Nottingham Trent University Course Specification

	Basic Course Information	
1	Awarding Institution:	Nottingham Trent University
2	School/Campus:	School of Science and Technology
3	Final Award, Course Title, and Modes of Study	MRes Chemistry Full Time and Part Time
4	Normal Duration:	12 months FT; 24-36 months PT
5	UCAS code:	FT September intake: CHEM087 FT January intake: CHEM088 PT September intake: CHEM089 PT January intake: CHEM090

6 **Overview and general educational aims of the course**

This exciting course in Chemistry is designed to give you the theoretical and practical skills needed to enter a career in chemistry or an allied science either in an academic institution, a research institute or in the industrial/business sector. In particular, it will give you the opportunity to develop your practical skills through an extended laboratory-based research project. It will also enable you to develop an ability to plan a research project, apply effective data analysis skills to your results, and to communicate your findings in an articulate and professional manner.

This course is ideal if you are:

- a recently qualified graduate with the equivalent of a good UK honours degree in chemistry and are looking for the professional skills needed to obtain a job in an chemistry research related area or a career in academic research involving chemistry;
- are working for a company in chemistry or an allied science and want a masters-level qualification to give you a competitive edge;
- are a graduate of a general science degree with some chemistry content (examples include: forensic science, environmental science, etc.) and are interested in broadening your career options.
- are a student in any one of these groups who is interested in a bridging degree programme between your undergraduate course and doctoral study.

In summary, the course aims to:

- provide an intellectually challenging and professionally relevant course at the forefront of chemistry, led by academic and professional experts;
- explain how the boundaries of knowledge in this discipline are advanced through research and enable you to conduct research through an extended, academically rigorous research project;
- give you opportunities to deal with complex issues in a systematic and creative way and show originality in solving problems;
- develop the theoretical and practical skills needed to plan and execute an in-depth laboratory-based chemistry research project;
- produce post-graduates who have sound judgement, personal responsibility and initiative, thus making them attractive to employers and doctoral programs.

You have the option switch to one of the other named MRes awards, namely: MRes in Analytical Chemistry, Pharmaceutical and Medicinal Science, Pharmaceutical Analysis or Advanced Materials Engineering, during your studies if you meet the appropriate learning outcomes (see appropriate course specifications for more details).

Minimum competencies of prospective students will be assessed by the teaching team, international development office, marketing and the admissions teams prior to admission onto the course. This involves assessment of your academic and professional background and if required you will be asked to successfully complete a supporting module in analytical chemistry.

7 **Course outcomes**

Course outcomes describe what you should know and be able to do by the end of your programme if you take advantage of the opportunities for learning that we provide.

Knowledge and understanding. By the end of the course you should be able to:

- Critically discuss and communicate clearly the ideas and concepts inherent in chemistry and assess the scientific, social and commercial impact of current and future developments.
- evaluate, critically appraise and use objective information and approaches in chemistry.
- apply appropriate scientific methods and reasoning to the analysis of complex problems in the field of chemistry.
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Skills, qualities and attributes. By the end of the course you should be able to:

- undertake and communicate the findings of a substantial, novel laboratory based research project in chemistry
- take responsibility for planning and risk assessment of advanced laboratory procedures and be critical of outcomes including limits of accuracy
- learn independently for continuing professional development and interact with professionals from other disciplines.
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8 **Teaching and Learning Methods**

This course is delivered by a combination of traditional lectures, seminars and tutorials, together with laboratory classes and an in depth laboratory based research project.

The research project is the main focus of the MRes course. If you are a full-time student, you will have the opportunity to carry out a research project in a chemistry research group at Nottingham Trent University or with one of our industrial, academic or health sector partners. If you are a part-time student, you will normally conduct the research project in your own workplace. You will be provided with detailed guidance on how to complete the research project successfully, the milestones that must be achieved and the timescales involved. Students conducting their research project either out in industry or within NTU will be assigned a project supervisor who will provide specific advice and training. A personal tutor will be allocated to each student at the beginning of their studies to provide additional support through a minimum of five personal tutorials to beheld throughout the duration of the course.

