Swansea University
Prifysgol Abertawe

FACULTY OF SCIENCE AND ENGINEERING

UNDERGRADUATE STUDENT HANDBOOK

YEAR 3 (FHEQ LEVEL 6)

CHEMISTRY

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)	Professor Laura Roberts
School of Engineering and Applied Sciences	
Head of School	Professor Serena Margadonna
School Education Lead	Professor Simon Bott
Head of Chemistry	Professor Owen Guy
Chemistry Programme Director	Dr Joel Loveridge
Year Coordinators	Year 0 – Professor Simon Bott Year 1 – Dr Joel Loveridge Year 2 – Dr Francisco Martin-Martinez Year 3 – Dr Mariolino Carta Year 4 – Dr Sumati Bhatia

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 3 (FHEQ Level 6) 2023/24
Chemistry
MCHEM Chemistry[F123]

Coordinator: Dr M Carta

Semester 1 Modules	Semester 2 Modules
CH-300 **Advanced Topics in Organic, Biological and Medicinal Chemistry** **20 Credits** **Dr M Carta/Dr S Bhatia**	**CH-343** **Advanced Laboratory Experience** **40 Credits** **Dr EJ Loveridge/Prof SG Bott/Dr M Carta/Dr MR Gill/...**
CH-340 **Advanced Topics in Inorganic and Materials Chemistry** **20 Credits** **Prof J Mareque-Rivas/Prof MJ Carnie/Dr MR Gill**	**CH-349** **Integrated Topics in Chemistry** **20 Credits** **Prof SG Bott/Prof AR Barron/Prof MJ Carnie/Prof OJ Guy/...**
CH-342 **Advanced Topics in Physical, Instrumental and Analytical Chemistry** **20 Credits** **Dr D Roy/Dr E Evans**	
Total 120 Credits	

Year 3 (FHEQ Level 6) 2023/24
Chemistry

BSc Chemistry[F100,F10F]
BSc Chemistry with a Year Abroad[F106]
BSc Chemistry with a Year in Industry[F101]

Coordinator: Dr M Carta

Semester 1 Modules	Semester 2 Modules
CH-300 **Advanced Topics in Organic, Biological and Medicinal Chemistry** **20 Credits** **Dr M Carta/Dr S Bhatia**	**CH-344** **Chemistry Project** **40 Credits** **Prof I Mabbett/Prof GN Alexandrowicz/Dr S Bhatia/Prof SG Bott/...**
CH-340 **Advanced Topics in Inorganic and Materials Chemistry** **20 Credits** **Prof J Mareque-Rivas/Prof MJ Carnie/Dr MR Gill**	**CH-349** **Integrated Topics in Chemistry** **20 Credits** **Prof SG Bott/Prof AR Barron/Prof MJ Carnie/Prof OJ Guy/...**
CH-342 **Advanced Topics in Physical, Instrumental and Analytical Chemistry** **20 Credits** **Dr D Roy/Dr E Evans**	
Total 120 Credits	

CH-300 Advanced Topics in Organic, Biological and Medicinal Chemistry

Credits: 20 Session: 2023/24 September-January

Pre-requisite Modules:

Co-requisite Modules:

Lecturer(s): Dr M Carta, Dr S Bhatia

Format:
30 hours practical,
33 hours lectures,
11 hours workshops,
76 hours independent study,
50 hours preparation for assessment

Delivery Method: Flipped classes, seminars, workshops, peer support, laboratory experiments and online content.

Module Aims: This module will give students a high-level understanding of organic and medicinal (pharmaceutical) chemistry. Students will gain deeper appreciation of mechanistic considerations in organic chemistry, and will broaden their knowledge of synthetic methods, particularly those involving main group elements and transition metals. Key contemporary methods in organic chemistry will be studied. The module will build on the organic chemistry knowledge acquired in the previous year. By the end of the module, students will have a comprehensive grounding in organic and medicinal chemistry, and will be able to design or predict complicated synthetic routes, evaluate the outcomes and predict/analyse structures using a variety of spectroscopic methods.

