

Programme Information		
Programme Title	Programme Code	HECoS Code
Communications and Signal Processing	H6U8	For Registry Use Only

Award	Length of Study	Mode of Study	Entry Point(s)	Total Credits	
				ECTS	CATS
MSc	1 calendar year (12 months)	Full-time	Annually in October	90	180
PG Diploma	N/A	N/A	N/A	60	120
PG Certificate	N/A	N/A	N/A	30	60

The PG Certificate and the PG Diploma are exit awards and are not available for entry. You must apply to and join the MSc. These exit awards are not currently accredited by the IET.

Ownership			
Awarding Institution	Imperial College London	Faculty	Faculty of Engineering
Teaching Institution	Imperial College London	Department	Electrical and Electronic Engineering
Associateship	Diploma of Imperial College (DIC)	Main Location(s) of Study	South Kensington Campus

External Reference	
Relevant QAA Benchmark Statement(s) and/or other external reference points	Master's Degree in Engineering
FHEQ Level	Level 7
EHEA Level	2nd Cycle

External Accreditor(s) (if applicable)			
External Accreditor 1:	Institution of Engineering and Technology (IET)		
Accreditation received:	2018	Accreditation renewal:	2025

Collaborative Provision			
Collaborative partner	Collaboration type	Agreement effective date	Agreement expiry date
N/A	N/A	N/A	N/A

Specification Details

Programme Lead	Panagiota (Tania) Stathaki
Student cohorts covered by specification	2023-24 entry
Date of introduction of programme	1975/1976
Date of programme specification/revision	August 23

Programme Overview
<p>The MSc in Communications and Signal Processing was founded in the early 80s. It continues to be a successful course which attracts around 600 high calibre applicants from all over the world per year for an annual intake of around 45 students.</p> <p>This degree provides you with in-depth knowledge and critical awareness of theoretical and practical solutions to problems at the forefront of communications and the signal processing. Communications and signal processing are closely intertwined, and together provide the basis of modern information engineering. Areas of application include:</p> <ul style="list-style-type: none"> • mobile communications (3G/4G/LTE and future 5G), access networks and wireless communication • communication networks including broadcast and computing communication networks • image processing and computer vision • machine learning and deep learning • audio and video recording • radar and sonar detection • biomedical signal processing • medical imaging • remote sensing • array signal processing and beamforming • space-time communications and processing <p>The programme is divided into three parts. During the Autumn and Spring Terms, you will study the programme's taught component. You will gain both theoretical and applied expertise in a variety of topics related to communications, signal processing and related fields. Additional laboratory work takes place during the Autumn term. Assignments and examinations held at the start of the Summer Term are used to assess the taught content. Building on the taught components of the degree, you will be allocated an individual research project of your choice around the beginning of Spring Term, for which you may start doing preliminary work. You will solely focus on your individual research project throughout the third part of the program, namely the Summer Term, with a deadline for submission being the end of August/start of September.</p> <p>The Communications and Signal Processing MSc programme benefits from long-serving, research-leading scholars with backgrounds in communication, signal processing, image processing, computer vision, machine learning and other related fields who deliver advanced courses and supervise research projects. Our staff who have demonstrated prominent international visibility and have ample and diversified research expertise contribute significantly to the quality and long-standing success of the Masters programme.</p> <p>Graduates of our MSc program work in public, private, and third-sector organizations around the world, including communication, signal and image processing, machine learning and other industries, business and finance or pursue PhD research at academic institutions in the UK and worldwide.</p>
Learning Outcomes
<p>On completion of the MSc in Communications and Signal Processing programme, you will be expected to:</p> <ol style="list-style-type: none"> 1. Assess and apply fundamental and advanced principles of communications and signal processing for building data and signal representations and for modelling communication systems 2. Develop insight into the problems involved in applying a variety of communication and signal processing techniques to deal with practical scenarios

3. Employ appropriate software tools and hardware test equipment in the design, implementation and validation of communications and signal processing algorithms and systems.
4. Develop and adapt project management and communication skills including problem definition, project design, execution, and reporting.
5. Appraise and apply computational principles and implement algorithms to solve communications and signal processing problems.
6. Formulate problem definitions and evaluate solutions using objective criteria.
7. Analyse and compare the strengths and weaknesses of popular approaches;
8. Predict potential outcomes of applying various types of techniques to a given problem
9. Compare, evaluate and critically review scientific and technical literature pertaining to communications and signal processing
10. Evaluate the effectiveness of a particular implementation through appropriate design and execution of experiments
11. Analyse and document evaluation results, draw appropriate conclusions and recommend actions to improve the performance

On completion of the PG Diploma, you will be able to cover items (1) to (7) from the above list.

On completion of the PG Certificate, you will be able to cover items (1) to (4) from the above list.