9 **Assessment Methods**

In the taught part of the course, you will be assessed by a variety of different types of course work, and by formal examination in all one of the elected modules. The Research Project module will involve the design, implementation and reporting of a major research task. You will communicate your findings at an interim stage of the research project in peer-reviewed journal format and you will present your findings orally to your peers and to members of the Programmes Team. You will receive advice and training on data analysis and presentation skills in the induction week and in the Research Methods & Independent Study module.

You will be assessed in each module in a manner consistent with the aims, objectives and learning outcomes of the module. Assessed work will take one or more of the following forms:

- Interim research project report
  This is a detailed account of the investigations you conducted up to the half way stage of your research project. You will present your work in the form of papers in scientific journals.
- Research Project thesis
  This module tests your ability to design and implement a research programme, and communicate the findings to an informed audience in a comprehensive thesis, written in an appropriate scientific style.
- Written assignment
  This tests your writing skills. You are expected to consider the scientific problems of the assignment topic and the way in which they have been resolved; this must be fully referenced from the current literature.
- Oral presentation
  This assesses your oral communication skills. You will be assessed on your ability to communicate cogently using appropriate visual aids. You will also be assessed on your ability to answer questions with knowledge and authority.
- Poster presentation
  This is a written poster display of the findings of your research project or of a specific taught module task. It tests your ability to synthesise arguments and present them in a highly condensed, accessible and pictorial form. You will need to defend the work verbally to members of the Programme Team.
- Laboratory report
  This may take the form of a short report (laboratory file) or a long report (formal report) with extensive data analysis and interpretation.
- Computer based tests or computer aided learning packages
- Formal examination
  This involves a 2 hour examination in Master 20 credit point masters level modules.

- Minimum Competence

  Minimum competencies of prospective students are assessed by the teaching team, international development office, marketing and the admissions teams prior to admission onto the course. This involves assessment of your academic and professional background and if required you will be asked to successfully complete a supporting module in analytical chemistry.

10 **Course structure and curriculum**

The course may be taken on a full-time or part-time distance-learning basis over 2-3 years, respectively, with intakes in September and January each year. A summary of the MRes course is given below; however, it is possible to select an alternative specific award title from: MRes in Analytical Chemistry, Pharmaceutical and Medicinal Science, Pharmaceutical Analysis or Advanced Materials Engineering, if the selected pathway meets the corresponding learning outcomes (see appropriate course specification for more details).

Core modules for MRes Chemistry include:

Research Methods and Independent Study (20 credit points): This module aims to provide an underpinning in research skills relevant to the independent study required for a Masters-level project in Chemistry. You will be introduced to the techniques required to formulate a research project and to carry out a literature review, and you will be given practice in the use of the library and learning resources including relevant IT packages.

Research Project for MRes (120 credit points): To develop the application of knowledge and skills to enable the organisation, execution, analysis and interpretation of an original research project. To develop the ability to critically evaluate research literature in a topic area. To develop the skills of communication via a range of different media to a scientific research audience.

You must then select two additional 20 credit point M-level modules. Possible option choices include the following, subject to minimum student numbers:

Drug detection, analysis and screening (20 credit points): In this module you will develop concepts of analytical chemistry applied to the detection and analysis of drugs and drug containing materials by standard methods such as: IR and NMR spectroscopic techniques, GC/HPLC, related hyphenated techniques, and immunoassays; develop concepts in calibration and statistics through to an advanced level for the purpose of analysing complex samples containing drugs; be able to present the principles, technologies, and methods of large scale drug analysis such as those encountered in high throughput screening and rapid screening of samples; develop an understanding of the role of advanced spectroscopy, chromatography, multivariate data processing, biophysics and related disciplines to the analytical chemistry of drugs and drug containing materials; be able to analyse trends and explore potential future developments in the methods, instrumentation, and analysis of drugs and drug containing compounds.

Organic Synthesis & Characterisation of Biologically Active Compounds (20 credit points): This modules looks at retrosynthetic analysis and total synthesis of biologically important molecules. Synthetic methodology for the controlled formation of C-C bonds and functional group transformations. Structure elucidation of complex molecules, including advanced NMR analysis (^{1}H and ^{13}C 2D NMR spectroscopy) with applications to selected problems.

