Imperial College London

Programme Specification 2021-22

Programme Information		
Programme Title	Programme Code	HECoS Code
MEng Chemical with Nuclear Engineering[1]	H890	For Registry Use Only

Award	Length of Study	Mode of Study	Entry Point(s)	Total Credits	
				ECTS	CATS
MEng Chemical with Nuclear Engineering[2]	4 years	Full-Time	Annually in October	240	480

[1] The MEng Chemical with Nuclear Engineering (H890) is not available for entry. All students must apply to join the MEng Chemical Engineering (H801).

[2] A student who withdraws before completing the MEng Chemical with Nuclear Engineering programme may be offered the following exit awards at the discretion of the Board of Examiners provided that they have met the ECTS requirements for that award in line with the College Regulations: Certificate in Higher Education in Chemical Engineering (60 ECTS), Diploma in Higher Education in Chemical Engineering (120 ECTS) and BEng Chemical Engineering (Pass) (180 ECTS). These exit awards are not accredited.

Ownership			
Awarding Institution	Imperial College London	Faculty	Faculty of Engineering
Teaching Institution	Imperial College London	Department	Chemical Engineering
Associateship	City and Guilds of London Institute (ACGI)	Main Location(s) of Study	South Kensington Campus
External Reference			
Relevant QAA Benchmark Statement(s) and/or other external reference points		Master's Degrees in Engineering	
FHEQ Level		Level 7	
EHEA Level		2nd Cycle	
External Accreditor(s) (if applicable)			
External Accreditor 1:	Institution of Chemical Engineers (IChemE)		
Accreditation received:	2014	Accreditation renewal:	2024
Collaborative Provision			
Collaborative partner	Collaboration type	Agreement effective date	Agreement expiry date
NA	N/A	N/A	N/A

Specification Details	
Programme Lead	Prof Jerry Heng
Student cohorts covered by specification	2021-22 entry
Date of introduction of programme	October 2019
Date of programme specification/revision	October 2021

Programme Overview

The aim of this programme is to graduate students of the highest quality who will demonstrate technical and professional leadership and who will go on to successful careers in industrial and other sectors of the economy.

You will achieve this aim by developing a strong foundation in the fundamental principles of science, mathematics and engineering and use this to build sound practical expertise and engineering judgement. You will study core chemical engineering subjects and will be able to demonstrate your competency in these subjects through the use of the 'mastery' concept. This is a holistic, systems-based approach to problem analysis and solution the aim of which is to ensure that students can demonstrate the essential elements of Chemical Engineering to a high standard. You will also study relevant business, economic and environmental subjects which will complement your core competencies resulting in a well-rounded graduate profile.

The course will use a variety of learning and teaching methods to help you become a well-rounded, independent practitioner and you are expected to contribute to the discussion with academic and technical staff during your lectures, practical work and laboratories.

We aim to encourage interdisciplinary interests and you may find that as you become more aware of the chemical engineering industry, your interests may develop in complementary directions. A variety of options is therefore available in the last year of the programme which provide specialised options to fit individual needs and career preferences. Examples of these options include choosing streams that range from core chemical engineering subjects to management and humanities options, as well as technical options from across the Faculty of Engineering.

As part of an integrated approach, you will also develop your professional and transferrable skills which include skills in group working, time and project management, problem-solving and competence in oral and written communication and presentation. You will also gain a strong awareness of industrial requirements for ethics, health and safety. This will broaden your outlook and employability skills.

At the end of this course, you will be fully qualified in Chemical Engineering but will also take a series of specialist modules which will give you a basis for employment in the nuclear and related industries. Consequently upon successful completion of your degree, you will be an industry-ready graduate with notable competencies across a wide of range of technical and non-technical subjects.