Module Content: Aromatic cross coupling reactions
Pericyclic reactions
Advanced retrosynthesis and synthetic strategy
Synthetic strategy for the synthesis of pharmaceutical active compounds
Asymmetric synthesis
Spectroscopy in organic chemistry

Intended Learning Outcomes: By the end of this module, students will be able to:

• Discuss advanced organic syntheses, especially concerning aromatic chemistry and the formation of extended rings via pericyclic reactions
• Plan stereoselective synthesis, especially via the use of main group and transition metal-containing reagents
• Apply the acquired knowledge to the synthesis of pharmaceutical active compounds (Medicinal chemistry)
• Predict and use complicated and unfamiliar mechanisms for advanced retrosynthesis
• Evaluate different strategies in organic synthesis by combining the knowledge acquired in previous modules
• Predict and confirm the structures of organic compounds using a variety of spectroscopic methods

Assessment:
Examination 1 (50%)
Laboratory work (25%)
Assignment 2 (25%)

Assessment Description: Examination
Laboratory work
Laboratory report
Workshop assessments

The Laboratory component must be passed (40%) in order to pass the module

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

Assessment Feedback: Group written feedback for exam. Individual written and oral feedback for coursework.

Failure Redemption: A suitable supplementary attempt will be permitted on relevant assessment in line with University policy.

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

Available to visiting exchange students provided they are present in the January assessment period.

CH-340 Advanced Topics in Inorganic and Materials Chemistry

Credits: 20 Session: 2023/24 September-January

Pre-requisite Modules:

Co-requisite Modules:

Lecturer(s): Prof J Mareque-Rivas, Prof MJ Carnie, Dr MR Gill

Format: 30 hours practical,
33 hours lectures,
11 hours workshops,
76 hours independent study,
50 hours preparation for assessment

Delivery Method: Flipped classes, seminars, workshops, peer support, laboratory experiments and online content.

Module Aims: This module will provide a fuller and more comprehensive understanding of inorganic chemistry built upon the principles introduced in Years 1 and 2. It will illustrate how various classes of inorganic compounds and materials, including coordination compounds and coordination polymers, cluster compounds, organometallic compounds, nanomaterials and colloidal inorganic nanoparticles, porous materials and supramolecular systems are prepared and characterised. The student will gain an understanding of inorganic materials properties and of the principles and experimental techniques that underpin their synthesis. The module will illustrate specific applications of inorganic materials and nanomaterials and will show the importance and use of inorganic chemistry, nanomaterials and metal-containing units in biology and medicine.

Module Content: Inorganic Chemistry at the Interface with Biology and Medicine

• Biocoordination chemistry
• Metals in biological systems
• Bioinorganic catalysis
• Metals, inorganic compounds and materials in medicine
• Probes for studying metals in living systems
• Inorganic chemistry in medical imaging
• Biomaterials, biofunctionalisation, biologically derived and bioengineered materials
• Inorganic nanomedicine
• Latest trends and future directions

Inorganic Materials

• The solid state (partial recap)
• Solid state reactions
• Materials based on metal oxides, nitrides, carbides, hydrides, halides and sulfides
• Carbon (graphene and nanotubes)
• Porous materials
• Synthesis of nanomaterials
• Materials for energy applications
• Analysis of materials

Intended Learning Outcomes: At the end of this module students will be able to:

• Describe the principles that underpin selected synthetic processes and suggest synthetic routes for specific types of inorganic compounds and materials
• Use the literature to identify optimised synthetic routes for specific compounds and materials
• Display a good understanding of the characterisation, properties and applications of different classes of inorganic compounds and materials
• Describe and compare the roles of metals, inorganic compounds and materials in living systems
• Discuss the importance and application of inorganic chemistry in medicine and the latest trends in the design of bioactive compounds and materials

Assessment: Examination 1 (50%)
Laboratory work (25%)
Assignment 2 (25%)

Assessment Description: Examination Laboratory work Laboratory report Workshop assessments The Laboratory component must be passed (40%) in order to pass the module
Moderation approach to main assessment: Moderation by sampling of the cohort
Assessment Feedback: Group written feedback for exam. Individual written and oral feedback for coursework.
Failure Redemption: Resit failed components
Additional Notes: Delivery of both teaching and assessment will be blended including live and self-directed activities online and on-campus. Available to visiting exchange students provided they are present in the January assessment period.