Inorganic Chemistry Beyond the Molecule (20 credit points): In this module you will investigate biomineralization as muse, aqueous and non-aqueous routes to small particles, nucleation and crystal/ particle growth, the partial charge model, the biomimetic approach, structures of proteins and small molecules, methods for the study of molecules at the 'interface'. Example studies including oxides and/or metals and application to biomaterials development. Supramolecular self-assembly; design, synthesis, analysis and application. Single crystal and powder x-ray diffraction theory and practice.

Physical Properties of Solid-state & Nano-composite Materials (20 credit points): This module will provide training in theoretical background, synthesis and characterization of inorganic and nanocomposite materials. These areas will include: classification of materials, synthesis methods (including solid state and solution based methods), characterization using solid state methods (DRIFT, diffuse reflectance UV, solid state NMR, X-ray/ neutron diffraction, XPS, EXAFS). Synthesis of carbon based nanomaterials and composites including fullerenes, carbon nanotubes and graphene. Synthesis of polymer/clay nanocomposites and measurement of their engineering and barrier properties. As a student you will be given direct practical

experience of synthetic and characterization methods in the form of practical laboratory sessions.

Chemotherapeutics (20 credit point): This module is split into three sections (i) Cancer Therapies Introduction to cancer, the cancer cell and drug targets in cancer chemotherapy. Mortality and the effects of cancer on patients. The anti-cancer drugs, antimetabolites, nucleotide synthesis in cells, the *de novo* and salvage pathways, pyrimidine antagonists. Covalent DNA binding drugs, alkylating agents, the nitrogen mustards, nitrosoureas, mechanism of action. Non-covalent DNA binding drugs, electrostatic binding, groove binding and intercalation. The anthracyclines, intercalation and interaction with topoisomerase. Inhibitors of chromatin function. Drugs that affect endocrine function. (ii)Antibacterial Agents A brief history of bacteria and antibacterial agents, introduction to the cell, prokaryotic and eukaryotic cells, the bacterial cell - Gram positive and Gram negative. The five major pathways of antibacterial action, bacteriostatins, inhibition of cell metabolism, the use of sulphonamide drugs as inhibitors of the folic acid pathway, the concept of selective toxicity. Ionophore antibiotics, interaction with the bacterial plasma membrane and ion transport. Bacterial protein synthesis, differences in prokaryotic and eukaryotic cells, use of aminoglycosides and tetracyclines as inhibitors of protein synthesis. Cell wall biosynthesis; synthesis of precursors, formation of peptidoglycans, cross-linking. The cross-linking process and the use of B-lactam antibiotics as inhibitors. Development of penicillins and cephalosporins, synthetic routes, penicillin resistance and the development of broad-spectrum antibiotics, suicide inhibitors. Inhibition of DNA transcription and replication, the significance of supercoiling and the use of DNA gyrase inhibitors. General synthetic routes to nalidixic acid analogues. (iii)Synthetic Methodology A brief review of those reactions commonly encountered in the synthesis of drugs and drug-like molecules. Case studies of two recent syntheses of current drugs.

11 **Admission to the course**

We wish to attract highly motivated and committed students who are seeking to gain skills and professional expertise in chemistry. We are interested in professionals in a public or private sector organisations wishing to obtain further qualifications or you may have just completed a first degree in chemistry or an allied discipline (biology, biochemistry, physics, forensic science, environmental science) to a high standard and wish to carry out an extended research project in a full-time or part time course. We are particularly keen to recruit students looking for a bridging degree between undergraduate general science degrees and Ph. D. work.

All recruitment and admission procedures will be conducted in accordance with the University's policy on equal opportunities. You will have to complete an application form and provide two references. To join the course you will normally be expected to meet one of the following requirements:

- To hold a undergraduate degree in chemistry (normally 2ii or higher) or equivalent in an allied discipline such as biology, biochemistry, physics, etc., and evidence of significant experience in laboratory based work (e.g. a sandwich placement year or good honours research project)

OR

- Such other qualification(s) and experience as the Admissions Panel deem to be equivalent in subject content and level of attainment (e.g. a 3rd with evidence of excellent laboratory experience).

