BSc Chemistry with Analytical Sciences (4 year Sandwich) **UCAS code: F181**

Awarding Institution:	The University of Reading
Teaching Institution:	The University of Reading
Relevant QAA subject benchmarking group(s):	Chemistry
Faculty of Science	Programme length: 4 years
For students entering Part 1 in 2003	Date of Specification: April 2003
Programme Director:	Prof HM Colquhoun
Programme Advisers:	Dr I. Mueller-Harvey and Dr MJ Almond*
Board of Studies:	Chemistry
Recognition:	Royal Society of Chemistry

* Dr WC Hayes will act as programme adviser during the year in industry.

Background

The proposed degree programme is based on several BSc Chemistry degrees that are established in the School of Chemistry and will utilise the same core chemistry modules as the 'pure' Chemistry degrees. In the BSc Chemistry with Analytical Sciences degree programme, the core analytical chemistry module from the 'pure' Chemistry degree courses is supplemented by four advanced analytical chemistry modules. In addition, the research project work in the School and the year in industry will be based on aspects of analytical science.

Summary of programme aims and learning outcomes

The programme aims to provide a thorough degree-level education in Chemistry with specific regard to analytical sciences. For a full statement of the programme aims and learning outcomes, see below. The programme is designed to receive recognition by the Royal Society of Chemistry.

Transferable skills

The University's Strategy for Teaching and Learning has identified a number of generic transferable skills that all students are expected to have developed by the end of their degree programme. In following this programme, students will have had the opportunity to enhance their skills relating to career management, communication (both oral and written), information handling, numeracy, problem solving, team-working and the use of information technology.

As part of this programme, students are expected to have gained experience and show competence in the following transferable skills: analytical methods, problem-solving, IT (word-processing, use of standard and mathematical software), scientific writing, oral presentation, team-working, time-management, use of library resources, career planning and management and business awareness.

Programme content

The course profile that follows states which modules must be taken (the compulsory part), together with one or more lists of modules from which the student must make a selection (the 'optional' modules). Students must choose an appropriate number of optional modules, in consultation with their programme adviser, in order to make 120 credits in each Part (the optional modules available in Part 1 are detailed in the supplementary material). The number of module credits for each module is shown adjacent to its title.

Part 1 (three terms)

Compulsory modules	*Title*	*Credits*	*Level*
CH1I1	*Introduction to Inorganic Chemistry*	20	C
CH1O1	*Introduction to Organic Chemistry*	20	C
CH1P1	*Introduction to Physical Chemistry*	20	C

Either			
BI1C10	*Cell Biology and Biochemistry*	10	C
BI1C11	*Genetics and Molecular Biology*	10	C
or/and			
AM1M11	*Microbiology 1*	10	C
AM1M12	*Microbiology 2*	10	C
Either			
1/CH/M	*Mathematics for Chemists*	20	C
or			
MA111	*Mathematics for Scientists*	20	C

Optional Modules
Students will select modules from outside the School to make up the total of 120 credits..

Part 2 (three terms)

Compulsory modules	*Title*	*Credits*	*Level*
CH2A1	*Analytical Chemistry and Professional Skills*	20	I
CH2I1	*Inorganic Chemistry 2*	20	I
CH2O1	*Organic Chemistry 2*	20	I
CH2P1	*Physical Chemistry 2*	20	I
CH2AA1	*Further Analytical Chemistry 1*	20	I
CH2AA2	*Further Analytical Chemistry 2*	20	I

Part 3 (three terms)

Compulsory modules	*Title*	*Credits*	*Level*
CH3PI1	*Industrial Project for BSc*	120	I

Part 4 (three terms)

Compulsory modules	*Title*	*Credits*	*Level*
CH3PR	*Project*	40	H
CH3A1	*Analytical Chemistry 2*	20	H
CH3AA1	*Further Analytical Chemistry 2*	20	H
Two modules selected from the following three:			
CH3I1	*Inorganic Chemistry 3*	20	H
CH3O1	*Organic Chemistry 3*	20	H
CH3P1	*Physical Chemistry 3*	20	H

Progression requirement
To proceed to Part 2, students must obtain:

at least an overall pass (≥40%) in Part 1, **and**
40% in the compulsory Chemistry modules (CH1I1, CH1O1, CH1P1) averaged together **and**
30% in every module.

- *Marks of less than 30% in a maximum of 20 non-core credits (1 module) will be condoned provided that the candidate has pursued the course for the module with reasonable diligence, has completed all required coursework and has not been absent from the examination without reasonable cause. For students taking CH1M, this module is considered as 'core'.*

To proceed to Part 3, students must obtain:

an overall pass (≥**40%**) in Part 2, **and**
at least **40%** in the compulsory Chemistry modules (CH2I1, CH2O1, CH2P1, CH2A1) averaged together, **and**
an average of 40% in the practical chemistry components of the core chemistry modules **and**
30% in every module.

In order to proceed to Part 4, students must receive a satisfactory report on their year's work in industry. The credits for Part 3 will be assessed in a pass/fail manner and so these credits will not contribute to the overall degree classification.

