PROGRAMME SPECIFICATION

Awarding body/institution	Glyndŵr University
Teaching institution (if different from above)	
Details of accreditation by a professional, statutory or regulatory body (including link to relevant website)	N/A
What type of accreditation does this programme lead to?	None currently. Team are looking to apply for RSC accreditation after one year of running the programme in line with RSC accreditation procedures.
Is accreditation in some way dependent on choices made by students?	N/A
Final award/s available eg BSc/DipHe/CertHE	BSc (Hons) Chemistry with Green Nanotechnology BSc Chemistry with Green Nanotechnology Diploma of Higher Education in Chemistry with Green Nanotechnology Certificate of Higher Education in Chemistry
Award title	Chemistry with Green Nanotechnology
JACS 3 code	F100
UCAS code (available from Admissions)	3NB8 E8N2 (4 years with foundation year)
Relevant QAA subject benchmark statement/s	QAA Chemistry 2007
Other external and internal reference points used to inform the programme outcomes	RSC accreditation of degree programmes 2012 document
Mode/s of study *(p/t, f/t, distance learning)*	Full Time, Part Time
Language of study	English
Date at which the programme specification was written or revised	April 2014 Revised October 2015

Criteria for admission to the programme

The admissions process adheres to Glyndŵr University's published policies on Equal Opportunities and Student Disabilities, and we encourage and fully support applications from *all* suitably qualified students. Students may make applications through the medium of Welsh if they so wish.

Entrance requirements for the programmes are:

i. 240 UCAS points at Level 3 including a science subject (preferably chemistry). In addition passes at GCSE in Maths and English/Welsh Language at grade C or above are normally expected.

OR

ii. Equivalent experiential learning will be considered for applicants with insufficient or no formal qualifications. An example of typical equivalent experiential learning would be 2-3 years working in a relevant scientific position, such as a laboratory technician. Candidates with no formal education must demonstrate evidence of an ability to study at the higher education level. The Admissions Tutor will require candidates to undertake a piece of written work, assessing their literacy and numeracy skills, and basic scientific knowledge, to demonstrate their capacity to study at the appropriate level. Those candidates who satisfactorily complete the written exercise will be invited to attend a formal interview with programme staff to assess their motivation, experience and readiness to study.

Applicants may be able to gain Accredited Prior Learning (APL) and/or Accredited Prior Experimental Learning (APEL) in accordance with Glyndŵr University regulations, dependent upon evidenced qualifications and/or experience.

International and European applicants with equivalent overseas qualifications will be expected to have attained IELTS 6.0 or an equivalent recognised Secure English Language Test (SELT) qualification.

This programme will also be offered as a four year kick-start degree (an introductory foundation year plus this three year degree programme). The kick-start will be offered where an applicant does not meet the entry requirements for the three year honours degree or where the department / applicants feel they would benefit from an additional year to gain some additional experience before progression to the full three year degree. Upon successful completion of foundation year the student will automatically progress to the BSc (Hons) Chemistry with Green Nanotechnology degree course. Entry to the four year kick-start programme will be conditional on interview and review of applications to confirm that students are able to satisfactorily complete the programme. The principal criteria for entry will be based on the academic judgement of the admissions tutor and members of the programme team in the relevant subject area. All applicants however must be able to demonstrate a minimum level of competence in English/Welsh Language and in Mathematics/Science, with a pass at Grade C or above in GCSE or an equivalent qualification. Therefore, this route is aimed at:

- those who do not meet the entry requirements for a full degree.
- those who have been out of education for a while and feel they would benefit from the extra year of preparation.
- those looking to undertake a degree in an entirely new subject area and do not have the subject specific experience necessary to go straight to a degree.

Students who are unsure if they meet the criteria should contact the Admissions Tutor, Dr Joss Bartlett, for advice.

Aims of the programme

The primary aim is to provide students with a programme that reflects the very latest developments in the field of chemistry and a new emerging area of green nanotechnology. The aim is to produce high quality graduates with excellent further study and employment opportunities. Modules have been designed to cover the specific criteria of the QAA Chemistry 2007 Benchmarks as well as aligned to the RSC accreditation standards 2012 (accreditation pending). The programme is structured so as to provide a logical, coherent progression through the modules.

Specifically, the programme will equip/provide students with:

(i) An in-depth knowledge of science in particular chemistry, physics, mathematics and statistics. (Glyndŵr Graduate Attribute- Expert)

(ii) A strong theoretical understanding of chemistry and green nanotechnology, as well as their real life applications. (Glyndŵr Graduate Attribute- Expert & Enterprising)

(iii) The practical laboratory skills, procedures and safety appreciation required for employment in a modern science laboratory. (Glyndŵr Graduate Attribute- Professional)

(iv) The ability to critically evaluate, analyse, discuss and present scientific data/information. (Glyndŵr Graduate Attribute- Independent thinkers)

(v) A broader understanding of science in both the workplace and society. Glyndŵr Graduate Attribute- (Lifelong learners and international and future oriented perspective).

(vi) The generic, transferable skills demanded by employers such as communication, numeracy, IT, information management, research and team working. (Glyndŵr Graduate Attribute- Professional)

Distinctive features of the programme

This programme has been designed to offer students three components:

- A solid foundation in the theory of chemistry and green nanotechnology.
- Practical skills and knowledge useful for employment in the chemical sector.
- Transferable skills valued by employers.

The chemical industry is UK's largest manufacturing export sector and this programme has been designed to meet the industry requirements. The transition from an oil based economy to a bio based one in order to develop a truly sustainable manufacturing industry is reliant largely on new technologies such as green nanotechnology. The BSc (Hons) degree in Chemistry with Green Nanotechnology has been specifically developed for students who have an interest in chemistry and a strong desire to explore the latest developments in the field of nanotechnology. Students will gain in depth theoretical knowledge and practical skills in chemistry through modules such as Introduction to Chemistry (SCI414) and Laboratory Chemical Analysis (SCI416) and an understanding of green nanotechnology through modules such as Introduction to

Nanotechnology (SCI516) and Foundation Green Chemistry (SCI422) to name a few. The programme has been structured so that theoretical and experiential learning modules interlink and support each other throughout. The programme has been designed with particular consideration to the widening participation agenda, which attracts and supports students from non-traditional backgrounds.