You may have considerable laboratory experience but perhaps lack the academic qualifications required to join an MRes course. If this is the case, you may be still able to join the course, but the Admissions Panel will have to assess your prior (experiential) learning. You will be required to provide a detailed CV outlining your relevant experience and may be asked to undertake an assignment to demonstrate your skills in a particular topic of relevance to the Course.
A good command of spoken and written English is an essential requirement for the Course. If you are an overseas applicant from a non-English speaking country, the minimum recommended requirement is the British Council IELTS grade 6.5 or its equivalent. Equivalent experience may include the successful completion of a non-UK degree in the English language or a significant period of residence/work placement in an English speaking country, for which evidence should be provided.

We wish to attract graduate (or equivalent) applicants with a particular profile. Individuals who:

- are highly self-motivated and committed;
- can deal with the demands of intensive learning;
- have the study skills and background required to acquire and retain the theoretical and practical knowledge relevant to analytical chemistry;
- have effective oral and written communication skills;
- may have work experience in this area;
- will benefit from the programme.
- are excited by the opportunity to carry out a year long research project and motivated to try to publish the results in international journals.

An important consideration is the extent to which you will succeed on the Course and benefit from it.

Minimum competencies of prospective students are assessed by the teaching team, international development office, marketing and the admissions teams prior to admission onto the course.

12 **Support for Learning**

You will receive considerable support throughout this Course from administrative staff, the academics and consultants on the teaching team and the Course Leader. You will have a Research project Supervisor who will give you guidance on all aspects of your research project. The University also has many support mechanisms to deal with non-academic problems.
When you enrol on the course, you will receive a comprehensive Student Handbook, which includes information on:

- guidance on course aims, outcomes and content;
- advice on time management;
- writing and submitting assignments;
- taking tests;
- assessment criteria;
- completing a Student Progress File;
- regulations for student conduct;
- regulations for health & safety;
- academic and pastoral support;
- careers information;
- accessing University resources (Libraries and Learning Resources, C & IT, Student Support Services, Careers Advisory and Employment Service, Student Union etc.).

Detailed guidance is also provided for each module.

13 **Graduate destinations/employability**

There is a wide range of career opportunities within chemistry. You will work with leading academics and practitioners on your programme so you will have gained important academic and professional skills necessary to help you obtain employment in this field. At the end of the Course you will also have developed many transferable skills that will make you more attractive to potential employers possibly in a wide range of areas needing the skills of a well-trained chemist. The Research Project will give you the skills you need to follow a career in research and development.
The University's Careers Service has an enviable reputation for helping our graduates find employment and offers individual consultations.
If you are already in employment and are seeking to further your career within an organisation, this Course will give you the skills you need to bring added value to your organisation and further your career.

14 **Course standards and quality**

The Course Management Team takes day-to-day responsibility for managing the Course, under the overall direction of the Course Committee. You will be represented on this committee by a full-time and part-time student representative, elected by the students. You may wish to stand for election. Student feedback is collected on each module and discussed in an annual Module Leader's Report. These reports are discussed at the Course Committee. Other methods for ensuring the standards and quality of the course include:

- The External Examiner report on the standards and quality of the Course, submitted annually.
- When the course was designed, the QAA descriptors for a qualification at Masters (M) level: Masters degree, informed the learning outcomes of this programme.
- The University was the subject of a successful institutional audit by the Quality Assurance Agency in May 2008.

An important measure of quality is the feedback you receive on your work. The Course Team will ensure that you receive comprehensive feedback on all your assignments.

15 **Assessment regulations**

This Course is subject to the University's Common Assessment Regulations: Taught Postgraduate Courses (located in it Section 16C of the Academic Standards and Quality Handbook).

16 **Additional Information**

Collaborative partner(s):

Course referenced to national QAA

Benchmark Statements:

Course recognised by:

Date implemented:

Any additional information: