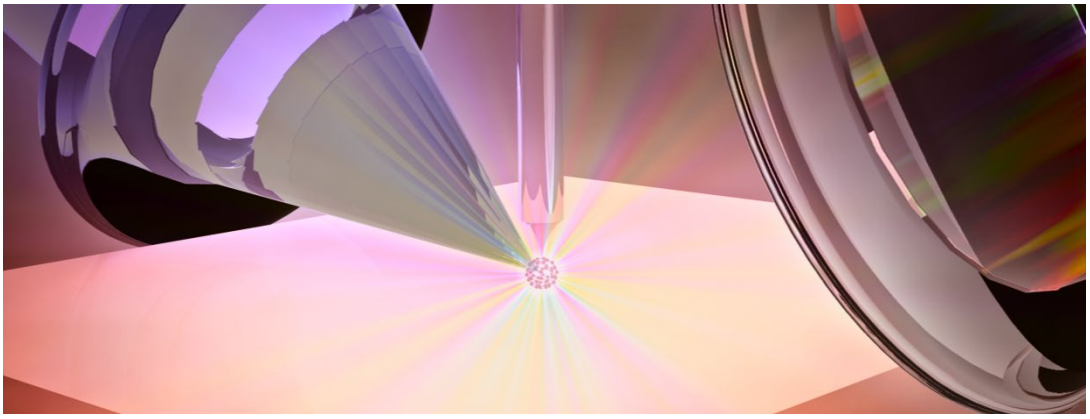
Course Handbook

MSc Nanoscience and Nanotechnology

2020/21

Course Leader: Dr Joe Smerdon

School of Natural Sciences



Please read this Handbook in conjunction with the University's Student Handbook.

All course materials, including lecture notes and other additional materials related to your course and provided to you, whether electronically or in hard copy, as part of your study, are the property of (or licensed to) UCLan and MUST not be distributed, sold, published, made available to others or copied other than for your personal study use unless you have gained written permission to do so from the Dean of School. This applies to the materials in their entirety and to any part of the materials.

Contents

1. Welcome to the course

The ‘nano’ in nanoscience refers to a length scale of a billionth of a metre (a nanometre). The difference between metres, millimetres, micrometres and nanometres is a thousand-fold each time. The important thing about nanometres is that as you descend from the microscale to the nanoscale, individual atoms and molecules start to be able to be discerned from the swirling masses.

Nanoscience is therefore science that is conducted on a length scale at which one may be dealing directly with the fundamental granularity of matter. This has been determined to be sub 100 nm. Technologies on this scale require different tools for assembly, and give access to different kinds of properties. Most of the benefits currently derived from nanotechnologies are the direct result of miniaturization (for example, squeezing more transistors onto a chip for increased performance). These are already some of the biggest drivers of the global economy; however, there is even greater potential for technologies that directly use the granularity of matter and concomitant emergent properties, rather than attempt to circumvent it.

This course will give students a solid foundation in nanoscience. There is a strong industrial component, to give the course a direct professional application, including an optional placement year with an industrial partner. However, this does not leave the fundamental physics and chemistry short: these are explored in depth via several core and optional modules. Introductory material is complemented with in-depth studies of various topics that particularly stand to benefit from nanoscience.

The course is offered by the School of Natural Sciences. It is taught by staff from Physics and Chemistry. It is at the nanoscale that all of the sciences intersect: physics teaches us how electrons behave, chemistry teaches us how they are exchanged between atoms to form molecules and molecular biology teaches us how nanomachines are ultimately the building blocks of life. The course will therefore be particularly attractive to graduates holding Physics or Chemistry degrees.

The multidisciplinary team of staff from each area comprises researchers and educators with excellent academic profiles who are world leaders in their respective areas. The facilities available to the course are excellent, particularly the new J. B. Firth Analytical Suite, which permits access to most modern techniques. Specialised equipment is also available to support the course.

As mentioned above, a particularly strong point of the course is the industrial component. This has been structured to increase the value to prospective employers of our graduates by ensuring that they will have been exposed to and solved problems in industry chosen collaboratively with industrial partners. Combined with the optional year in industry, this provides a highly desirable and credible route to employment, or to personal and professional development for existing employees.

1.1 Rationale, aims and learning outcomes of the course

This list of the major learning outcomes of the programmes will give you an idea of the global learning goals. However in the module booklets you will see the syllabuses of the individual modules and their learning outcomes that will give you more information. You could also refer to the module descriptions, which are in effect summaries of the module booklets and are available on BlackBoard.

Aims of the Programme

- To develop the student's knowledge of the core science required to understand nanotechnology
- To provide students with the ability to plan and carry out experiments independently and assess the significance of outcomes
- To develop in students the knowledge required to discuss the opportunities and challenges in nanoscience
- To instil a critical awareness of advances at the forefront of nanotechnology and nanoscience
- To prepare students effectively for professional employment or doctoral studies in the area of nanoscience

Learning Outcomes

The programme provides opportunity for learners to achieve the following outcomes:

Knowledge and Understanding

- Have detailed knowledge of current issues and opportunities in nanoscience and nanotechnology.
- Present scientific information clearly and concisely
- Research information from literature/manuals/internet.
- Effectively plan a project and record data and perform critical analysis.
- Design, plan and implement research questions to problems in nanotechnology including evaluation of hazards and environmental effects.
- Develop general strategies for analysis including the identification of additional information required and problems where there is not a unique solution.

Subject-specific skills

- Be able to determine which experimental technique to employ for which type of study.
- Demonstrate competence in the planning, design and execution of experiments
- Evaluate different potential solutions to an unfamiliar problem.
- Work independently, under minimum supervision, and be self-critical in the evaluation of risks, experimental procedures and outcomes.
- Use an understanding of the limits of accuracy of experimental data to inform the planning of future work.

Thinking Skills

- Evaluate technical and theoretical information
- Adapt and apply methodology to the solution of unfamiliar problems.
- Assimilate, evaluate and present research results objectively.
- Undertake an individual research project, the outcome of which is potentially publishable.
- Assess the success of such a project.