Learning Outcomes

Upon successful completion of your MEng Chemical with Nuclear Engineering programme, you will be able to:

Knowledge and Understanding

1. Demonstrate a strong fluency in the fundamental principles of mathematics and science which underpin chemical engineering;
2. Explain the theory of reaction engineering, separations, transfer processes, control systems, process analysis and process design to integrate and apply these to practical engineering situations;
3. Explain the behaviour of selected nuclear materials as well as the theory underpinning nuclear chemical engineering, nuclear thermal hydraulics and reactor physics and be able to apply these to practical engineering situations;
4. Demonstrate an understanding of the ethical, health, safety and sustainability requirements within the process industries;
5. Acquire and develop a broad knowledge base which includes an appreciation of business, humanities and management subjects;

Intellectual Skills

6. Think critically in the context of open-ended problems and develop investigative and modelling

strategies to solve them;
7. Demonstrate the skills necessary to plan, conduct and report a programme of independent research or a project of direct and immediate industrial relevance;
8. Exercise engineering judgement and employ advanced diagnostic, modelling and innovative skills in order to optimise the performance of selected chemical engineering systems;

Practical Skills

9. Start-up, operate and shut down safely a pilot-scale process plant;
10. Analyse experimental results using a wide range of computational tools and packages to determine the range of their accuracy, precision, and validity;
11. Plan, execute and scale-up experiments for a variety of industrially relevant problems in order to choose optimal solutions and/or deliver set targets;

Professional Skills Development

12. Develop a range of professional skills and proficiencies including effective communication, team-working, time management and leadership;
13. Develop an awareness of the ethical, environmental, economic and social impact of chemical processes;
14. Acquire and develop skills for the purpose of continuous professional development.

The MEng in Chemical Engineering with Nuclear Engineering is an accredited degree with the Institution of Chemical Engineers (UK) which meets all academic requirements to achieve chartered status, should you wish to pursue this professional recognition after graduation.

If you withdraw from the MEng Chemical Engineering with Nuclear Engineering programme and are offered a BEng Chemical Engineering with Nuclear Engineering (Pass) exit award, you will have achieved the following learning outcomes:

Knowledge and Understanding

1. Use and apply the fundamental principles of mathematics and science which underpin chemical engineering;
2. Explain the fundamental principles and theory of reaction engineering, separations, transfer processes, control systems, process analysis and process design and be able to use these to solve selected engineering problems;
3. Explain the fundamental theory underpinning nuclear chemical engineering and be able to apply these to selected practical engineering situations;
4. Demonstrate an understanding of the ethical, health, safety and sustainability requirements within the chemical engineering industry;
5. Acquire an appreciation of business, humanities and management subjects;

Intellectual Skills

6. Think critically to develop strategies to solve practical engineering problems;
7. Demonstrate the skills necessary to plan, conduct and report a programme of guided research or project of direct and immediate industrial relevance;
8. Exercise engineering judgement in order to optimise the performance of selected chemical engineering systems;

Practical Skills

9. Start-up, operate and shut down safely a pilot-scale process plant;
10. Plan and execute experiments for selected industrially relevant problems and analyse the experimental results using selected computational tools and packages to determine the range of their accuracy and validity;

Professional Skills Development

11. Communicate effectively through oral presentations and written reports using a wide range of ICT packages;
12. Work effectively in a team to achieve an objective under imposed time and resource constraints, with due respect and recognition to contribution from other members of the team;
13. Demonstrate effective time-management and leadership skills.

The BEng Chemical Engineering with Nuclear Engineering is not an accredited degree and is only awarded at the discretion of the Board of Examiners in line with College Regulations. Should you wish to pursue

recognition as a professional chemical engineer after withdrawing, a full review of your academic formation and possibly further study will be necessary to support your application for professional registration.

If you withdraw from the MEng Chemical Engineering programme and are offered a Diploma in Higher Education in Chemical Engineering exit award, you will have achieved the following learning outcomes:

Knowledge and Understanding

1. Use and apply the fundamental principles of mathematics and science which underpin chemical engineering;
2. Explain the basic principles of reaction engineering, separations, transfer processes and process analysis and use these to solve foundational engineering problems;
3. Demonstrate a basic understanding of the ethical and sustainability requirements within the chemical engineering industry;

Intellectual Skills

4. Analyse and evaluate the performance of selected chemical engineering systems and be able to make recommendations to optimise their performance;

Practical Skills

5. Start-up, operate and shut down safely a pilot-scale process plant;
6. Plan and execute experiments for foundational industrial problems and analyse the experimental results to determine the range of their accuracy and validity;

Professional Skills Development

7. Communicate effectively through oral presentations and written reports using ICT packages;
8. Work effectively in a team and demonstrate effective time-management to achieve an objective under imposed resource constraints;

The Diploma in Higher Education in Chemical Engineering is not an accredited programme and is only awarded at the discretion of the Board of Examiners in line with College Regulations. Should you wish to pursue recognition as a professional chemical engineer after withdrawing, a full review of your academic formation and further academic study will be necessary to support your application for professional registration.

If you withdraw from the MEng Chemical Engineering programme and are offered a Certificate in Higher Education in Chemical Engineering exit award, you will have achieved the following learning outcomes:

Knowledge and Understanding

1. Use and apply the fundamental principles of mathematics and science which underpin chemical engineering;
2. Explain the basic principles of separations, transfer processes and process analysis and use these to solve foundational engineering problems;
3. Demonstrate a basic understanding of the sustainability requirements within the chemical engineering industry;

Intellectual Skills

4. Analyse and evaluate the performance of selected chemical engineering systems;

Practical Skills

5. Execute basic experiments and analyse the experimental results to determine their accuracy and validity;

Professional Skills Development

6. Communicate effectively through written reports using ICT packages;
7. Work effectively in a team and demonstrate effective time-management skills.

The Certificate in Higher Education in Chemical Engineering is not an accredited programme and is only awarded at the discretion of the Board of Examiners in line with College Regulations. Should you wish to pursue recognition as a professional chemical engineer after withdrawing, a full review of your academic formation and further academic study will be necessary to support your application for professional registration.

The Imperial Graduate Attributes are a set of core competencies which we expect students to achieve through completion of any Imperial College degree programme. The Graduate Attributes are available at: www.imperial.ac.uk/students/academic-support/graduate-attributes

Entry Requirements	
Academic Requirement	**A Level Requirements:** Minimum A*A*A A* in Mathematics, A* in Chemistry, Relevant subjects for the remaining A-level include: Physics, Biology, Further Mathematics, and Economics **IB Requirements:** Minimum 39 overall (or a comparable qualification recognised by the College) 7 in Mathematics at higher level, 6 in Chemistry at higher level, 6 in Physics or Biology at higher level – Economics may also be considered (or a comparable qualification recognised by the College).
Non-academic Requirements	NA
English Language Requirement	Standard requirement IELTS score of 6.5 overall (minimum 6.0 in all elements)
Admissions Test/Interview	There is no Admissions Test for entry onto the programme but an interview is required.

The programme's competency standards documents can be found at:
http://www.imperial.ac.uk/engineering/departments/chemical-engineering/courses/undergraduate/admissions/

Learning & Teaching Approach

Our Chemical with Nuclear Engineering programme aims to offer an integrated approach to learning which will allow you to make meaningful connections between the different chemical engineering areas. This will create a more profound and holistic understanding of chemical and nuclear engineering as you engage in purposeful and relevant learning. Our approach uses a variety of independent study as well as taught, practical and design-based strategies to achieve the programme's learning outcomes.

Further learning support is also available from the Centre for Academic English (http://www.imperial.ac.uk/academic-english) and the Library (https://www.imperial.ac.uk/admin-services/library/learning-support/).

Teaching and practical work
You will be taught using a combination of lectures, tutorials, guest lectures and presentations. Throughout your programme, you will also build your practical expertise through lab-based modules. The first year Foundation Lab teaches practical skills through illustrating relevant engineering scenarios. The second year Knowledge Laboratory module focuses on solving practical engineering problems through using unit operations and relates the theoretical knowledge gained through lectures to practical results. The third year Discovery Laboratory consists of open-ended investigative experiments requiring searching for information, objective analysis, experimental planning, and scientific conclusion. All modules develop laboratory skills within a culture of safe working. You will also be taught the fundamentals of chemical plant operation and learn how to control and operate a state-of-the art pilot plant for a variety of practical engineering situations.