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	<ul style="list-style-type: none"> - Normally a high first class (1st) (75%+) UK Bachelor's Degree with Honours in Electrical Engineering or a related subject. - The equivalent of a high first class degree from countries other than UK in line with the College's Admissions Policy.
Non-academic Requirements	N/A
English Language Requirement	<p>Meet the College's higher English-language requirement. You can do this in a number of ways:</p> <ul style="list-style-type: none"> • Pass the Imperial Pre-sessional English Programme (applicants for postgraduate taught or research admission only) • Take an English language proficiency test • Provide evidence of a previous qualification that you have taken that confirms your English level • Provide evidence that you meet one of our English language exemptions <p>Higher Requirement: IELTS 7.0 overall (minimum 6.5 in all elements)</p>
Admissions Test/Interview	<p>Applications are reviewed by a selection committee consisting of the programme director and a nominated member of staff. The main criteria for selection are academic performance to date and academic potential. Applicants are not interviewed.</p>

The programme's competency standards document is available from the department.

Learning & Teaching Approach

Learning and Teaching Delivery Methods

Our MSc programme aims to offer an integrated approach to learning which will allow you to make meaningful connection between the related areas of control and signal processing. This will create a more profound and holistic understanding of control and signal process 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.

Scheduled Learning & Teaching Methods

- Lectures and seminars
- Problem solving classes

You will be taught using a combination of lectures, tutorials, and problem-solving classes. Throughout your programme, you will also build your practical expertise through problem-solving exercises and their application. Lectures will be delivered using a variety of methods which include traditional style lectures, flipped classroom and online learning supported through pre-recorded lectures. Most lectures and practical work involve student engagement and you are expected to contribute to the discussion with peers, academic and technical staff during your lectures, practical work, and seminars.

In Problem Solving sessions you may work through problem sheets along side other students, and with the support of academic staff and Graduate Teaching Assistants (GTAs).

E-learning & Blended Learning Methods

- Software laboratory: To train you in the use of specialist software appropriate timetabled sessions will be run from our computer room facilities. These sessions are often supported by a team of GTAs to assist you in your learning.

Project Learning Methods

- Group projects: These team-based activities are used throughout your programme which will require you to work effectively with other team members as you plan, organise, prioritise and produce deliverables.
- Individual projects: You will be working on a research project of your choice, supervised by one or more members of our academic staff, who are leaders of international renown in their field of research. This will allow you to undertake in-depth research in areas of interest to you, be exposed to state-of-the-art knowledge and develop the communication skills to effectively present your research findings and deliver a research output that contributes to knowledge. You will meet regularly with your supervisor to discuss your progress and plan your work. You will work part-time on the project from January to May and full time from May to end of August/early September.

As part of the learning and teaching delivery you will be encouraged to be creative in the art of communication in both written and oral presentations, and during the programme you will be challenged to produce different types of output for assessments that rely on your communication skills. These include group/individual coursework report, programming code, lab report, an individual research dissertation and a research poster presentation.

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 expected total study time of 25 hours. Therefore, the expected total study time is 2250 hours for 90 ECTS programme. This is split approximately to 1000 hours for taught courses study, 250 hours for Laboratory work and 1000 hours for research project.

Assessment Strategy

Assessment Methods

- Written examinations
- Coursework
- Oral and poster presentations
- Reports
- Individual Research Project

A range of summative and formative assessment methods are utilised throughout the programme to maximise student learning. Summative assessment refers to those that will test whether you have met the intended learning outcomes of each module and contribute towards the programme-level intended learning outcomes. Formative assessments are designed for you to identify your areas of strength and weakness to enhance your learning.

Written examinations are utilised for modules where theoretical knowledge and its applications are introduced. In addition to a final summative assessment, such modules will typically offer opportunities for you and/or your instructors to assess your level of understanding and progress through formative assessments such as problem-solving exercises (in class and for self-study), quizzes and coursework exercises carried out individually or as part of a group with peer assessment in some cases. The individual research project is evaluated on the quality of the submitted report, its originality and technical contribution, the independence shown by the student and through a poster presentation.

The exact balance of the summative assessment across the programme depends upon your choice of elective modules, but an indicative breakdown is:

Coursework	50%
Exams	40%
Practical	10%

Academic Feedback Policy

The Department of Electrical and Electronic Engineering recognises that feedback is an essential part of learning and gives high priority to the timeliness and quality of feedback offered to you on all modules. The primary purpose of feedback is to assist learning and the development of skills, by highlighting strengths and weaknesses on one hand, and by identifying actions for improvement on the other. It is important to recognize that: 1) feedback comes in various forms and 2) feedback requires your active engagement.

Feedback will be provided for all assessments carried out as part of Communication and Signal Processing MSc programme. For examinations, the published model answers will be annotated to highlight the common mistakes, and alternate approaches to the solutions. For coursework and the laboratory-based exercises, written feedback will normally be provided within two working weeks of submission. For the research project, feedback will be provided by the supervisor(s) on a continuous basis during the regular project supervision meetings. Oral feedback on the research project will be provided immediately by assessors during/after the poster presentation.

Some of the modules will further aim to provide you with the opportunity to receive feedback ahead of any major summative assessment. Such feedback may be provided in the form of in-class quizzes, problem sheets, etc.

You should keep in mind that not all feedback is structured, and important feedback may be obtained from self-reflection on your progress to date, from peers when studying or working together in a team, in dialogue with a lecturer in or outside of a class or laboratory, or by email.