Other skills relevant to employability and personal development

- Problem-solving skills including the demonstration of self-direction and originality
- Communicate and interact with professionals from other disciplines
- Ability to exercise initiative and personal responsibility
- Ability to make decisions in complex and unpredictable situations
- Independent learning ability required for continuing professional development.
- Work independently under minimum supervision.
- Develop and write a research project within guidelines and be able to assess the success of such a project.

It is often useful to know which learning outcomes will be covered in the different modules; hence it is highly recommended to see the appendix where you can see a table containing the curriculum skill map.

1.2 Course Team

The course team is responsible for the academic delivery of the programme. The members of the course team are:

Joe Smerdon	BSc (Hons) PhD (Physics) e-mail: jsmerdon@uclan.ac.uk Ext 2700 Room Le006
Serban Lepadatu	MEng (Hons) PhD (Physics) e-mail: slepadatu@uclan.ac.uk Room Le005
Jennifer Readman	BA (Hons Oxon) PhD (Inorganic Chemistry) MRSC e-mail: **jereadman@uclan.ac.uk** Ext: 3578 Room JBF109
Antonios Kelarakis	BSc(Hons) Ph.D (Materials Chemistry) email: **AKelarakis@uclan.ac.uk** Ext 4172 Room JBF107
Tapas Sen	BSc, MSc, PhD (Materials Chemistry), FHEA, FRSCe -mail: **tsen@uclan.ac.uk** Ext 4371 Room JBF107
Sergey Zlatogorsky	Hons Dip Specialist, PhD (Organometallic Chemistry) email: **szlatogorsky@uclan.ac.uk** Ext 4336 Room MB059

1.3 Expertise of staff

Most of the course is delivered by university staff but, where appropriate, external experts in their own field are brought in to speak with authority from their own experience and expertise.

Staff in the Physics and Chemistry teaching teams are all qualified to postgraduate level, and have a wealth of teaching and research experience. Each member of the teaching team has held either postdoctoral research positions or industrial posts before joining UCLan.

Particular areas of interest include:

- Nanomaterials
- Novel materials
- Porous materials
- Nuclear materials
- Organic optical materials
- Molecular electronics
- Nanomagnetism

1.4 Academic Advisor

You will be assigned an Academic Advisor who will provide additional academic advice and support during the year. They will be the first point of call for many of the questions that you might have during the year. Your Academic Advisor will be able to help you with personal development, providing insight and direction to enable you to realise your potential.

1.5 Administration details

Campus Admin Services provides academic administration support for students and staff and are located in the following hubs which open from 8.45am until 5.15pm Monday to Thursday and until 4.00pm on Fridays. The hub can provide general assistance and advice regarding specific processes such as extenuating circumstances, extensions and appeals.

Allen Building
Medicine
Dentistry
telephone: 01772 895566
email: AllenHub@uclan.ac.uk

Harris Building
Lancashire Law School
Humanities and the Social Sciences
Centre for Excellence in Learning and Teaching
telephone: 01772 891996/891997
email: HarrisHub@uclan.ac.uk

Foster Building
Forensic and Applied Sciences
Pharmacy and Biomedical Sciences
Psychology
Physical Sciences
telephone: 01772 891990/891991
email: FosterHub@uclan.ac.uk

Computing and Technology Building
Art, Design and Fashion
Computing
Journalism, Media and Performance
Engineering
telephone: 01772 891994/891995
email: CandTHub@uclan.ac.uk

Greenbank Building
Sport and Wellbeing
Management
Business
telephone: 01772 891992/891993
email: GreenbankHub@uclan.ac.uk

Brook Building
Community, Health and Midwifery
Nursing
Health Sciences
Social Work, Care and Community
telephone: 01772 891992/891993
email: BrookHub@uclan.ac.uk

1.6 Communication

The University expects you to use your UCLan email address and check regularly for messages from staff. If you send us email messages from other addresses they risk being filtered out as potential spam and discarded unread.

The team may also use Blackboard as a means to contact you or supply course information. Appointments to speak directly with academic staff can be made either in person or by email.

1.7 External Examiner

The University has appointed an External Examiner to your course who help to ensure that the standards of your course are comparable to those provided at other higher education institutions in the UK. The name of this person, their position and home institution can be found below. If you wish to make contact with your External Examiner, you should do this through your Course Leader and not directly. External Examiner reports will be made available to you electronically. The School will also send a sample of student coursework to the external examiner(s) for external moderation purposes, once it has been marked and internally moderated by the course tutors. The sample will include work awarded the highest and lowest marks and awarded marks in the middle range.

Dr Vinod Dhanak, Reader in Physics, University of Liverpool

2. Structure of the course

2.1 Overall structure

The course is a three-part full time programme which lasts for 46 weeks. The first two semesters are approximately 15 weeks long and correspond to the two University semesters and the third semester of 16 weeks is over the summer period.

If desired, you may take a sandwich course with a placement in industry for a year, which runs from the end of the second semester. In this case, you will return to campus at the end of the placement for the Research Project, which runs over the summer period.

The one-year full-time course is also available as a 2.25 year part time course.

There are two intermediate exit points designed into the course. A student who successfully completes three modules may be eligible for a Postgraduate Certificate (PgCert). This is dependent on passing the modules required for the exit award as shown in the programme specification which can be found in the appendix at the back of this handbook.

A student who successfully completes six modules is eligible for a Postgraduate Diploma (PgDip).

2.2 Modules available

Each module is a self-contained block of learning with defined aims, learning outcomes and assessment. A standard module is worth 20 credits. It equates to the learning activity expected from one sixth of a full-time undergraduate year. Modules may be developed as half or double modules with credit allocated up to a maximum of 120 credits per module.