Key benefits of the programme are:

(i) Highly experienced, research-active staff, all holding doctorate degrees.

(ii) Dedicated chemical and instrumental analysis labs to allow students' hands-on practical experience.

(iii) Research-led advanced modules in chemistry and nanotechnology.

(iv) Work-related learning opportunities.

(v) Opportunities to become a Student Member of the Royal Society of Chemistry and engage with the RSC North Wales section events.

(vi) University support available through the medium of Welsh.

Programme structures and requirements, levels, modules, credits and awards

The full-time study takes 3 years as shown in the following modular framework table. The part-time study takes 6 years. The exit awards are listed below:

Certificate of Higher Education in Chemistry
This qualification is available for students who exit the programme after gaining 120 credits at Level 4 or above.

Diploma of Higher Education in Chemistry with Green Nanotechnology
This qualification is available for students who exit the programme after gaining 240 credits with a minimum of 120 credits at level 5 or above.

BSc Chemistry with Green Nanotechnology (Ordinary Degree)
This qualification is available for students who exit the programme after gaining 300 credits with a minimum of 60 credits at level 6, including Advanced Green Chemistry and Topics in Nanotechnology modules.

BSc (Hons) Chemistry with Green Nanotechnology
This qualification is available for students who exit the programme after gaining 360 credits with a minimum of 120 credits at level 6.

Programme structure for full time

Year One Level Four	Tri 1	**Introduction to Chemistry** SCI414 (20 Credits) Core - Dr Jixin Yang	**Academic Study Skills and Personal Development** SCI421 *(*20 Credits) Core - Dr Amiya Chaudhry	**Foundation Green Chemistry** SCI422 *(*20 Credits) Core - Dr Ian Ratcliffe
	Tri 2	**Maths and Statistics for Science** SCI415 (20 Credits) Core - Dr Jixin Yang	**Laboratory Chemical Analysis** SCI416 (20 Credits) Core - Dr Amiya Chaudhry	**Inorganic and Materials Chemistry** SCI423 *(*20 Credits) Core - Dr Clive Buckley

Year Two Level Five	Tri 1	**Analytical Methods** SCI509 (20 Credits) Core - Dr Jixin Yang	**Introduction to Nanotechnology** SCI516 (20 Credits) Core - Dr Ian Ratcliffe	**Work Related Learning** SCI518 (20 Credits) Core - Dr Amiya Chaudhry
	Tri 2	**Instrumental Analysis** SCI512 (20 Credits) Core - Dr Jixin Yang	**Laboratory Instrumental Analysis** SCI513 (20 Credits) Core - Dr Jixin Yang	**Structure and Synthesis** SCI517 (20 Credits) Core - Dr Jixin Yang

Year Three Level Six	Tri 1	**Advanced Green Chemistry** SCI617 (20 Credits) Core - Dr Ian Ratcliffe	**Drugs and Toxicology** SCI609 (20 Credits) Opt - Dr Amiya Chaudhry	**Research Project** SCI618 (40 Credits) Core - Dr Amiya Chaudhry
			Polymer Chemistry and Formulations SCI614 (20 Credits) Opt - Dr Ian Ratcliffe	
	Tri 2	**Topics in Nanotechnology** SCI615 (20 Credits) Core - Dr Jixin Yang	**Advanced Nano-semiconductors** SCI616 (20 Credits) Core - Dr Vincent Barrioz	

Programme structure for part time

Year One Level Four	Tri 1	**Introduction to Chemistry** SCI414 (20 Credits) Core - Dr Jixin Yang	**Academic Study skills and Personal Development** SCI421 (20 Credits) Core - Dr Amiya Chaudhry
	Tri 2	**Maths and Statistics for Science** SCI415 (20 Credits) Core - Dr Jixin Yang	
Year Two Level Four	Tri 1	**Foundation Green Chemistry** SCI422 (20 Credits) Core - Dr Ian Ratcliffe	
	Tri 2	**Inorganic and Materials Chemistry** SCI423 (20 Credits) Core - Dr Clive Buckley	**Laboratory Chemical Analysis** SCI416 (20 Credits) Core - Dr Amiya Chaudhry
Year Three Level Five	Tri 1	**Introduction to Nanotechnology** SCI516 (20 Credits) Core - Dr Ian Ratcliffe	**Work Related Learning** SCI518 (20 Credits) Core - Dr Amiya Chaudhry
	Tri 2	**Structure and Synthesis** SCI517 (20 Credits) Core - Dr Jixin Yang	
Year Four Level Five	Tri 1	**Analytical Methods** SCI509 (20 Credits) Core - Dr Jixin Yang	
	Tri 2	**Instrumental Analysis** SCI512 (20 Credits) Core - Dr Jixin Yang	**Laboratory Instrumental Analysis** SCI513 (20 Credits) Core - Dr Jixin Yang
Year Five Level Six	Tri 1	**Advanced Green Chemistry** SCI617 (20 Credits) Core - Dr Ian Ratcliffe	**Drugs and Toxicology** SCI609 (20 Credits) Opt - Dr Amiya Chaudhry
			Polymer Chemistry and Formulations SCI614 (20 Credits) Opt - Dr Ian Ratcliffe
	Tri 2	**Topics in Nanotechnology** SCI615 (20 Credits) Core - Dr Jixin Yang	
Year Six Level Six	Tri 1		**Research Project** SCI618 (40 Credits) Core - Dr Amiya Chaudhry
	Tri 2	**Advanced Nano-semiconductors** SCI616 (20 Credits) Core - Dr Vincent Barrioz	

- The programme includes a work-related module but does not include a compulsory work placement for achievement of the award.
- All the learning and teaching hours, including tutorials are associated with credit.
- The part-time provision will be along with the full-time timetable.