- *Marks of less than 30% in a maximum of 20 non-core credits (1 module) will be condoned provided that the candidate has pursued the course for the module with reasonable diligence, has completed all required coursework and has not been absent from the examination without reasonable cause.*

A pass of at least 40% in module CH3PR is required to qualify for an honours degree.

Summary of teaching and assessment

Teaching is organised in modules that incorporate a balance of lectures, tutorials, workshops and practical laboratory classes. Modules in Part 1 and 2 are assessed by a mixture of coursework and formal written examination. In Part 4, modules are either assessed wholly by coursework or by a mixture of coursework and formal written examination – details are provided in the module descriptions.

Part 2 contributes 33% and Part 4 contributes 67% towards the overall assessment.

To be eligible for Honours, students must normally pass H Level modules with a total credit of at least 80 in Chemistry. The degree awarded will be in accord with the University of Reading degree classification as detailed below:

Mark / %	Degree Classification
70-100	First Class
60-69	Upper Second Class
50-59	Lower Second Class
40-49	Third Class
35-39	Below Honours Standard
0-34	Fail

Admission requirements

Entrants to this programme are normally required to have obtained:
Grade C or better in English at GCSE level; and achieved
UCAS Tarif: 260 points from 3 A levels (with B in Chemistry at A2 level) or 260 points from 3 A levels and 1 AS level
International Baccalaureat: 30 points including 6 in Higher Chemistry; or
Irish Leaving Certificate: Grade B in Chemistry and three Bs and a C in four other subjects
Two AS grades are accepted in place of one A-level
BTEC Higher or National Certificate or Diploma with three merits in appropriate subjects.
Advanced GNVQ Science Merit with some additional mathematics.

Admissions Tutor: Dr Andy Russell (Chemistry) email : a.t.russell@rdg.ac.uk

Support for students and their learning

University support for students and their learning falls into two main categories. Learning support includes IT Services, which has several hundred computers and the University Library, which across its three sites holds over a million volumes, subscribes to around 4000 current periodicals, has a range of electronic sources of information and houses the Student Access to Independent Learning (S@IL) computer-based teaching and learning facilities. There are language laboratory facilities both for those students studying on a language degree and for those taking modules offered by the Institution-wide Language Programme. Student guidance and welfare support is provided by Personal Tutors, the Careers Advisory Service, the University's Special Needs Advisors, Hall Wardens and the Students' Union.

Within the providing Schools, additional support is given through practical classes in both Chemistry and Analytical Methods. The development of key analytical and problem-solving skills is assisted by extensive practice in practical laboratory classes and by the provision of structured workshop/tutorial problem sessions. A dedicated analytical laboratory has been created in the School of Chemistry in 2001 that features a comprehensive range of modern instrumentation that is prerequisite for courses of this type in order to provide the necessary 'hands-on' experience to the undergraduate students. There are Directors of Undergraduate Studies who are available to offer advice on the choice of modules within the programme. During the industrial placement year, support is provided by the assigned supervisor in the company in which the placement is being carried out and on an academic basis, from the School of Chemistry in the form of an assigned tutor and the industrial placement tutor, Dr WC Hayes.

Career prospects
The need for biochemical, chemical and physical analysis spans across numerous fields and consequently there is always a high demand for skilled, well-trained Chemists with specialist skills in analytical science. Analytical chemists therefore find employed in a diverse range of situations: to solve an environmental issue, provide routine water quality analysis, determine the purity of a drug or to help investigate an athlete who is suspected of using illegal performance enhancing drugs.

However, the employment prospects are not only limited to chemistry-based careers – as consequence of the numeracy and report-writing skills developed in this course and exposure to the legal aspects of chemical analysis, graduates with a degree in Chemistry with Analytical Sciences will be employable in vocations such as accountancy and law.

Opportunities for study abroad or for placements
The course has been designed with the specific aim of incorporating a one-year industrial placement into the programme. An industrial placement is a key factor to a degree course of this type and will enhance the skill base and employment prospects of the undergraduates taking part. The 'value-added' factor received from an industrial placement is enormous. The School of Chemistry has numerous contacts with a wide range of industries who are keen to place Reading Chemistry undergraduates within their laboratories and is thus well placed to run courses of this nature. A member of staff, Dr W C Hayes, is the industrial placement tutor and acts as the liaison and co-ordinator between the School of Chemistry and the various industrial companies involved with this programme.

The School of Chemistry has a strong track history for enabling study abroad, both in terms of its MChem with a year in Europe degree and *via* the SOCRATES exchange programme. Students registered on the BSc Chemistry with Analytical Sciences degree programme will be able to take advantage of the SOCRATES exchange programme and undertake their final year project at one of the participating European universities:– Bordeaux, Strasbourg (both Louis Pasteur and ECPM) (France); Braunschweig, Dortmund, Essen, Stuttgart (Germany); Thessaloniki (Greece); Lisbon (Portugal); Santiago, Tarragona, Zaragoza (Spain) and KTH Stockholm (Sweden).