AP4610

This semester introduces the concepts of nanoscience and nanotechnology and explores the key opportunities and issues that arise for science and technology at this length scale.
Sample topics include: Moore's Law, Limits to Smallness, Nanoscience of Living Systems
This semester explores some areas of nanoscience in detail and explores the cutting edge of nanoscience research.
Sample topics include: Scanning tunnelling microscopy, Low-dimensional materials, Molecular electronics, Biomaterials

AP4870 Magnetism (O)

This module is optional and requires the student to hold a Physics degree, due to the level of mathematics required. Students without a Physics degree may take the Physics for Energy module instead.

This module introduces topics in condensed matter physics and micromagnetics at level 7. The content is structured to enable students to undertake further study in this area and provide a knowledge basis for research projects. This module aims to instil critical thinking and allow students to critically review published research in this area.
Sample topics: Experimental methods in magnetism and nanophysics, Magneto-resistance, Magnetic domain walls and their motion

AP4614 Physics for Energy (O)
The purpose of this optional module is to introduce some of the physics that is fundamental to understanding the energy economy and some of the technologies of energy production and storage. It also introduces the current state-of-the-art in energy technology and explains the physical principles that have enabled it.
Sample topics: Hydrogen economy, Solar energy, Batteries

FZ4810 Professional Research Skills
The aim of the module is to provide the student with transferable career skills that will allow the student to communicate scientific ideas via a variety of media, to manage and plan projects, gain practical experience of designing scientific experiments and analysing the results.
Sample topics: Scientific writing, Ethics, Presentation skills

FZ4801 Advanced Structural and Surface Analysis
The aim of this module is to develop advanced knowledge and understanding of the techniques used for the surface and elemental analysis of inorganic solids / advanced materials.
Sample topics: Diffraction, Photoelectron spectroscopy, Electron Microscopy

FZ4803 Advanced Inorganic and Materials Chemistry
To provide advanced knowledge of inorganic chemistry including molecular symmetry and the chemistry of the f-block elements. To develop the practical skills associated with Inorganic/materials chemistry and knowledge of their applications in chemical industry, materials science, health and medicine.
Sample topics: Synthesis of nanomaterials, Vibrational spectroscopy, Optical properties of solids

AP4611 Current Topics in Industrial Nanoscience
The purpose of this module is to expose students to current industrial applications, problems and benefits of nanoscience. To promote engagement of students with industrial partners. To prepare the students for either a placement year or a project by proactively choosing a preferred theme based on industrial factors.
Sample topics: Water treatment, Glass coatings, Digital technology design. (The topics covered depends on the industrial partners involved)

AP4613 Industrial Placement
This module will provide students with practical experience of working in a nanoscience-related area. It will encourage students to build on and apply the material studied during the taught element of their course. It will expose students to professional working practices and develop their personal and professional skills.

Delivery method
Most of the modules that you will study in Semesters 1 and 2 of the Programme will consist of lectures and practical sessions/tutorials. Typically, as a full time student you are expected to study for 12 hours per week per module which may be broken down into lectures, practical classes, seminars, tutorials and independent study (in the library, laboratory or at home). This

amounts to a minimum of 36 hours per week. **Any lesser commitment than this is unlikely to produce a good degree.**

Students should bear this in mind if they are going to undertake part-time employment. Students' first commitment must be to the course: if they register as a **full-time** student it means just that.

Semester 3 of the course comprises only the Research Project, when students will be expected to spend approximately 14 weeks undertaking a project either at the University or on the premises of another suitable establishment. This will be followed by a 2-week period during which you will complete your report and prepare for your presentation. Whilst conducting your project, you will be expected normally to work on your project for at least 36 hours per week.

The amount of time spent in private study will vary from student to student and will depend on your academic ability. The recommended time should therefore in practice be taken as a minimum value.

2.3 Course requirements

Students must choose between AP4870 and AP4614. If they do not hold a degree in Physics, they will struggle with the mathematics in AP4870, so they are strongly encouraged to choose AP4614. If they wish, they may take a year in industry to convert the course into a 2-year sandwich course; in this case, the placement begins after the 2nd semester and the student returns to perform a research project in the summer of the 2nd year.

2.4 Module Registration Options

Discussions about your progression through the course normally take place in February each year. It is an opportunity for you to make plans for your study over the next academic year. The course team will tell you about the various modules / combinations available and you will both agree on the most appropriate (and legal) course of study for you.

2.5 Study Time

2.5.1 Weekly timetable

A timetable will be available once you have enrolled onto the programme, through the Student Portal.

2.5.2 Expected hours of study

20 credits is a standard module size and equals 200 notional learning hours.

The normal amount of work involved in achieving a successful outcome to your studies is to study for 10 hours per each credit you need to achieve – this includes attendance at UCLan and time spent in private study.

You are therefore expected to spend a total of 200 hours on each module. It is important that you allocate time reasonably equally to all modules constantly throughout the academic year if you want to gain a good honours degree.

On average then, you should be planning to do between 36 and 40 hours per week. Any lesser commitment is unlikely to produce a good degree. You should bear this in mind if you intend to undertake part-time employment or pursue other interests outside the curriculum.

2.5.3 Attendance Requirements

You are required to attend all timetabled learning activities for each module. Notification of illness or exceptional requests for leave of absence must be made to: Foster Hub.

All UCLan students are monitored on the Student Attendance Monitoring (SAM) system. In the School of Physics Sciences and Computing, each student's attendance is reviewed weekly, so we can identify students who may be having problems and try to help them. If you miss classes, you may be asked to discuss your progress and commitment with the Course Leader. If you are unable to explain your absences you may be asked to see the Academic Lead. You may wish to check your attendance record through myUCLan.

If you have not gained the required authorisation for leave of absence, do not respond to communications from the University, and if you are absent for four weeks or more, you may be deemed to have withdrawn from the course. If this is the case, then the date of withdrawal will be recorded as the last day of attendance.

Some international students will have their attendance at specific classes monitored closely. If you are in this category under the UK Border Agency (UKBA), Points Based System (PBS) you MUST attend your course of study regularly; under PBS, UCLan is obliged to tell UKBA if you withdraw from a course, defer or suspend your studies, or if you fail to attend the course regularly.