Intended learning outcomes of the programme

Learning outcomes are based on the standards written in the QAA Chemistry benchmark (2007) document. These have been closely aligned with RSC accreditation of degree programmes (2012) (accreditation pending) document. The programme provides opportunities for students to develop through the levels of the programme and demonstrate knowledge and understanding, qualities and skills in the following areas (see over the page):

A Knowledge and Understanding

		Level 4 Cert. HE	Level 5 Dip. HE	Level 6 Ordinary	Level 6 Honours
A1	**Concepts, principles and theories in chemistry**	An understanding of the Fundamental concepts, principles and theories in chemistry.	An understanding and explanation of the concepts, principles and theories in chemistry.	A critical understanding and application of the higher level concepts, principles and theories in chemistry.	A critical understanding and application of the higher level concepts, principles and theories in chemistry.
A2	**Laboratory chemical and instrumental analysis**	Competence of working safely in a chemistry laboratory and being able to conduct documented laboratory procedures and measurement of chemical properties under the guidance of a tutor.	Competent understanding of how to work safely in a chemistry laboratory and being able to conduct documented laboratory procedures and measurement of chemical properties.	A critical understanding of how to work safely in a chemistry laboratory and being able to conduct documented laboratory procedures and measurement of chemical properties.	A critical understanding of how to work safely and independently in a chemistry laboratory and able to plan and conduct laboratory procedures and measurement of chemical properties.
A3	**Material science and nanotechnology**	An understanding of selected topics in material science and nanotechnology at the leading edge of research.	An understanding and explanation of selected topics in material science and nanotechnology at the leading edge of research.	A critical understanding and explanation of selected topics in material science and nanotechnology at the leading edge of research.	A critical understanding explanation of advanced topics in material science and nanotechnology at the leading edge of research.
A4	**Green chemistry**	An understanding of the fate and behaviour of chemicals in the environment and alternative synthetic approaches based upon the notion of environmental sustainability.	An understanding and explanation of the fate and behaviour of chemicals in the environment and alternative synthetic approaches based upon the notion of environmental sustainability.	A critical understanding and explanation of the fate and behaviour of chemicals in the environment and alternative synthetic approaches based upon the notion of environmental sustainability.	A critical understanding and application of the fate and behaviour of chemicals in the environment and alternative synthetic approaches based upon the notion of environmental sustainability.
A5	**Mathematics and statistics**	Demonstrates basic numeracy, algebraic and statistical competence and ability to manipulate data related to scientific problems.	Applies more advanced numerical, mathematical and statistical skills in solving scientific problems.	A critical understanding of essential knowledge of mathematics and statistics and its applications in scientific problems. Applies a range of more specialist mathematical and statistical skills as appropriate to scientific subject.	A critical understanding of essential knowledge of mathematics and statistics and its applications in scientific problems. Confidently applies a range of specialist mathematical and statistical skills as appropriate to the specialist subject area.

B Intellectual Skills

		Level 4 Cert. HE	Level 5 Dip. HE	Level 6 Ordinary	Level 6 Honours
B1	**Knowledge application**	Demonstrate ability to organise and appraise the knowledge and understanding of the essential scientific facts, concepts and theories relating to chemistry and green nanotechnology.	Demonstrate increasing ability to organise and appraise the knowledge and understanding of the essential scientific facts, concepts and theories relating to chemistry and green nanotechnology.	Organise efficiently and appraise the knowledge and understanding of the essential scientific facts, concepts and theories relating to chemistry and green nanotechnology.	Organise efficiently and appraise the knowledge and understanding of the essential scientific facts, concepts and theories relating to chemistry and green nanotechnology with critical thinking.
B2	**Information Assembly and Evaluation**	Demonstrate the ability to assemble information from a variety of sources.	Demonstrate the ability to assemble and evaluate information from a variety of sources.	Assemble efficiently, evaluate and critically assess information from a variety of sources.	Assemble efficiently, evaluate and critically assess scientific data/information from a variety of sources.
B3	**Database and literature**	Demonstrate an awareness of the scientific database and the ability to perform basic academic literature search under the guidance of tutor.	Demonstrate a comprehensive awareness of the scientific database and the ability to perform academic literature search.	Critically evaluate the usefulness of the scientific database and perform independent literature search.	Critically evaluate the usefulness of the scientific database and show the strong ability of literature search to locate key information.
B4	**Academic communication and presentation**	Demonstrate basic academic presentation skills (oral and writing) in the subject of study.	Apply essential academic communication skills (oral and writing) in the subject of study.	Apply extensive academic communication skills (oral and writing) in the subject of study.	Apply professional academic writing and oral presentation skills in the subject of study.
B5	**Methodology and approaches**	Demonstrate fundamental understanding of methodology in laboratory work.	A comprehensive advanced understanding of methodology in laboratory work.	Critically understand the methodology in laboratory work.	Critically understand methodology in laboratory work, with ability to formulate and plan experiments.
B6	**Influences of science and technology**	A basic understanding of the influences of science and technology to the wider society.	A good understanding of the influences of science and technology to the wider society.	A critical understanding of the influences of science and technology to the wider society with case studies.	A critical understanding of the influences of science and technology to the wider society with case studies.

C Subject Skills

		Level 4 Cert. HE	Level 5 Dip. HE	Level 6 Ordinary	Level 6 Honours
C1	**Risk assessment**	Summarise the health and safety issues of laboratory experiments. Perform proper risk assessment under guidance from the tutor.	Comprehensive understanding and ability to summarise the health and safety issues of laboratory experiments. Perform proper risk assessment.	Critically evaluate health and safety issues of laboratory experiments. Perform proper risk assessment.	Critically evaluate health and safety issues of laboratory experiments. Be able to work on research project in the laboratory with minimum supervision.
C2	**Analytical Skills**	A basic understanding of the use of possible techniques and tools for the analysis of chemical substances.	A comprehensive understanding of the use of possible techniques and advanced instruments for the analysis of chemical substances	Critically appraise the possible techniques and instruments for the analysis of chemical substances.	Critically appraise the possible techniques for the analysis of chemical substances. Demonstrate certain ability to select, set up and use laboratory equipment.
C3	**Experimental procedure**	A basic knowledge on recording and appraising experimental observations and processing data results.	Record and appraise experimental observations in a logical, comprehensive and contemporaneous manner. Interpret data/scientific information in a meaningful, structured manner.	Record and appraise experimental observations in a logical, comprehensive and contemporaneous manner. Critically interpret data/scientific information in a meaningful, structured manner.	Record and appraise experimental observations in a logical, comprehensive and contemporaneous manner. Critically analyse and interpret data/scientific information in a meaningful, structured manner.
C4	**Research**	Appreciate the importance of research work in scientific area.	Understand and appreciate the general research methodology.	Critically appreciate the general research methodology and strategy.	Critically appreciate the general research methodology and strategy. Plan and conduct research, under supervision, to expand their knowledge base.

D Practical, Professional and Employability Skills

		Level 4 Cert. HE	Level 5 Dip. HE	Level 6 Ordinary	Level 6 Honours
D1	**Communication and Presentation Skills**	Communicate in a clear and concise way, in writing and orally, in particular demonstrating some competence in academic writing.	Communicate in a clear, systematic and concise way, in writing and orally, in more formal academic and professional styles, and in longer pieces of scientific writing.	Engage effectively in a variety of roles; debate in writing and orally; produce clear, structured scientific reports and other extended pieces of work in a variety of contexts.	Engage effectively in independent roles; engage effectively in debate in a professional manner, in writing and orally; produce detailed critiques and coherent scientific documents and project dissertation.
D2	**IT Skills**	Demonstrate basic use of the elements of Microsoft office; Word, Excel and PowerPoint. Demonstrate good skills in using the Internet and particularly virtual learning environment. Access data and information from University and other resources.	Apply more advanced IT skills; Use online databases effectively to gain information.	Access and use a limited selection of more specialist softwares related to subject. Conduct effective search for information using a range of online resources.	Access and use a limited selection of more specialist softwares related to subject for analysing experimental data. Conduct effective search for information using a range of online resources.
D3	**Learning Skills and time management**	Study in a systematic, directed way with the aid of appropriate tutor guidance. Finish all the tasks within the time frame set by the tutor.	Learn in an increasingly effective and purposeful way, with beginning of development as an autonomous learner. Demonstrate a responsible, ethical, professional approach to work.	Adopt a broad-ranging and flexible approach to study; identifies learning needs; pursues activities designed to meet these needs in increasingly autonomous ways. Work independently, setting and achieving appropriate goals.	With minimal guidance, manage own learning using a wide range of resources appropriate to profession; seek and make effective use of feedback. Effectively manage their time, and work within a framework where there are competing priorities and values.

D4	**Interactive and Group Skills**	Interact with tutors and fellow students; participate in clearly defined group situations.	Gain more advanced interactive and group skills, including effective participation in more demanding group tasks, including a group project and meet obligations to others.	Interact effectively within a learning or subject-specific group, giving and receiving information and ideas and modifying responses where appropriate.	Interact effectively within learning or professional groups; recognise, support or be proactive in leadership; negotiate in a professional context and manage conflict.
D5	**Problem-Solving**	Apply basic theory and methods to a well-defined problem and appreciate the complexity of the issues in the subject.	Identify key areas of problems and choose appropriate tools/methods for their solution in a considered manner.	Be confident and flexible in identifying and defining complex problems and can apply appropriate knowledge and skills to their solution.	Be increasingly independent, confident and flexible in identifying and defining complex scientific problems, and in the application of knowledge and skills appropriate to their solution.

CURRICULUM MATRIX demonstrating how the overall programme outcomes are achieved and where skills are developed and assessed within individual modules.

			Knowledge and understanding, intellectual skills, subject skills, and practical, professional and employability skills																			
	Module Title	*Core/ Opt*	***A1***	***A2***	***A3***	***A4***	***A5***	***B1***	***B2***	***B3***	***B4***	***B5***	***B6***	***C1***	***C2***	***C3***	***C4***	***D1***	***D2***	***D3***	***D4***	***D5***
4	SCI414 Introduction to Chemistry	*C*	*				*	*	*	*	*		*				*	*	*			*
	SCI415 Maths and Statistics in Science	*C*					*												*			*
	SCI421 Academic Study Skills and Personal Development	*C*					*		*	*	*						*	*	*	*	*	
	SCI416 Laboratory Chemical Analysis	*C*	*	*			*	*	*	*	*	*		*	*	*	*	*	*	*	*	*
	SCI422 Foundation Green Chemistry	*C*	*	*		*			*	*	*	*	*	*		*	*	*	*			
	SCI423 Inorganic and Materials Chemistry	*C*	*		*		*		*	*	*				*		*	*	*	*		*
5	*Module Title*	*Core/ Opt*	***A1***	***A2***	***A3***	***A4***	***A5***	***B1***	***B2***	***B3***	***B4***	***B5***	***B6***	***C1***	***C2***	***C3***	***C4***	***D1***	***D2***	***D3***	***D4***	***D5***
	SCI509 Analytical Methods	*C*	*				*	*	*	*	*		*		*		*	*	*			*
	SCI516 Introduction to Nanotechnology	*C*	*		*	*		*	*	*	*				*			*		*		
	SCI517 Structure and Synthesis	*C*	*			*	*	*	*	*	*						*	*	*	*		*
	SCI512 Instrumental Analysis	*C*	*	*			*	*				*	*		*							*
	SCI513 Laboratory Instrumental Analysis	*C*	*	*			*	*	*	*	*	*	*	*	*	*	*	*	*			*
	SCI518 Work Related Learning	*C*			*			*	*	*	*	*	*	*			*	*	*	*	*	*
6	*Module Title*	*Core/ Opt*	***A1***	***A2***	***A3***	***A4***	***A5***	***B1***	***B2***	***B3***	***B4***	***B5***	***B6***	***C1***	***C2***	***C3***	***C4***	***D1***	***D2***	***D3***	***D4***	***D5***
	SCI609 Drugs and toxicology	*O*	*				*	*	*	*	*		*		*			*	*		*	*
	SCI614 Polymer Chemistry and Formulations	*O*	*	*	*		*	*	*	*	*	*		*		*	*	*	*	*	*	*
	SCI615 Topics in Nano technology	*C*	*		*			*	*	*	*		*				*	*	*	*		*
	SCI616 Advanced Nano-semiconductors	*C*	*		*		*	*	*	*	*		*		*	*	*	*	*	*		*
	SCI617 Advanced Green Chemistry	*C*	*	*		*	*	*	*	*	*	*	*	*		*	*	*	*	*		*
	SCI618 Research Project	*C*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*