Design-based projects
Design-based projects are used throughout your programme to integrate your chemical engineering knowledge with problem-solving and team-working skills. You will design reactors, process control systems, whole-plant flow sheets and mechanical systems. These are team-based activities which will require you to work effectively with other team members as you plan, prioritise, organise and produce deliverables.

Professional and transferable skills
Throughout your course, you will also attend workshops designed to develop transferable skills (e.g. career development, team building, ethical behaviour, and report-writing and presentation skills). This will be complemented by options to develop individual interdisciplinary interests, and you may choose to study abroad for a year (in English or a foreign language) or choose streams that focus different disciplines such as

humanities, business and management studies and other STEMM subjects and other technical options from across the College.

Independent learning
Students are expected to spend significant time on independent study outside of face to face contact time. There is a prerequisite amount of independent study hours for each module which can be augmented based on your needs. This time will typically be used to access allocated reading material, review lecture notes and watch lecture recordings, work on individual and group assignments and coursework as well as to revise for in-class tests and examinations. It is essential that you manage your time effectively to meet your learning needs.

Overall Workload
Your overall workload consists of face-to-face sessions and independent learning. While your actual contact hours may vary according to the optional modules you choose to study, the following gives an indication of how much time you will need to allocate to different activities at each level of the programme. At Imperial, each ECTS credit taken equates to an indicative total study time of 25 hours. Therefore, the indicative total study time is 1500 hours per year. As these are indicative study times, you may need to make reasonable adjustments to these suggested times to account for your learning style.

Typically, in the first 3 years of your programme, you will spend around 25% of your time in lecturers, tutorials and other time-tabled activities (around 380 hours). The remaining 75% (around 1120 hours) will be used for independent study.

In your fourth year, you will spend about 10% of your time in lectures and tutorials (about 150 hours) and approximately 15% of your time undertaking team activities as part of your final design project (about 250 hours). The rest of your time will be spent in independent study.

Assessment Strategy

Assessment Methods

Both summative and formative assessments will be used to demonstrate that you have met the intended learning outcomes for each module leading to an overall fulfilment of the programme learning outcomes.

The goal of summative assessment is to evaluate student learning at the end of an instructional unit, project, module, term or academic year. A variety of summative assessment types will be used throughout your degree programme. Typical examples include final examinations, in-class tests, coursework, laboratory experiments as well as individual and group reports and presentations. Summative assessments are weighted components which count towards your final mark.

The goal of formative assessment is to monitor student learning to provide ongoing feedback that can be used by students to improve their learning and by academic staff to improve their teaching. These assessments are non-weighted elements which are crucial to your learning development as they lead to a better summative performance. Formative assessments help you to identify your strengths and weaknesses as you progress through your modules which can help you to close knowledge gaps and further develop specific areas. Typical examples of formative assessments used include problem sheets, individual and group presentations, drafts of project reports and laboratory experiments, pilot-plant and practical work.

Some assessments in your programme are also non-weighted (called pass/fail elements) where you will need to pass these assessments in order to progress. These kinds of assessments will clearly be identified at the start of your modules.

Self-reflection is also an important part of the feedback and assessment process and you should actively engage with the feedback from your assessments to evaluate your performance. This will help you to improve and further build your competencies.

Based on a typical pathway through the programme, the percentages below provide a breakdown of how you will be assessed in terms of coursework, practical work and examinable components:

	Year 1	Year 2	Year 3	Year 4
Coursework	20%	30%	40%	45%
Practical	10%	7.5%	5%	5%
Examination	70%	62.5%	55%	50%

Academic Feedback Policy
The department strives to provide timely and rich feedback to students on all coursework. For standard pieces of coursework the department adheres to the college's 10 working-day rule. Larger coursework items have longer turn-around times that are published. Solutions to the exam questions are provided on Blackboard after exam results have been ratified at the examiners' meeting. Students who have failed are provided with individual feedback and invited to retake the exam. The College's Policy on Academic Feedback and guidance on issuing provisional marks to students is available at: www.imperial.ac.uk/about/governance/academic-governance/academic-policy/exams-and-assessment/
Re-sit Policy
The College's Policy on Re-sits is available at: www.imperial.ac.uk/student-records-and-data/for-current-students/undergraduate-and-taught-postgraduate/exams-assessments-and-regulations/
Mitigating Circumstances Policy
The College's Policy on Mitigating Circumstances is available at: www.imperial.ac.uk/student-records-and-data/for-current-students/undergraduate-and-taught-postgraduate/exams-assessments-and-regulations/

Additional Programme Costs		
There are additional costs associated with the MEng Chemical Engineering with a Year Abroad which are not included in your tuition fees and are only applicable to your year abroad.		
Description	Mandatory/Optional	Approximate cost
N/A	N/A	N/A

Programme Structure

Year 1 – FHEQ Level 4
Students study all core and compulsory modules.

Code	Module Title	Core/ Compulsory/ Elective	Group	Term	Credits
CENG40001	Mastery 1	Core	NA	1 & 2	5.0
CENG40002	Process Analysis	Core	NA	1	5.0
CENG40003	Chemical Engineering Practice 1	Core	NA	1 & 2	10.0
CENG40004	Transfer Processes 1	Core	NA	1 & 2	7.5
CENG40005	Thermodynamics 1	Core	NA	1 & 2	5.0
CENG40006	Chemistry 1	Compulsory	NA	2	7.5
CENG40007	Mathematics Fundamentals	Compulsory	NA	1 & 2	10.0
CENG40008	Physical Chemistry	Compulsory	NA	1	5.0
CENG40009	Separation Processes 1	Core	NA	2	5.0
				Credit Total	60

Year 2 - FHEQ Level 5
Students study all core and compulsory modules.

Code	Module Title	Core/ Compulsory/ Elective	Group	Term	Credits
CENG50001	Mastery 2	Core	NA	1 & 2	5.0
CENG50002	Transfer Processes 2	Core	NA	2	5.0
CENG50003	Chemical Engineering Practice 2	Core	NA	1 & 2	10.0
CENG50004	Reaction Engineering 1	Core	NA	1	7.5
CENG50005	Thermodynamics 2	Core	NA	1	5.0
CENG50006	Process Dynamics and Control	Core	NA	1	5.0
CENG50007	Engineering Mathematics	Compulsory	NA	1	10.0
CENG50008	Chemistry 2	Compulsory	NA	2	7.5
CENG50009	Separation Processes 2	Core	NA	2	5.0
				Credit Total	60

Year 3 - FHEQ Level 6 **Students study all core and compulsory modules.**					
Code	Module Title	Core/ Compulsory/ Elective	Group	Term	Credits
CENG60001	Mastery 3	Core	NA	1 & 2	5.0
CENG60002	Reaction Engineering 2	Core	NA	1	5.0
CENG60003	Particle Engineering	Core	NA	2	5.0
CENG60004	Process Design	Core	NA	2	10.0
CENG60005	Safety and Loss Prevention	Core	NA	1	5.0
CENG60006	Environmental Engineering	Core	NA	2	5.0
CENG60007	Chemical Engineering Practice 3	Core	NA	1 & 2	10.0
CENG60008	Process Optimisation	Compulsory	NA	1	5.0
	Introduction to Nuclear Energy	Core	NA	1	5.0
CENG60013	Nuclear Chemical Engineering	Core	NA	2	5.0
				Credit Total	60