Each time you are asked to enter your details on SAM (the Student Attendance Monitoring System) you must remember that the University has a responsibility to keep information up to date and that you must only enter your own details on the system. To enter any other names would result in inaccurate records and be dishonest. Any student who is found to make false entries can be disciplined under the student guide to regulations.

3. Approaches to teaching and learning

3.1 Learning and teaching methods

The programme is designed to produce postgraduates with both general and specific skills pertinent to the area studied. The course is assessed by both coursework and examination to ensure that your knowledge and abilities are fully evaluated.

The course will be delivered by lectures, tutorials and practical sessions. The practical sessions will be dependent upon the particular programme being followed and specialist laboratories will be used when appropriate. Some specialist equipment may only be available in certain rooms. Rooms will generally be open during normal university working hours, i.e. Monday to Friday, 0800-1700.

The final semester (3rd) has been solely kept for your research project in order to allow you to work independently, under minimum supervision, and be self-critical in the evaluation of risks, experimental procedures and outcomes. The nature of the work and the interaction with other researchers that is needed to complete the project will all contribute to the experience.

The 2nd year can be used for optional module AP4613, Professional Placement where students should work in an industry in collaboration with students' 3rd semester dissertation

supervisor. Students will be expected to reflect upon their placement work experience critically and to apply their experience to theoretical and practical elements of their course.

You will find that the pace of delivery and demands of practical sessions will increase as you progress through the modules in semester 1.

The assessment strategies of the course have been developed so that you are assessed in the way that is the most appropriate to the area of study. Therefore some modules will be assessed by coursework only whilst others will have formal examinations where this is the best way to assess your knowledge and understanding of the subject area and your ability to apply it.

3.2 Study skills

Study Skills - 'Ask Your Librarian'

https://www.uclan.ac.uk/students/support/study/it_library_trainer.php

You can book a one to one session with a subject Librarian via Starfish. These sessions will help with questions such as "My lecturer says I need a wider variety of sources in my references, what do I do?"
"I need to find research articles, where do I start?"
"How do I find the Journal of ...?"
"How do I use RefWorks?"

General study skills are taught early in the degree: you will be taught how to take advantage of the resources available through the library, including a huge array of online materials.

For general study skills, there are a variety of services to support students; these include:
WISER https://portal.uclan.ac.uk/webapps/portal/frameset.jsp?tab_tab_group_id=_33_1
LIS https://portal.uclan.ac.uk/webapps/portal/frameset.jsp?tab_tab_group_id=_25_1

3.3 Learning resources

3.3.1 Learning and Information Services (LIS)

The best place to start when exploring the Library resources available to you is;

- Your 'Subject Guide' can be found in the Library Resources
- Your 'My Library' tab in the Student Portal
- Library search

Extensive resources are available to support your studies provided by LIS – library and IT staff. Take advantage of the free training sessions designed to enable you to gain all the skills you need for your research and study.

LIS provide access to a huge range of electronic resources – e-journals and databases, e-books, images and texts.

3.3.2 Electronic Resources

Lecturers and relevant module tutors will make material relevant to their modules available on Blackboard, the University's online learning platform. This material could include lecture notes, tutorial examples and solutions, past exam papers, links to online resources, and so on.

3.4 Personal development planning

While you are at university, you will learn many things. You already expect to learn lots of facts and techniques to do with chemistry, but you will also learn other things of which you might be unaware. You will learn how to study, how to work with other people, how to manage your time to meet deadlines, and so on. If you are to be an employable graduate it is vital that you can list in your CV the skills that employers value.

Employers are looking for skills such as:

- self-organisation
- team work
- good written communication
- good oral communication
- problem solving

To help you, we have introduced a system that aims to:

- help you to identify the skills you should be developing,
- help you to **identify** the ones you are weak in, and
- to take **action** to improve those skills.

This approach can broadly be described as **Personal Development Planning**, and can be defined as:

A structured and supported process undertaken by an individual to reflect upon their own learning, performance and/or achievement and to plan for their personal, educational and career development.

The University puts a high priority on your personal development, and so keeping a record of your achievements is encouraged and will help when you are applying for jobs. When you ask staff for a reference, they could use this information to help them provide more rounded detail.

3.5 Preparing for your career

Your future is important to us, so to make sure that you achieve your full potential whilst at university and beyond, your course has been designed with employability learning integrated into it. This is not extra to your degree, but an important part of it which will help you to show future employers just how valuable your degree is. These "Employability Essentials" take you on a journey of development that will help you to write your own personal story of your time at university:

- To begin with, you will explore your identity, your likes and dislikes, the things that are important to you and what you want to get out of life.

- Later, you will investigate a range of options including jobs and work experience, postgraduate study and self- employment,
- You will then be ready to learn how to successfully tackle the recruitment process.

It's your future: take charge of it!

Careers offers a range of support for you including:-

- career and employability advice and guidance appointments
- support to find work placements, internships, voluntary opportunities, part-time employment and live projects
- workshops, seminars, modules, certificates and events to develop your skills

Daily drop in service available from 09:00-17:00 for CV checks and initial careers information. For more information come along and visit the team (in Foster building near the main entrance) or access our careers and employability resources via the Student Portal.

On completing an MSc in Nanoscience and Nanotechnology from UCLan your employment potential should be very high. As an example, the chemical industry provides direct employment for 214,000 people within the UK where instrumental and analytical tools are part and parcel of day to day R & D activity. The importance of the UK chemical industry to the balance of trade for the country cannot be over stated, it is the UK manufacturing number one exporter with a trade surplus of £4.5 billion. This has obvious implications on employment prospects, which are generally considered to be good with a wide variety of industries employing instrumental and analytical chemists in several analytical labs. In addition, your exposure to industry via the Topics in Industrial Nanoscience module and an optional placement year will provide ample opportunity for networking.