Learning and teaching strategy used to enable outcomes to be achieved and demonstrated

Learning and Teaching Strategies

Modules will be taught *via* a range of delivery methods, appropriate to the material covered:

- Lectures
- Seminars and workshops
- Laboratory classes
- Tutorials
- Independent study
- IT supported learning
- Work-related learning

Lectures
Lectures will be used to provide students with an introduction to each topic, covering the fundamental factual and theoretical material. This delivery method ensures all students gain a common, firm basis on which to build. During the course of lectures students will also develop key transferable skills such as active listening and note taking.

Seminars and workshops
Seminars and workshops will be used to support lecture material, providing opportunities for more student-centred, interactive learning and the development of problem solving skills. Seminars and workshops deepen students' knowledge and understanding of a particular subject, and their ability to sort and critically evaluate information. Students will also have the opportunity to develop presentation, communication and team working skills.

Laboratory classes
In laboratory classes, students will gain hands-on experience of the various experimental techniques used in chemical and instrumental analysis. Laboratory classes enable students to develop their practical skills in a simulated work environment. Practical and problem solving skills will be strongly developed, as will students' written communication skills. The Department has a wide range of instrumentation such as Fourier Transform Infrared Spectrometers, Fluorescence Spectrometer, High Performance Liquid Chromatography, Gas Chromatography, Ion Exchange Chromatography, Atomic Absorption Spectrophotometer, Ultraviolet/Visible Spectrometers, Particle Sizers, Particle Image Analysers, Constant Stress Rheometers, Extensional Rheometer, Controlled Strain Rheometer, Scanning Electron Microscope, Electron Spin Resonance Spectrometer, Matrix Assisted Laser Desorption Ionisation Time of Flight (MALDITOF) Mass Spectrometer, Differential Scanning Calorimetry and Isothermal Titration Calorimetry.

Tutorials
Small group tutorials provide students with the opportunity to explore themes and ideas in an in-depth, self-directed, but staff guided fashion. Tutorials play a pivotal part in the personal development of students, building confidence and developing communication skills.

Independent study
Independent study is a key element in any degree programme promoting self-discipline and reflective learning at a pace set by the learner, which is essential to their employability skills. Initial staff-directed self-study will, as the student progresses, give way to student-directed self-study, which enables the learners to expand their knowledge and explore the subject matter to the full limit of their abilities. It also facilitates the development of students' peer and self-assessment skills.

IT supported learning

Virtual learning environment (VLE) will be extensively used to support the teaching and learning of all the modules in this programme, with the emphasis of student's independent study. Through Moodle VLE, students will be able to access all the course materials (including lecture notes, PowerPoint slides, e-books, e-journals and softwares *etc*.), try exercises and quizzes, use the virtual learning chemistry software LabSkills and participate in online forums and discussion boards. The reading of e-journals, available from Science Direct, enhances knowledge and helps students evaluate information critically.

Students will be given an introduction to all of the available learning resources during Induction. The Programme handbook is available electronically and is updated annually and supplemented with other materials during the programme, such as Module Handbooks containing detailed assessment tasks. The programme assessment guidelines and grading criteria (including penalties for late submission and plagiarism). It contains advice about writing assessments and scholarly requirements for the presentation of work and the code of ethics which students will be expected to adhere to for example in relation to boundaries of confidentiality.

Work-Related Learning

Experience of a work environment will be based on site visitations, working practice/simulated scenarios and invited guest speakers. Work related placements (20 hours) for the research project can be based in either an industrial or teaching setting. The placement supervisor (in the case of a real workplace) will be a mutually agreed person at the workplace who is deemed capable of providing the student with appropriate advice and guidance as necessary to assist the student in the understanding and completion of the work related learning. The mutual agreement for the placement supervisor will be between the module tutor and the student studying on the module. The placement supervisor (in the case of WRL taking place in a simulated workplace) will be either the module tutor or another appropriate academic who could fulfil this role. Again, they will be deemed capable of providing the student with appropriate advice and guidance as necessary to assist in the understanding and completion of the work related learning. The placement supervisor will provide feedback on the students' performance and participation in the WRL aspects of the module to the Module Tutor, but will not be formally involved in the marking of the assessments for the module. A work related placement handbook (Appendix 1) will be made available to all students.

Welsh Medium Provision

In line with Glyndŵr University's Welsh Language Policy, students are entitled to submit assessment in Welsh. The programme however will be delivered through the medium of English.

Assessment strategy used to enable outcomes to be achieved and demonstrated

Any assessment has three primary aims:

(i) To provide a framework for the assessment of students' competence, knowledge and understanding and a method for evaluating a student's abilities for the purposes of progression and certification.

(ii) To provide a vehicle for the promotion of student learning, during the stages of both preparing for the assessment and reading feedbacks from the tutors afterward.

(iii) To provide information to teaching staff and external examiners on the quality of the provision and to ensure equity of standards across the HE sector.

The most appropriate methods of assessment vary between modules. The methods of assessment used will reflect the content and learning objectives of each module, ensuring that students get different opportunities to showcase their ability, knowledge, understanding and transferable skills. Students will be made fully aware of the methods of assessment and the weighting of individual components to be used in each module from the outset, as well as the marking criteria *etc*.

The following methods of assessment will be used:

i. Unseen written examination
ii. Problem solving (open-book)
iii. Short question assignments
iv. Written reports/research essay
v. Oral presentations
vi. Poster presentations
vii. Portfolio
viii. Dissertation

Unseen written examinations

Unseen written examinations test a student's knowledge and understanding of the subject matter, along with their ability to develop lines of argument, solve problems and work independently. Assessment by unseen written examinations is expected by professional bodies, such as the Royal Society of Chemistry, and will be used as part of the assessment process in modules with a substantial lecture component.

Problem solving (open-book)

In open-book problem solving assessments students will be asked to apply their knowledge and understanding to solving new problems, testing their critical thinking, and analysis of data, rather than their ability to recall information.

Written reports/assignments

Report writing is another key skill for scientists. Data must be correctly noted and presented in a logical, coherent fashion, understandable to both fellow scientists and lay persons. Written assignments enable a student to develop a fuller understanding and explore ideas in more depth. Written reports and assignments test a student's critical thinking, information collection, management and communication skills. Group assignments also develop team working and interpersonal skills.

Practical tests

Employers demand science graduates with a high degree of practical skill. Practical tests enable these skills to be assessed. In addition to testing a student's ability to perform specific tasks, practical tests also assess a student's ability to evaluate a problem and form a plan of action, collect and process data/information, manage their time effectively and learn independently.

Oral presentations

Oral presentations promote self-confidence, and develop verbal and visual communication skills. Other skills developed/assessed include time management, critical thinking, planning, research, and, of group projects, team working and interpersonal skills.

Poster presentations

Scientific information is often disseminated in the form of a poster presentation. It is therefore important that students are able to compile information and present it in a cogent fashion *via* this medium. A student's critical thinking and judgement, time management, information management and communication skills are also challenged by this form of assessment.

Portfolio

Typically, a portfolio will contain a number of pieces of work, usually connected by a topic or theme. A practice-based portfolio requires signing-off by a mentor or supervisor.

All assessments are peer reviewed for consistency of standard and layout before issuing to students. All module assessments for level 5 and 6 will be approved by the programme leader, academic head and sent to the external examiner in line with university regulations, to ensure that each assessment is explicit in its intent, and that it is valid and reliable. Samples of student assessments for each module are double marked by a tutor in the same subject area in order to ensure the correct standard of marking. Samples of marked assessments are then sent to the External Examiner for further scrutiny. All stages of peer review and double marking are recorded on a proforma for each module.

Students will receive formative assessment, particularly during the practical and self-study elements of the programme to ensure they can keep track of their progress and development. This will also be a key factor in ensuring student engagement and retention on the programme of study. In the case of practical assessment, there may be a final summative assessment, so more frequent formative assessment provides academic rigour and increases student awareness and confidence in the subject.

Module leaders will collate work and are responsible for presenting this at assessment boards, to enable ratification of results. External examiners will attend assessment boards and contribute to the process, to ensure external validity of assessment. Students will be informed of provisional results prior to an assessment board, and in writing following ratification of the results, with re-submission dates if needed.

An overview of module assessments throughout the programme, with an indication of submission dates in a typical academic year is summarised in the table over the page.

	Module	Assessment type and weighting	Assessment loading	Indicative submission date
LEVEL FOUR	SCI414 Introduction to Chemistry	50% Coursework 50% In class test	1,500 words 2 hours	Week 12, Tri 1 Week 13, Tri 1
	SCI415 Maths and Statistics in Science	50% Coursework 50% In class test	1,500 words 2 hours	Week 13, Tri 2 Week 13, Tri 2
	SCI421 Academic Study Skills and Personal Development	100% Portfolio	3,000 words	Week 12, Tri 1
	SCI416 Laboratory Chemical Analysis	50% Exam 50% Practical examination & written report	1 hour MCQ 2 hours	Week 13, Tri 2 Week 13, Tri 2
	SCI422 Foundation Green Chemistry	40% In class test 60% Portfolio	1 hour 3,000 words	Week 12 ,Tri 1 Week 13, Tri 1
	SCI423 Inorganic and Materials Chemistry	50% Exam 50% Poster Presentation	2 hours 1500 words	Week 13, Tri 2 Week 11, Tri 2
LEVEL FIVE	SCI509 Analytical Methods	50% Coursework 50% Examination	1500 words 2 hours	Week 10 ,Tri 1 Week 14, Tri 1
	SCI516 Introduction to Nanotechnology	50% Learning Logs 50% Examination	2,000 words 2 hours	Week 11,Tri 1 Week 14, Tri 1
	SCI517 Structure and Synthesis	50% Coursework 50% Examination	1500 words 2 hours	Week 10, Tri 2 Week 14, Tri 2
	SCI512 Instrumental Analysis	50% In class test 50% Examination	2 hours 2 hours	Week 14, Tri 2 Week 14, Tri 2
	SCI513 Laboratory Instrumental Analysis	100% Laboratory Portfolio	3,500 words	Week 13, Tri 2
	SCI518 Work Related Learning	100% Portfolio	3,500 words	Part 1 of portfolio Week5 Tri 1 Part 2 of portfolio Week12 Tri 1
LEVEL SIX	SCI609 Drugs and Toxicology	50% Poster presentation 50% Exam	20 minutes 2 hours	Week 11, Tri 1 Week 15, Tri 1
	SCI614 Polymer Chemistry and Formulations	50% Case study 50% Report	2,000 words 2,000 words	Week 6 ,Tri 1 Week 12, Tri 1
	SCI615 Topics in Nanotechnology	50% Essay 50% Poster presentation	2,000 words 20 minutes	Week 11, Tri 2 Week 12, Tri 2
	SCI616 Advanced Nano-semiconductors	50% Essay 50% Exam	2,000 words 2 hours	Week 12, Tri 2 Week 14, Tri 2
	SCI617 Advanced Green Chemistry	50% Report 50% Presentation	2,000 words 20 minutes	Week 8, Tri 1 Week 12, Tri 1
	SCI618 Research Project	20% Presentation 80% Dissertation	15 minutes 7,000- 9,000	Week 13, Tri 2 Week 14, Tri 2