CH-342 Advanced Topics in Physical, Instrumental and Analytical Chemistry

Credits: 20 Session: 2023/24 September-January

Pre-requisite Modules:

Co-requisite Modules:

Lecturer(s): Dr D Roy, Dr E Evans

Format:
30 hours practical,
33 hours lectures,
11 hours workshops,
76 hours independent study,
50 hours preparation for assessment

Delivery Method: All Programmes will employ a blended approach to delivery using the Canvas Digital Learning Platform for live and self-directed online activity, with live and self-directed on-campus activities each week. Students may also have the opportunity to engage with online versions of sessions delivered on-campus

Flipped content, online and F2F active classrooms and workshops, peer-led learning, practicals

Module Aims: This module completes the core aspects of Physical Chemistry for the undergraduate programme, applying existing understanding of thermodynamics and quantum mechanics to connect the quantum world with the observable world in Statistical Mechanics and relating quantum understanding to the application of light in chemical reactions.
Laboratory experiments will be fully investigative, with students carrying out advanced ‘mini projects’ to initiate and guide students in elementary research skills in preparation for their research projects.
Material, techniques and skills covered in the course of this module will require understanding of prior modules.

Module Content: Photochemistry

• Revisiting properties of light and techniques of controlling light
• Polarised and unpolarised light
• Momentum and angular momentum of an electromagnetic wave relating to quantum optics
• Controlling light with electric and magnetic fields (e.g. Pockels and Kerr effects)
• Revisiting optical properties of matter
• The optical absorption in molecules
• The optical properties of solids
• Basic nonlinear optical phenomena
• Light absorption and energy transfer processes
• Mechanisms of absorption and decay of excited singlet states;
• Quenching;
• Resonance energy transfer
• Probing light matter interaction using electronic spectroscopy
• Diatomic & polyatomic molecules
• Excited states and lifetimes
• Measuring quantum yield;
• Understanding hot electron generations in plasmonic systems
• Introduction to plasmon and plasmonic systems
• Quantum methods to understand the topic e.g. Fermi's golden rule
• Example of a hot electron system applied to photochemistry
• Example of photochemistry in photocatalysis to be chosen from recent advances using nanomaterials

Statistical Mechanics

• Recap of statistical nature of entropy
• From microscopic to macroscopic properties
Ensembles
Boltzmann distribution
• Partition functions
Connection to thermodynamic state functions
Molecular partition functions
• The canonical ensemble
Concepts of ensembles
Contributions of energies
Effect of volume on energies
• Statistics and thermodynamic observables
Internal energy
Entropy
Free energies
Equilibria

Intended Learning Outcomes: By the end of this module, students will be able to:

Apply knowledge to prior understanding and connect the microscopic world to the macroscopic world.

Describe and explain core concepts in photochemistry and statistical mechanics.

Relate concepts taught to recent research outputs

Integrate new understanding with prior understanding to develop a more complete understanding of physical chemistry.

Apply theoretical models to explain experimental observations

Design and refine experimental protocols to explore unknown phenomena in the laboratory

Create laboratory procedures to investigate experimental phenomena.

Assessment: Examination 1 (50%)
Laboratory work (25%)
Assignment 2 (25%)

Assessment Description: Examination
Laboratory work
Laboratory report
Workshop assessments

The Laboratory component must be passed (40%) in order to pass the module

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

Assessment Feedback: Group written feedback for exam. Individual written and oral feedback for coursework.

Failure Redemption: Resit failed component

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

Available to visiting exchange students provided they are present in the January assessment period.

CH-343 Advanced Laboratory Experience

Credits: 40 Session: 2023/24 January-June

Pre-requisite Modules:

Co-requisite Modules:

Lecturer(s): Dr EJ Loveridge, Prof SG Bott, Dr M Carta, Dr MR Gill, Dr FJ Martin-Martinez, Dr JW Ryan

Format: 100 lab hours
100 hours independent study
200 hours preparation for assessment

Delivery Method: Online prelab material.

Module Aims: This last formal lab module for those on the M Chem course consists of "project practicals" which can last from 3 to 10 weeks. These are intended to lay the groundwork for the more extensive research project carried out in the final year. The practicals change from one year to the next based on the current research of the department. They may be synthetic, analytical or purely involve extensive data treatment.

Module Content: Students will carry out between 1 and 3 extended practicals that can be based on organic or inorganic synthesis, instrumental or chemical analysis, data collection and treatment.

Intended Learning Outcomes: At the end of this module students will be able to:

Demonstrate detailed understanding of experimental aspects of cutting edge research in the department.

Demonstrate expanded experimental capabilities and techniques.

Critically evaluate different lab techniques in order to apply the correct one to the problem at hand

Plan and carry out multistep synthesis of organic and inorganic compounds

Assessment: Report (60%)
Presentation (20%)
Laboratory work (20%)

Assessment Description: Lab Report of no more than 8000 words on main practical (if more than one, student selects)
Presentation of 10-15 minutes on main or secondary practical (if more than one, student selects)
Continual assessment of laboratory work including but not limited to health and safety, technique, quality of data obtained

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

Assessment Feedback: Individual written feedback

Failure Redemption: Given the nature of the work, there is no redemption of failure possible if the necessary hands-on material has not been completed by the end of the term.

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

CH-344 Chemistry Project

Credits: 40 Session: 2023/24 January-June

Pre-requisite Modules:

Co-requisite Modules:

Lecturer(s): Prof I Mabbett, Prof GN Alexandrowicz, Dr S Bhatia, Prof SG Bott, Dr M Carta, Dr E Evans, Dr MR Gill, Prof OJ Guy, Dr EJ Loveridge, Prof J Mareque-Rivas, Dr FJ Martin-Martinez, Dr D Roy, Dr JW Ryan

Format: 20 hours meeting with supervisor,
80 hours project work,
300 hours independent study and dissertation writing

Delivery Method: This will consist of a briefing, followed by independent work embedded in a research group, guided by regular meetings with an academic supervisor.

Module Aims: 3rd year projects are the opportunity to bring all you've learnt during your degree together and apply that knowledge to solve a problem. In Swansea these projects can be embedded in active research groups across the colleges of science, engineering or medicine, allowing you to build a network and experience in your chosen specialism within the chemical sciences.
These projects are your opportunity to demonstrate to employers that you have a full understanding of your course and are able to direct your own studies, manage an independent research project and effectively communicate your findings.
This selection suggests an interest in a project embedded within a research group in engineering, focusing on materials chemistry or chemical engineering

Module Content: 'Research ready' briefing around literature searching, IP, GLP, COSHH etc

Literature review then research project

These are open ended activities requiring students to manage their own learning.

They will be embedded in a research group and must use their previous learning to inform their research. Their project work will be guided by an academic supervisor and they will meet regularly.

Intended Learning Outcomes: At the end of this module students will be able to:

Demonstrate and explain fundamental Physico-Chemical principles as they apply to Chemistry.

Demonstrate and explain the application of Instrumental and Analytical Chemistry across core Chemistry themes/areas.

Demonstrate detailed understanding at the forefront of the field of one or more of the Chemistry specialisms developed at Swansea University.

Apply their knowledge of both general Chemistry and Chemistry specialisms to analyse and solve specific applied problems in the field.

Apply their knowledge of both general Chemistry and Chemistry specialisms, along with their practical skills and project management knowledge, to the completion of a substantial research project

Analyse and identify their own intellectual and practical skill gaps, and address them via independent learning.