Of course, you may not wish to leave! The MSc provides a good foundation for further postgraduate work. PhD scholarships are advertised as they arise, and include fees and a stipend. Alternatively, you may self-finance your way through PhD studies – for this, you just need to find a willing supervisor in your chosen area!

Your University experience is not only about achieving your chosen award, it is also about developing as a person and realising your potential. We want you to gain the skills and attitudes that will help you to achieve your goals and aspirations.

4. Student Support

Information on the support available is at: https://www.uclan.ac.uk/students/

Your primary contact for advice on general academic matters is your academic advisor. They will advise you on matters like progression, modules, and so on. They also have a role in pastoral care, and can advise you on who to talk to in the university about a range of problems. In addition, there is the general advice desk for students called 'The i' – this is described below.

The 'i' is a central Student Information Centre and your first point of contact. You can obtain information on a wide range of topics including Council Tax Exemption Certificates, Bank and Confirmation of Study Letters, Portable Financial Credits, (continuing students only, Printing and Printer Credit, UCLan Cards, the 'I' shop and UCLan Financial Support Bursary (first year students only).

4.1 Academic Advisors

Your primary contact for advice on general academic matters is your academic advisor. They will advise you on matters like progression, modules, and so on. They also have a role in pastoral care, and can advise you on who to talk to in the university about a range of problems. You can arrange to meet with your Academic Advisor whenever you wish. Also, if issues arise with attendance or grades, your Academic Advisor may call a meeting.

4.2 Students with disabilities

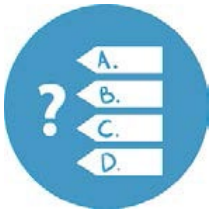
Assessment arrangements for students with a disability

Arrangements are made for students who have a disability/learning difficulty for which valid supporting evidence can be made available. Contact the Disability Adviser for advice and information, disability@uclan.ac.uk

4.3 Students' Union

The Students' Union offers thousands of volunteering opportunities ranging from representative to other leadership roles. We also advertise paid work and employ student staff on a variety of roles. You can find out more information on our website: http://www.uclansu.co.uk/

5. Assessment



5.1 Assessment Strategy

Please note that all modules will be assessed. You are expected to attempt all required assessments for each module for which you are registered, and to do so at the times scheduled unless authorised extensions, special arrangements for disability, or extenuating circumstances allow you to defer your assessment.

Several different types of assessment are used in the course including reports, log book/diaries, problem solving, oral presentations, dissertations etc. In each case there are a number of common elements. The criteria listed in the following pages are the main ones used for marking. Different assessment types will contain different balances of criteria.

Classification	**Methods**	**Problem-solving**	**Conceptual understanding**
Outstanding/ Excellent/Very Good 70-100%	Error-free Application of methods to a range of easy and hard problems	Thorough grasp of complex problems, possible solutions and their limitations	Thorough grasp of the underlying concepts

Good (above average) 60-69%	Some errors in complex problems	Thorough grasp of problems but incomplete understanding of limitations of solutions	A grasp of most of the underlying concepts
Average 55-59%	Able to apply methods to a range of problems, some non-standard	Able to solve some complex problems, with some indication of limitations	A superficial understanding of the concepts with indications of the students limitations
Satisfactory (below average) 50-54%	Able to apply methods to a range of simple problems	Able to produce simple solutions to easy problems	Limited conceptual understanding
Bare minimal pass 50%	Able to apply methods to some simple problems; often with errors	An understanding of simple problems, with some idea of appropriate solutions	An understanding of only very simple concepts with conceptual gaps and misunderstandings
Fail <50%	Failure to apply methods to simple problems, or many errors	Failure to understand the nature of the problem	No grasp of even the simplest concepts

Classification	Work done	Motivation	Group work
Outstanding/ Excellent/ Very Good 70-100%	Considerable work done, excellent experimental technique and achievement	Highly self motivated and high level of initiative	Well organised task management with clear delineation of roles within the group
Good (above average) 60-69%	Clear evidence of work done, good experimental technique and significant achievement	Self motivated but requiring some staff help occasionally	Organised task management with some delineation of roles within the group
Average 55-59%	Reasonable amount of work done, adequate experimental technique and achievement	Student requires a moderate level of staff involvement to sustain the work	Task management is subdivided within the group but not very clearly
Satisfactory (below average) 50-54%	Some evidence of work done, poor experimental technique and some identifiable achievement even if not the original aim	Student shows little self motivation or initiative and requires a lot of staff involvement	Task management is poorly subdivided within the group and there is some confusion over roles
Bare minimal pass 50%	Small amount of work done with a small but identifiable achievement; experimental technique is very poor	Student shows little motivation and requires considerable staff involvement	Task management is ineffectively subdivided within the group and there is confusion about job allocation
Fail <50%	Inadequate work and achievement; inadequate experimental technique	No motivation and lack of positive input into the project	No attempt to work as a group

Classification	Relevance	Knowledge	Analysis
Outstanding/ Excellent/ Very Good 70-100%	Directly relevant to the title; able to address the implications, assumptions and nuances of the title	Makes effective use of excellent knowledge and thorough understanding of the relevant material	A very good analysis of the evidence, arguments or results, giving clear illuminating conclusions
Good (above average) 60-69%	Directly relevant to the title	A substantial knowledge and understanding of the relevant material	Good analysis, clear and orderly
Average 55-59%	Some attempt to address the title, may drift away from the title in the less focussed passages	Adequate knowledge of a fair range of the relevant material with intermittent evidence of understanding	Some analytical treatment but may be prone to description or lacking in analytical purpose
Satisfactory (below average) 50-54%	Some significant degree of irrelevance to the title is common	Basic understanding of a limited range of material	Largely descriptive with little evidence of analytical skill
Bare minimal pass 50%	Relevance to the title may be intermittent; the topic may be reduced to its vaguest and least challenging terms	A limited understanding of a narrow range of material	Mainly descriptive with little analytical content
Fail <50%	Outright irrelevance to the title	Lack of basic knowledge necessary for an understanding of the topic	Inadequate description and no analysis