Assessment regulations that apply to the programme

Glyndŵr University regulations for Bachelor Degrees, Diplomas, Certificates and Foundation Degrees will apply to this programme.

Requirement for raising classification in borderline cases:

- At least 50% of the credits at level 6 fall within the higher classification.
- All level 6 modules must have been passed at the first attempt.
- The mark for the 40 credit Research Project module at level 6 must fall within the higher classification.

Programme Management

Programme management

The programme team includes:

Dr Amiya Chaudhry (senior lecturer in science and **programme leader**)
Dr Jixin Yang (senior lecturer in chemistry)
Dr Ian Ratcliffe (senior lecturer in science)
Dr Clive Buckley (principal lecturer)
Dr Vincent Barrioz (senior research lecturer)
Dr Chandra Senan (senior research officer)
Dr Joss Bartlett (admissions tutor)

The Programme will be managed under the auspices of the Department of Chemistry and the programme will operate in close collaboration with the School for Undergraduate Studies Office. A designated Programme Leader for this programme will be responsible for the day-to-day running of it. Responsibilities and duties of the Programme Leader include the following:

- The management and development of curriculum and the course portfolio;
- Student tracking and student records;
- Management/co-ordination of overall assessment activities across the programme;
- Collation of results, presentation of data at assessment boards;
- Liaison with external bodies and agencies;
- Quality assurance and annual monitoring, including compilation of the Annual Monitoring Report;
- Co-ordination of admissions activities, including student induction.
- Co-ordination of other recruitment activities, including relevant publicity activities.

At module level there is devolved responsibility (module leader) for the following:

- The maintenance and development of teaching and learning materials for all students enrolled on the module;
- The publishing and updating of module timetables, which shall include a weekly schedule of module sessions and required reading, to be distributed to students at the start of all modules;
- The setting, marking and collation of marks for all module assessments and examination papers, including resit assessments, and submission of student results to the Programme Leader;
- Tutorial support for students taking the module which they are responsible for;

- Quality monitoring, including processing of annual student feedback questionnaires and, where appropriate, student feedback for individual modules;
- Liaison with part-time members of staff involved in module teaching.

Research and Scholarship underpinning the curriculum:

The programme team is actively involved in frontline research and scholarly activities that have informed and underpinned both the module content and the structure of the proposed programme. The student will benefit from the expert knowledge of tutors to expand their scope of learning, quality of their final year research project and the choice of exit routes from this programme. A brief introduction to the members in the programme team is given below.

The **Programme Leader, Dr Amiya Chaudhry** received her BSc (Hons) (1998) in Environmental Science and a PhD (2004) in Polymer Chemistry from the University of Sussex. Her PhD, funded by the Atomic Weapons Establishment UK was based on the characterisation and degradation of a typical room temperature vulcanized (RTV) filled foamed poly(dimethyl)siloxane rubber. Her research interests lie in the broad area of polymer degradation and biopolymers. In 2004 she was appointed as an associate lecturer at the Open University on a number of technology and science courses. In 2005 she joined the Materials Science Research Centre at Glyndŵr University as a knowledge transfer associate on a two-year research project funded by the Department of Trade and Industry and Almetron Ltd. In 2007 she took a permanent academic position teaching on the BSc Environmental Science and Forensic Science degree programmes and now she is the Fellow of Higher Education Academy (FHEA).

Dr Jixin Yang received his BSc in Nanjing University (China) in 1996 and MSc in Chinese Academy of Sciences (Beijing) in 1999. Since then he studied his PhD at University of Nottingham on transient species in conventional and supercritical fluid solutions by time-resolved infrared spectroscopy. After graduating in 2003, he worked as a postdoctoral research fellow at Nottingham, focusing on the area of materials chemistry. Dr Yang took the academic position at Glyndŵr University in 2009. Now he is actively involved in undergraduate/postgraduate teaching and research activities. Dr Yang is Charted Chemist (CChem), member of Royal Society of Chemistry (MRSC) and fellow of Higher Education Academy (FHEA). He has extensive research experience in nanotechnology and green chemistry (including metal and semiconductor nanoparticles and polymer nanocomposites *etc*.) gained in the last over 10 years and has published 26 research papers so far in peer-reviewed journals, including some high-impact ones such as Advanced Materials and Advanced Functional Materials. He is acting as a peer reviewer for a number of RSC journals in this area.

Dr Ian Ratcliffe has over 10 years industrial experience in product formulation across sectors including coatings, lubricants, cleaning products, personal care and pharmaceuticals. Subsequently he has gained over 13 years experience within the Centre for Water Soluble Polymers, mostly in research oriented positions, working on projects concerning controlled release, rheology, polymer synthesis, and latterly biopolymer modification and analysis. He is a member of the RSC Formulation Special Interest Group and committee member of the RSC North Wales Section. His research interests are within the 'green chemistry' field, particularly in the areas of biopolymers and their modification and characterisation. Ian was appointed as a lecturer in science in 2011 and also programme leader for postgraduate courses in Chemistry.