Year 4 - FHEQ Level 7 **Students study all core modules and choose THREE electives at Level 7.**					
Code	Module Title	Core/Compulsory/ Elective	Group	Term	Credits
	Chemical Engineering Practice 4	Core	NA	1 & 2	30.0
	Nuclear Reactor Physics	Core	NA	2	5.0
	Nuclear Materials	Core	NA	1	5.0
	Nuclear Thermal Hydraulics	Core	NA	1	5.0
	Applied Spectroscopy	Elective*	A	1	5.0
	Colloids and Interface Science	Elective*	A	1	5.0
	Product Characterisation	Elective*	A	2	5.0
	Advanced Process Operations	Elective*	B	2	5.0
	Advanced Process Optimisation	Elective*	B	1	5.0
	Dynamic Behaviour of Process Systems	Elective*	B	1	5.0
	Dynamical Systems in Chemical Engineering	Elective*	B	1	5.0
	Pharmaceutical Process Development	Elective*	B	2	5.0
	Modelling of Biological Systems	Elective*	B	2	5.0
	Advanced Bioprocess Engineering	Elective*	B	2	5.0
	Transport Processes in Biological Systems	Elective*	B	1	5.0
	Molecular Modelling of Fluids	Elective*	B	1	5.0
				Credit Total	60

* You must choose at least 1 elective from Group B. Please note that electives may not run due to low student numbers and lecturer availability.

Progression and Classification

Progression

In order to progress to the next level of study, you must have passed all modules (equivalent to 60 ECTS) in the current level of study at first attempt, at resit or by a compensated pass.

The overall weighted average for each year must be 40%, including where a module(s) has been compensated, in order for you to progress to the next year of the programme.

Classification

The marks from modules in each year contribute towards the final degree classification.

In order to be considered for an award, you must have achieved the minimum number of credits at the required levels prescribed for that award and met any programme specific requirements as set out in the Programme Specification.

Your classification will be determined through:

i) Aggregate Module marks for all modules
ii) Year Weightings

For this award, Year One is weighted at 7.5%, Year Two at 35% and Year Three at 57.5%.

The College sets the class of undergraduate degree that may be awarded as follows:

i)	First	70% or above for the average weighted module results
ii)	Upper Second	60% or above for the average weighted module results
iii)	Lower Second	50% or above for the average weighted module results
iv)	Third	40% or above for the average weighted module results

Programme Specific Regulations

In order to fulfil a part of the IChemE accreditation requirements of your programme, you are expected to pass the HAZOP component of your Year 3 Safety and Loss Prevention module. A hazard and operability study (HAZOP) is a structured and systematic analysis of a process or operation that is used to identify and evaluate risks to persons or equipment.

Supporting Information
The Programme Handbook is available at: **TBA**
The Module Handbook is available at: **TBA**
The College's entry requirements for undergraduate programmes can be found at: www.imperial.ac.uk/study/ug/apply/requirements/
The College's Quality & Enhancement Framework is available at: www.imperial.ac.uk/registry/proceduresandregulations/qualityassurance
The College's Academic and Examination Regulations can be found at: www.imperial.ac.uk/about/governance/academic-governance/regulations
Imperial College is an independent corporation whose legal status derives from a Royal Charter granted under Letters Patent in 1907. In 2007 a Supplemental Charter and Statutes was granted by HM Queen Elizabeth II. This Supplemental Charter, which came into force on the date of the College's Centenary, 8th July 2007, established the College as a University with the name and style of "The Imperial College of Science, Technology and Medicine". www.imperial.ac.uk/admin-services/secretariat/college-governance/charters/
Imperial College London is regulated by the Office for Students (OfS) www.officeforstudents.org.uk/advice-and-guidance/the-register/
This document provides a definitive record of the main features of the programme and the learning outcomes that a typical student may reasonably be expected to achieve and demonstrate if s/he takes full advantage of the learning opportunities provided. This programme specification is primarily intended as a reference point for prospective and current students, academic and support staff involved in delivering the programme and enabling student development and achievement, for its assessment by internal and external examiners, and in subsequent monitoring and review.

Modifications			
Description	**Approved**	**Date**	**Paper Reference**
N/A	N/A	N/A	N/A