Classification	Structure	Originality	Presentation
Outstanding/ Excellent/ Very Good 70-100%	Coherently and logically structured, making use of appropriate standard formats	Distinctive work showing independent thought and critical judgement	Very well presented on good English and correct spelling and syntax; creative use of IT and inclusion of bibliography and clear instructive diagrams
Good (above average) 60-69%	Generally coherent and logical structure	May contain some distinctive or independent work and some evidence of critical judgement	Well written, with good style, spelling and syntax, acceptable use of IT, diagrams and bibliography
Average 55-59%	Some attempt at using a logical structure and/or standard format	Sound work but showing no distinctive elements; conforming to standard patterns of approach	Competently written with only minor errors of spelling and syntax. Acceptable use of IT, diagrams and bibliography
Satisfactory (below average) 50-54%	A basic argument may be evident, but tends to lack clarity	Largely derivative showing little originality of approach	Rather poorly written with numerous lapses of spelling and syntax; poor diagrams, use of IT and bibliography
Bare minimal pass 50%	Little evidence of a logical structure	Mostly derivative	Poorly presented with numerous lapses of spelling, syntax and poor diagrams
Fail <50%	No evidence of clear and logical structure	No originality shown	Garbled and negligently presented

5.2 Notification of assignments and examination arrangements

Because different modules will be assessed in different ways, there is no central rule for when or how assessments should be submitted. For each module, when there is an assessed piece of work to be done the module tutor will give you an assignment brief which tells what, when and how to submit the resulting work. The tutor will also give some indication of how the work will be marked. The majority of assessments will be submitted via Turnitin on Blackboard. Most of the submitted assignments will be marked *via* blackboard using Grade mark hence students will be able to see the assignment feedback online *via* blackboard.

Reassessment

If you fail a module you may be offered reassessment for a maximum of 50%. However, these students, along with those who do not seek reassessment or who fail reassessment may be considered for the awards of PgCert or PgDip.

5.3 Referencing

The main referencing system physicists and chemists use is numerical (Vancouver) referencing. More information can be found in "Study and Communication Skills for the Chemical Sciences" by Overton, Johnson & Scoot which is available in the UCLan Library.

5.4 Confidential material

Within your course you are unlikely to have access to confidential information during the course. However, if you do, it is important to respect confidentiality. Any students who have to deal with confidential material will be briefed on this by their tutor at the time.

5.5 Cheating, plagiarism, collusion or re-presentation

Please refer to the information included in section 6.6 of the University Student Handbook for full definitions. The University uses an online Assessment Tool called Turnitin. A pseudo-Turnitin assignment will be set up using the School space on Blackboard to allow students to check as many drafts as the system allows before their final submission to the 'official' Turnitin assignment. Students are required to self-submit their own assignment on Turnitin and will be given access to the Originality Reports arising from each submission. In operating Turnitin, Schools must take steps to ensure that the University's requirement for all summative assessment to be marked anonymously is not undermined and therefore Turnitin reports should either be anonymised or considered separately from marking. Turnitin may also be used to assist with plagiarism detection and collusion, where there is suspicion about individual piece(s) of work.

5.6 How do I know that my assessed work had been marked fairly?

Assessment is an integral part of the course. Module staff work closely together to design assessments, agree the marking criteria and approve final versions of assessments to ensure that these are appropriate. The criteria for assessment will be communicated to you clearly during the module teaching.

All module staff engage in development and training in assessment, marking and feedback. Once the assessments have been completed the module team will discuss the assessment methods and marking criteria, prior to starting to mark, so that there is a common understanding of what is expected of students. All assessed modules have moderation built into the marking process. Moderation involves sampling students' assessed work to make sure that the learning outcomes and agreed marking criteria have been interpreted and applied in the same way. This ensures that you and your fellow students are treated equitably and

that the academic standards are applied consistently. During the marking process the module leader will co-ordinate moderation to ensure that at least 10% of assessed work (or a minimum of three pieces) has been reviewed by other markers and any concerns about consistency or accuracy addressed with the whole module team. Your work may or may not be part of this sample, but the processes for developing assessments and marking criteria as well as moderation mean that you can be confident that teaching staff are marking assessments to the same criteria. Module teams may then use feedback from moderation to improve clarity about the nature and purpose of future assessment, or to make changes if required.

Modules are also moderated externally. The module leader will arrange for the external examiner to receive a sample of work for review and comment. External examiners cannot change individual grades, but can act as 'critical friends' and confirm that marking standards are in line with other, similar courses in the sector. If, on reviewing the sample, external examiners feel that the marking criteria have not been applied consistently the work of the whole cohort will be reviewed.

6. Classification of Awards

The University publishes the principles underpinning the way in which awards and results are decided in Academic Regulations. Decisions about the overall classification of awards are made by Assessment Boards through the application of the academic and relevant course regulations.

To be eligible for the award of MSc you must normally:

(i) Pass a total of nine modules (AP4612 is a 60 credits (triple) module) with an overall APM of 50% or better. AP4613 does not count to this total.

(ii) Obtain a percentage mark of 50% or better in the MSc Research Project module.

The award will be an MSc in Nanoscience and Nanotechnology

The APM is calculated using a rather complicated formula as stated in academic regulations.

$$APM = \frac{m_1 l_1 c_1 + m_2 l_2 c_2 + \ldots + m_n l_n c_n}{l_1 c_1 + l_2 c_2 + \ldots + l_n c_n}$$

Put simply, the APM calculation takes into account the mark you got in a module (m), the size or credit of the module (c) and also the level of the module (l).

Your APM is calculated using all nine taught modules you studied. The Professional Placement (AP4613) is not included.

Candidates who are considered by the Board of Examiners to have shown exceptional levels of performance may be awarded an **MSc with Distinction**. Normally this would require:

(i) Obtain an overall APM of 70% or better.