Educational aims of the programme
The programme aims to provide a thorough degree-level education in Chemistry with particular emphasis on analytical science. The primary objective is to produce competent well-rounded chemists first and foremost , but who are also able to carry out a variety of modern analytical techniques and consequently able to:

- Assess/evaluate an analytical problem
- Develop appropriate analytical methodologies
- Accurately record/measure data;
- Analyse and evaluate the results obtained;

- Report the data in an appropriate form and critically assess the results obtained.

The primary aim of this programme is to produce chemists who are equipped with analytical skills and thus employable by the wide range of industries who require chemical analysis.

Programme outcomes
The programme provides opportunities for students to develop and demonstrate knowledge and understanding, skills, qualities and other attributes in the following areas:

Knowledge and Understanding

A. Knowledge and understanding of:	**Teaching/learning methods and strategies**
1. the fundamental concepts and techniques of chemistry 2. a selection of more specialist topics in the three main branches of the subject and in analytical chemistry 3. the main techniques involved in practical work 4. the spectroscopic methods used to identify molecules and to determine their structure and the basics of the underlying theory.	The knowledge required for the basic topics is provided in formal lectures supported by problem sets for students to tackle on their own and which are discussed formally in tutorial sessions with members of staff. 2 is addressed particularly during Part 4 of the course. Practical classes are held throughout Parts 1 & 2 in which students develop their skills prior to applying them in their Part 3 &4 projects. Feedback on student work is provided by the discussion and return of work in tutorials and by regular workshop sessions during which students tackle unseen problems in the presence of academic staff who provide support. All practical work is marked and returned to the student. *Assessment* Most knowledge is tested through a combination of coursework and unseen formal examinations, although 3 is assessed by coursework. Dissertations and oral presentations also contribute to assessment, particularly in Part 4.

Skills and other Attributes

B. Intellectual skills – able to:	**Teaching/learning methods and strategies**
1. think logically 2. analyse and solve problems 3. organise tasks into a structured form 4. understand the evolving state of knowledge in a rapidly developing area 5. transfer appropriate knowledge and methods from one topic within the subject to another 6. plan, conduct and write a report on an independent project 7. construct a poster 8. work in an industrial environment.	Logic is an essential part of the understanding and construction of synthetic methods and mechanistic pathways which form the framework for much organic and inorganic chemistry. While not exclusively the preserve of physical chemistry, problem solving plays a major part in this section of the course. Latest developments in the subject are introduced where appropriate, particularly in Part 4. Practical reports in Part 1 & 2 provide training for the Part 3 & 4 project reports. *Assessment* 1-4 are assessed directly and indirectly in most parts of this chemistry course, while 5 contributes to the most successful work. 6 & 7 are assessed in the Part 3 project report. 8 is assessed through the report on the placement year.

C. Practical skills – able to:

1. follow practical instructions safely and accurately
2. carry out a variety of experimental procedures
3. measure and interpret various spectroscopic techniques
4. interpret quantitatively the results of their experiments
5. formulate safety protocols
6. devise suitable experimental methods for tackling a particular problem

Teaching/learning methods and strategies

Detailed practical manuals are provided for all practical courses in Parts 1 & 2, together with sources of recommended further reading. Staff and post-graduate demonstrators are present during every practical session to guide and help students and to mark their reports.

Workshop sessions are held to assist students in interpreting spectroscopic information obtained on unknown compounds.

In Part 4 students work on individual projects under the supervision of one or more members of staff.

Assessment

1 to 4 are tested to different extents by the practical work associated with Parts 1 - 3 of the chemistry course.

3 is assessed through problems set in written examinations.

5 is specifically assessed during the organic practical course in Part 2, although safe working procedures are emphasised at every stage.

3 is specifically but not exclusively assessed within core modules CH2A1 and CH2AA1.

6 is assessed in the Part 4 project and during the placement in Industry.

D. Transferable skills – able to:

1. use IT (word-processing, spreadsheets and chemical databases)
2. communicate scientific ideas
3. give oral presentations
4. work as part of a team
5. use library resources
6. manage time
7. plan their career.

Teaching/learning methods and strategies

The use of IT is embedded throughout the side of the programme but, is specifically addressed in the core modules CH2I1, CH2O1, CH2P1.

Team work and career planning are both part of module CH2A1 and the former in the taught practical classes in Part 2. Oral presentations are associated with modules CH3A1 CH3I1 and CH3PR.

Library resources are specifically addressed through a small project in module CH3A1, and within the fourth year project.

Time management is essential for the timely and effective completion of the programme

Assessment

1 - 5 contribute assessed coursework within the two compulsory modules on analytical and professional skills, CH2A1 and CH3A1.

Career planning is assessed through the 5 credit CMS course embedded within module CH2A1.

Please note – This specification provides a concise summary of the main features of the programme and the learning outcomes that a typical student might reasonably be expected to achieve and demonstrate if he/she takes full advantage of the learning opportunities that are provided. More detailed information on the learning outcomes, content and teaching, learning and assessment methods of each module can be found in the study module guide and programme handbook.