Demonstrate the essential Chemistry-related practical skills as described in the QAA Chemistry Benchmark Statement.

Execute laboratory-based experiments and apply a range of synthetic and measurement techniques.

Apply specific and general safety practices to laboratory-based and other practical work.

Assessment: Report (60%)
Presentation (20%)
Participation Exercise (20%)

Assessment Description: Project assessed on write up Presentation and viva/defense Must attend 'research ready' briefing and be engaged in project work
Moderation approach to main assessment: Moderation by sampling of the cohort
Assessment Feedback: Individual written feedback for dissertation, and written/verbal as appropriate feedback for presentation.
Failure Redemption: Resubmit dissertation.
Additional Notes: Delivery of both teaching and assessment will be blended including live and self-directed activities online and on-campus. Module code reserved by i.mabbett on 10/05/2016 16:39:31

CH-349 Integrated Topics in Chemistry

Credits: 20 Session: 2023/24 January-June

Pre-requisite Modules:

Co-requisite Modules:

Lecturer(s): Prof SG Bott, Prof AR Barron, Prof MJ Carnie, Prof OJ Guy, Dr C Klinke, Dr EJ Loveridge, Prof J Mareque-Rivas, Dr D Roy, Miss E Winrow

Format: 56 hours lectures,
144 hours independent study and preparation for assessment

Delivery Method: Flipped classes, lectures, seminars, workshops, peer support, laboratory experiments and online content.

Module Aims: This module gives students the opportunity to explore options within Chemistry, giving opportunity to apply prior learning to advanced research topics and allowing students to pursue more specialised topics related to their research interests and aligned with the research areas represented within the Department. Study areas available will include advanced spectroscopic techniques, the application of instrumentation in chemistry, as well as more advanced synthetic pathways and a return to more integrated study of the traditional branches of organic/inorganic/physical chemistry. The module will also include a mandatory employability component. Classes will be supported with workshops which will help students gain a thorough understanding of the integrated nature of Chemistry at an advanced level.

Where possible, topics will be taught using relevant examples from primary literature, encouraging students to evaluate and appraise a range of primary literature sources and locate appropriate new sources.

The module is designed to be flexible to allow the content to vary with the research areas represented within the Department and wider university.

Module Content: Students will have the choice within following broad study areas:

- Organo-main group chemistry
- Physical organic chemistry
- Organic polymer chemistry
- Further computational chemistry
- Instrumentation in Chemistry
- Advanced optical spectroscopy
- Medical imaging
- Inorganic nanomedicine
- Multinuclear NMR
- The f-Block
- Employability skills for chemists

Students will be examined on FOUR of the study areas (three of their choice, plus employability) but should plan to attend lectures on all topics.

All options will be subject to minimum interest levels in order to run. Students will have the opportunity to specify preferences from a master list in Semester One to determine what topics are taught.

As the module is designed to include topic areas aligned with the research areas of the Department, the broad study areas may vary over time. The list of topic areas for the academic year will be finalised at the start of that academic year prior to student selection.

No books or formal reading list will be assigned as the reading will be extensive, from the primary literature, and very topical.

Intended Learning Outcomes: By the end of this modules, students will be able to

Explain advanced concepts in chemistry based on prior learning
Analyse research findings in research articles and evaluate these in light of other sources.
Identify appropriate sources for research articles and summarise these as part of a critical appraisal of material.
Formulate arguments to explain chemical phenomena in a range of contexts

Assessment: Examination (100%)

Assessment Description: There will be one question offered on each topic taught with a combination of mandatory and optional parts. Students will complete four questions.
Moderation approach to main assessment: Moderation by sampling of the cohort
Assessment Feedback: Students will receive regular targeted feedback on their work through verbal, written and online media. Students will also be trained in self-reflection and peer support to enhance the student-generated feedback. Students will also be supported in making best use of feedback available.
Failure Redemption: A suitable supplementary attempt will be permitted on relevant assessment in line with University policy.
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.