If the above is not achieved, the award of an **MSc with Merit** may be considered by the Board of Examiners. Normally this would require:

(i) Obtain an overall APM of 60% or better

Exit Awards

Postgraduate Diploma (PgDip)

In the event of failing to pass all modules after a reassessment you will be eligible for the award of a Postgraduate Diploma in Nanoscience and nanotechnology as long as you have achieved 120 credits.

Postgraduate Certificate (PgCert)

A Postgraduate Certificate in Nanoscience and nanotechnology may be awarded for completing only 60 credits.

Reassessment

Candidates who fail any of the modules are normally entitled to one reassessment. The conditions for passing a module are explained in the *Assessment Strategy* of each of the modules.

The grade allocated to a passed reassessed module will not exceed a percentage mark of 50%.

The timing of the reassessment will be determined by the Progress Review or Examination Boards.

Appeals

If you consider that you have a reason to appeal against an assessment board decision, please bear in mind that your reasons must fall within the grounds specified in the University Academic Regulations: Section I. You cannot appeal simply because you disagree with the mark given. The specified grounds for appeal are:

1. that an Assessment Board has given insufficient weight to extenuating circumstances;
2. that the student's academic performance has been adversely affected by extenuating circumstances which the student has, **for good reason**, been unable to make known to the Assessment Board;
3. that there has been a material administrative error at a stage of the examining process, or that some material irregularities have occurred;
4. that the assessment procedure and/or examinations have not been conducted in accordance with the approved regulations.

If you want to appeal, then you must do so within 14 days of your results being published. The onus is on you to find out your results and submit your appeal on time. Contact the Students' Union Advice and Representation Centre by emailing: suadvice@uclan.ac.uk for support and guidance.

The dates for the publication of results can be found on the academic calendar.

7. Student Feedback

You can play an important part in the process of improving the quality of this course through the feedback you give.

7.1 Student Staff Liaison Committee meetings (SSLCs)

Details of the Protocol for the operation of SSLCs is included in section 8.2 of the University Student Handbook.

The purpose of a SSLC meeting is to provide the opportunity for course representatives to feedback to staff about the course, the overall student experience and to inform developments which will improve future courses. These meetings are normally scheduled once per semester.

Your Course Leader will facilitate the meetings using guidelines and provide a record of the meeting with any decisions and / or responses made and / or actions taken as a result of the discussions held. The meetings include discussion of items forwarded by course representatives, normally related to the following agenda items (dependent on time of year).

The course team encourage student feedback in all areas and recognise that additional items for discussion may also be raised at the meeting

- Update on actions completed since the last meeting
- Feedback about the previous year – discussion of external examiner's report; outcomes of National /UCLan student surveys.
- Review of enrolment / induction experience;
- Course organisation and management (from each individual year group, and the course overall);
- Experience of modules - teaching, assessment, feedback;
- Experience of academic support which may include e.g. Personal Development

Planning, personal tutoring arrangements and The Card;
- Other aspects of University life relevant to student experience e.g. learning resources, IT, library;
- Any other issues raised by students or staff.

Course representatives are volunteers. If you wish to be considered as a course representative, please contact the course leader.

The dates of SSLC meetings are emailed to the students directly and module tutors and lecturers will also remind students during their lectures; minutes of the meetings are made available through the chemistry blackboard site.

8. Appendices

8.1 Programme Specification

UNIVERSITY OF CENTRAL LANCASHIRE

Programme Specification

This Programme 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.

Sources of information on the programme can be found in Section 17

1. Awarding Institution / Body	University of Central Lancashire
2. Teaching Institution and Location of Delivery	University of Central Lancashire Preston Campus
3. University School/Centre	Natural Sciences
4. External Accreditation	None
5. Title of Final Award	MSc in Nanoscience and Nanotechnology
6. Modes of Attendance offered	1 year full-time, 2.25 year part-time, 2 year full-time with placement
7. a) UCAS Code b) JACS Code	F290, HECoS 101234
8. Relevant Subject Benchmarking Group(s)	Physics, Chemistry
9. Other external influences	Royal Society of Chemistry, Institute of Physics
10. Date of production/revision of this form	August 2020
11. Aims of the Programme	
• To develop the student's knowledge of the core science required to understand nanotechnology	
• To provide students with the ability to plan and carry out experiments independently and assess the significance of outcomes	
• To develop in students the knowledge required to discuss the opportunities and challenges in nanoscience	
• To instil a critical awareness of advances at the forefront of nanotechnology and nanoscience	
• To prepare students effectively for professional employment or doctoral studies in the area of nanoscience	

12. Learning Outcomes, Teaching, Learning and Assessment Methods

A. Knowledge and Understanding

A1. Have detailed knowledge of current issues and opportunities in nanoscience and nanotechnology.
A2. Present scientific information clearly and concisely
A3. Research information from literature/manuals/internet.
A4. Effectively plan a project and record data and perform critical analysis.
A5. Design, plan and implement research questions to problems in nanotechnology including evaluation of hazards and environmental effects.
A6. Develop general strategies for analysis including the identification of additional information required and problems where there is not a unique solution.

Teaching and Learning Methods

Lectures, seminars, structured laboratory classes, practical projects

Assessment methods

Exams, Laboratory reports, project report group and individual presentations

B. Subject-specific skills

B1. Be able to determine which experimental technique to employ for which type of study.
B2. Demonstrate competence in the planning, design and execution of experiments
B3. Evaluate different potential solutions to an unfamiliar problem.
B4. Work independently, under minimum supervision, and be self-critical in the evaluation of risks, experimental procedures and outcomes.
B5. Use an understanding of the limits of accuracy of experimental data to inform the planning of future work.

Teaching and Learning Methods

Lectures, seminars, structured laboratory classes, directed reading, group and individual projects and presentations.

