission tomography
- Magnetic resonance imaging

Intended Learning Outcomes: Demonstrate an understanding of the physical laws describing atoms, nuclei, and sub-atomic particles.

Ability to perform calculations and solve problems based on the content of this module. In particular:

- The photoelectric effect
- Atomic energy spectra
- Radioactivity
- Nuclear energy
- Particle physics

Students will be capable of explaining important terms and concepts, and recalling key formulae, without the aid of text books or other sources.

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

Assessment Description: Coursework 1 30 weekly continuous assessment including workshop exercises

Examination 70% Final Assessment/Exam

Moderation approach to main assessment: Second marking as sampling or moderation

Assessment Feedback: Written work marked by the lecturer: work is returned to student with written feedback.
Peer-marked work: students mark each-other's work, according to a marking scheme prepared by the lecturer.
Electronic assessments: work is marked electronically.
Workshops: marks and individual verbal feedback are given during the workshop.
All assessments: students can request more detailed feedback by contact the lecturer, for example during office hours.

Failure Redemption: Re-sit if applicable.

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-026 Foundation Mathematics for Physicists II

Credits: 20 Session: 2022/23 January-June

Pre-requisite Modules:

Co-requisite Modules:

Lecturer(s): Dr SG Roberts

Format: Lectures - 22 hours (2 x 1 hour per week); Workshops - 22 hours (1 x 2 ouhsr per week)

Delivery Method: Lectures and workshops (problem-solving sessions, experimental labs, computing labs, or skills sessions).

Module Aims: Mathematics skills to complement the Foundation Year physics curriculum and prepare students for Level 1 physics.

Module Content: Differentiation
Integration
Complex numbers
Matrices

Intended Learning Outcomes: Demonstrate an understanding of the fundamental mathematics required for introductory physics studies.

Ability to perform calculations and solve problems based on the content of this module. In particular:

Students will be capable of explaining important terms and concepts, and recalling key formulae, without the aid of text books or other sources.

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

Assessment Description: Coursework 1 30% weekly continuous assessment including workshop exercises

Examination 70% Final Assessment/Exam

Moderation approach to main assessment: Second marking as sampling or moderation

Assessment Feedback: Written work marked by the lecturer: work is returned to student with written feedback.
Peer-marked work: students mark each-other's work, according to a marking scheme prepared by the lecturer.
Electronic assessments: work is marked electronically.
Workshops: marks and individual verbal feedback are given during the workshop.
All assessments: students can request more detailed feedback by contact the lecturer, for example during office hours.

Failure Redemption: Re-sit if applicable.

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.