Dr Clive Buckley received his BSc (Applied Chemistry) in 1981 and his PhD (solid state chemistry) in 1985. He completed his MEd in 2001 and MA (Online and Distance Education) in 2009. Following the award of his PhD, Clive undertook post-doctoral research (3 years, MOD funded) on high-temperature battery systems before moving to Glyndŵr University in 1985. Clive has extensive teaching experience and has been programme leader for a number of courses including BSc Chemistry and MA Education. He is currently programme leader for the MSc Learning and Technology and seconded (0.6 FTE) to the University's Centre for Learning, Teaching and

Assessment where he is responsible for supporting the development of technology-enhance learning across the university. He has held an associate lecturer appointment with the Open University since 1995. He has also served as an external examiner to Keele and Edge Hill universities.

Dr Vincent Barrioz is the Low Carbon Research Institute (LCRI) Senior Research Lecturer, at the Centre for Solar Energy Research (CSER, http://www/cser.org.uk) on the OpTIC centre site in Glyndŵr University. VB has extensive working experience in the field of nanocrystals. His research interests cover deposition of thin film materials by metal-organic chemical vapour deposition (MOCVD), thin film solar cells and applications of advanced thin film materials to the solar energy and opto-electronics industry. Over the last 13 years, VB has worked on depositing, monitoring and characterising layers and devices through various means, with focus on photovoltaic research. His research has led to the development of key layers in the structure of an innovative atmospheric pressure (AP) all-MOCVD dry process, with systematic improvement in the device performance leading to a better understanding of the material's behaviour. His research is currently looking at scaling up the process (lower cost and high performance materials and devices) to a chamberless system and system integration of the produced devices. Vincent is a committee member of the Institute of Physics Wales (IOPW).

Dr Chandra Senan completed a bachelor's degree in Chemistry and subsequently a Master's degree, including a dissertation concerning synthesis of various copolymers (hydrogels) – suitable for use as contact lens materials - by means of solution polymerisation. He then worked as research polymer chemist in Luxembourg for the International Synthetic Rubber Company for 4 years, carrying out numerous projects on both natural and synthetic rubbers. On returning to England, he did a Master's degree in Business Systems Analysis, his dissertation being the design of a materials database and its user interface. He then joined the Chemistry department of Glyndŵr University (known as the North East Wales Institute of Higher Education) and undertook his PhD on a part-time basis, obtaining his PhD in Physical Chemistry in 1999. His thesis involved the synthesis of a number of hydrophobically modified sodium polyacrylates and the characterisation of their solution and adsorption properties by rheology and electron spin resonance spectroscopy.

Quality Management

Programme board meetings are held three times a year. The board consists of the programme team noted above. In addition to the matters raised by the programme team, the meetings consider the minutes from Staff-Student consultative committee (SSCC) meetings which are held two times a year, and are attended by student representatives from each level of the programme. Minutes of the SSCC meetings and team responses to the outcomes raised are published on Moodle available to all students.

Minutes from the programme boards then go forward to the relevant academic subject board, which the programme team also attend.

The formal mechanisms used to evaluate student perception of quality include the Student Evaluation of Module (SEM) form on each module, the feedback from the SSCC meetings noted above, and the NSS completed by final year students. Information from each of these is considered firstly at the programme board, and can if necessary also go to the academic subject board.

Quality is also monitored by the programme leader's annual monitoring report (AMR) and by the report of the external examiner. Issues arising from the examiner's report and from the above evaluations of student perception are responded with actions in the AMR. This is considered by the programme team and the head of department at an annual meeting, and the report and minutes of the meeting are forwarded to the academic quality assurance unit of the university.

Particular support for learning

Student Support
Many students find adjusting to higher education difficult and/or stressful. Support will be available to students from a variety of sources, both at programme level and at the institutional/university level.

All students will be allocated a personal tutor at the beginning of the programme to whom they can turn to for help and support in academic contexts. The personal tutor or programme leader is typically the first person to be approached by a student experiencing difficulties. If the problem cannot be resolved by the team, they may then be referred to the Academic Head of Department or to Student Services, as necessary. Staff members also operate an "open door" policy to promptly resolve students' queries and difficulties.

Students' attendance will be monitored at all classes using electronic registers, which enables the tutors to quickly identify any students with a poor engagement record in that module. Additionally, registers from different modules will be cross-referenced to ascertain if students are missing from Individual modules or from the programme as a whole, which is monitored by the administrators from the School for Undergraduate Studies Office. Students whose attendance gives cause for concern will be contacted by the Programme Leader in order to discuss the situation.

Students' academic progress will be monitored constantly throughout each module, through in-class quizzes and assessments. Students struggling academically are thus quickly highlighted, enabling appropriate remedial support to be offered.

An induction week will take place prior to the commencement of the programme where the team will set out to ensure that the students are informed and understand the programme requirements, the processes in place, such as student handbooks and personal tutor roles.

Each Level 6 student will be provided with a supervisor whose academic and research expertise matches the project in order to provide relevant support for the students.

Student' learning activities will be strongly supported by the use of Moodle. The electronic resources are an important part of the programme. A number of electronic books and journals can be accessed by students as well as the lecture material which is available on Moodle. The multiple functions of Moodle, such as news, forum, texting, Turnitin *etc*. are fully utilised to assist the programme delivery. We have also chemistry virtual learning software embedded in Moodle for students to use.

The University offers a wide range of support from welfare services, such as accommodation, finance, welfare, disability support, counselling, chaplaincy and healthcare provision, to practical services such as photocopying and laptop loaning. The support service teams are based in the Edward Llwyd Centre on the Plas Coch campus, together with the Library, IT Helpdesk and Careers Centre. Childcare facilities are also available to students.

Equality and Diversity

The programme team is committed to the needs of university stakeholders and to the recruitment of non-traditional students. Thus the student intake is likely to contain students who have a range of diverse needs either in terms of disabilities, illness, language, their family circumstances or work commitments. In accordance with our legislative obligations every effort is made to facilitate students with disabilities by arranging extra time or special facilities for assessments.