Assessment methods

Exams, Laboratory reports, project report group and individual presentations

C. Thinking Skills

C1. Critically evaluate technical and theoretical information
C2. Adapt and apply methodology to the solution of unfamiliar problems.
C3. Assimilate, critically evaluate and present research results objectively.
C4. Undertake an individual research project, the outcome of which is potentially publishable.
C5. Assess the success of such a project

Teaching and Learning Methods

Skills developed through seminars, data interpretation, case studies, practical work, research projects, presentations, problem solving.

Assessment methods

Practical reports, essays and group and individual presentations.

D. Other skills relevant to employability and personal development

D1. Problem-solving skills including the demonstration of self-direction and originality
D2. Communicate and interact with professionals from other disciplines
D3. Ability to exercise initiative and personal responsibility
D4. Ability to make decisions in complex and unpredictable situations
D5. Independent learning ability required for continuing professional development.
D6. Work independently under minimum supervision.
D7. Develop and write a research project within guidelines and be able to assess the success of such a project.

Teaching and Learning Methods

Skills developed through seminars, data interpretation exercises, case studies, practical work, research projects, presentations, problem solving.

Assessment methods

Exams, Laboratory reports, project report group and individual presentations.

13. Programme Structures*				14. Awards and Credits*
Level	**Module Code**	**Module Title**	**Credit rating**	
Level 7	AP4610	Introduction to Nanoscience Advanced Topics in Nanoscience	20	**MSc in Nanoscience and Nanotechnology** Requires 180 credits at Level 7
	AP4611	Current Topics in Industrial Nanoscience	20	**Postgraduate Diploma in Nanoscience and Nanotechnology**
	AP4612	Research Project	60	Requires 120 credits at Level 7
	FZ4801	Advanced Structural and Surface Analysis	20	**Postgraduate Certificate in Nanoscience and Nanotechnology**
	FZ4803	Advanced Inorganic and Materials Chemistry	20	Requires 60 credits at Level 7
	FZ4810	Professional Research Skills	20	Students who successfully complete AP4613 will receive the award 'with placement'.
	AP4870	Magnetism (O)	20	
	AP4614	Physics for Energy (O)	20	
	AP4613	Professional Placement (O)	notional	
		(O) optional module		

15. Personal Development Planning

PDP is embedded and monitored through the modules that make up the course, particularly the skills modules, and the personal tutor system. Students are introduced to the idea of PDP and career planning through sessions in induction week, and are provided with a PDP folder which provides information about opportunities for PDP and provides a place to keep any information and/or evidence which the student wishes to keep to hand. Reflection and self-assessment on their achievements and goal setting is developed in many of the core modules and through the feedback provided on assessment coversheets.

16. Admissions criteria

Applicants will normally be required to have:

2:2 Hons Degree in Physics, Chemistry or equivalent qualifications and experience.

Applicants will be required to have a minimum level of proficiency in English Language equivalent to IELTS grade 6.5.
Please consult the UCLAN admissions department for the most up to date requirements.

17. Key sources of information about the programme

- University web site (www.uclan.ac.uk)
- School website (http://www.uclan.ac.uk/schools/physical-sciences-computing/)
- Course Leader
- Admissions tutor

18. Curriculum Skills Map

Please tick in the relevant boxes where individual Programme Learning Outcomes are being assessed

Level	Module Code	Module Title	Core (C), Compulsory (COMP) or Option (O)	Programme Learning Outcomes																						
				Knowledge and understanding						Subject-specific Skills					Thinking Skills					Other skills relevant to employability and personal development						
				A1	A2	A3	A4	A5	A6	B1	B2	B3	B4	B5	C1	C2	C3	C4	C5	D1	D2	D3	D4	D5	D6	D7
LEVEL 7	AP4610	Introduction to Nanoscience | Advanced Topics in Nanoscience	COMP	X		X			X	X		X			X	X	X			X		X		X		
	AP4611	Current Topics in Industrial Nanoscience	COMP	X	X	X	X	X	X			X	X		X	X	X			X	X	X		X	X	X
	AP4612	MSc Research Project	CORE		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
	FZ4801	Advanced Structural and Surface Analysis	COMP		X		X		X	X	X			X	X	X	X									
	FZ4803	Advanced Inorganic and Materials Chemistry	COMP		X	X	X	X	X	X	X			X	X					X		X		X		
	FZ4810	Professional Research Skills	COMP		X	X	X	X	X	X	X	X			X	X	X			X		X	X	X		
	AP4613	Professional Placement	O			X	X		X						X	X	X			X	X	X	X	X		
	AP4870	Magnetism	O		X	X				X	X				X		X			X		X				
	AP4614	Physics for Energy	O	X	X	X			X	X		X			X	X				X		X				

Note: *Mapping to other external frameworks, e.g. professional/statutory bodies, will be included within Student Course Handbooks*

19. Exit Awards

Learning outcomes for the award of Postgraduate Diploma in Nanoscience and Nanotechnology:

A1. Have detailed knowledge of current issues and opportunities in nanoscience and nanotechnology.
A2. Present scientific information clearly and concisely.
A3. Research information from literature/manuals/internet.

B1. Be able to determine which experimental technique to employ for which type of study.
B2. Demonstrate competence in the planning, design and execution of experiments
B3. Evaluate different potential solutions to an unfamiliar problem.

C1. Evaluate technical and theoretical information
C2. Adapt and apply methodology to the solution of unfamiliar problems.
C3. Assimilate, evaluate and present research results objectively.

D1. Problem-solving skills including the demonstration of self-direction and originality
D2. Communicate and interact with professionals from other disciplines
D3. Ability to exercise initiative and personal responsibility
D4. Ability to make decisions in complex and unpredictable situations

Learning outcomes for the award of Postgraduate Certificate in Nanoscience and Nanotechnology:
A1. Have detailed knowledge of current issues and opportunities in nanoscience and nanotechnology.
A2. Present scientific information clearly and concisely

B1. Select appropriate techniques and procedures for the synthesis of specific compounds.

C1. Evaluate technical and theoretical information
C2. Adapt and apply methodology to the solution of unfamiliar problems.

D1. Problem-solving skills including the demonstration of self-direction and originality