The Board of Examiners will meet to consider the results of the examinations and the research project in mid-late October and results will be released to you only via student e-service within 10 days. Students who have not managed a clear pass will be informed, setting out possible courses of action within 10 days of the examiner's board.

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/about/governance/academic-governance/academic-policy/exams-and-assessment/

Mitigating Circumstances Policy

The College's Policy on Mitigating Circumstances is available at: www.imperial.ac.uk/about/governance/academic-governance/academic-policy/exams-and-assessment/

Additional Programme Costs

This section should outline any additional costs relevant to this programme which are not included in students' tuition fees.

Description	Mandatory/Optional	Approximate cost
Course material	Mandatory	Provided
Lab equipment	Mandatory	Provided

Important notice: The Programme Specifications are the result of a large curriculum and pedagogy reform implemented by the Department and supported by the Learning and Teaching Strategy of Imperial College London. The modules, structure and assessments presented in this Programme Specification are correct at time of publication but might change as a result of student and staff feedback and the introduction of new or innovative approaches to teaching and learning. You will be consulted and notified in a timely manner of any changes to this document.

Programme Structure ¹					
Year 1 – FHEQ Level 7. You must take all core and compulsory modules and must choose 4 elective modules.					
Code	Module Title	Type	Group	Term	Credits
ELEC70077	Digital Signal Processing and Digital Filters	Compulsory		Spring	5
ELEC70045	Advanced Communication Theory	Compulsory		Autumn	5
ELEC70048	Probability and Stochastic Processes	Compulsory		Autumn	5
ELEC70001	Adaptive Signal Processing and Machine Intelligence	Compulsory		Spring	5
ELEC70095	Laboratory Experiments	Core		Autumn-Spring	10
ELEC70062	Individual Research Project	Core		Autumn-Summer	40
ELEC70069	Cryptography and Coding Theory	Elective		Autumn	5
ELEC70078	Digital Image Processing	Elective		Autumn	5
ELEC70079	Optical Communication	Elective		Autumn	5
ELEC70037	Topics in Large Dimensional Data Processing	Elective		Autumn	5
ELEC70039	Wavelets, Representation Learning and their Applications	Elective		Autumn	5
ELEC70073	Computer Vision and Pattern Recognition	Elective		Spring	5
ELEC70070	Information Theory	Elective		Spring	5
ELEC70080	Speech Processing	Elective		Spring	5
ELEC70067	Traffic Theory and Queuing Systems	Elective		Spring	5
ELEC70081	Wireless Communications and Optimisation	Elective		Spring	5
ELEC70082	Distributed Optimisation and Learning	Elective		Spring	5
ELEC70083	Quantum Information and Post-Quantum Cryptography	Elective		Autumn	5
ELEC70084	Reinforcement Learning for Communication Systems	Elective		Spring	5

¹ Core modules are those which serve a fundamental role within the curriculum, and for which achievement of the credits for that module is essential for the achievement of the target award. Core modules must therefore be taken and passed in order to achieve that named award. Compulsory modules are those which are designated as necessary to be taken as part of the programme syllabus. Compulsory modules can be compensated. Elective modules are those which are in the same subject area as the field of study and are offered to students in order to offer an element of choice in the curriculum and from which students are able to select. Elective modules can be compensated.

ELEC70085	Computational Sensing and Imaging	Elective		Autumn	5
ELEC70051	Radio Frequency Subsystems	Elective		Spring	5
				Credit Total:	90

Progression and Classification

Award and Classification for Postgraduate Students

Award of a Postgraduate Certificate (PG Cert)

To qualify for the award of a postgraduate certificate you must have a minimum of 30 ECTS credits at Level 7.

Award of a Postgraduate Diploma (PG Dip)

To qualify for the award of a postgraduate diploma you must have accumulated at least 60 ECTS credits at Level 7 or above and no more than 10 credits as a Compensated Pass.

Award of a Masters Degree

To qualify for the award of a postgraduate degree a student must have:

1. accumulated credit to the value of no fewer than 90 credits at level 7
2. and no more than 10 ECTS credits as a Compensated Pass as this programme is accredited by the Institution of Engineering and Technology.

Classification of Postgraduate Taught Awards

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

1. Distinction: 70.00% or above.
2. Merit: 60.00% or above but less than 70.00%.
3. Pass: 50.00% or above but less than 60.00%.

For a Masters, your classification will be determined through the weighted average mark in the designated 'taught' and 'research' aspects of the programme each meeting the threshold for the relevant classification band.

ELEC70095 Laboratory Experiments is a P/F module and does not count towards the programme average.

Your degree algorithm provides an appropriate and reliable summary of your performance against the programme learning outcomes. It reflects the design, delivery, and structure of your programme without unduly over-emphasising particular aspects.

Programme Specific Regulations

The accreditation body (IET) permits no more than 10 ECTS credits as compensated pass

Supporting Information
<p>The Programme Handbook is available at: http://www.imperial.ac.uk/electrical-engineering/study/current-students-course-handbook/#m</p>
<p>The Module Handbook is available at: http://www.imperial.ac.uk/electrical-engineering/study/current-students-course-handbook/#m</p>
<p>The College's entry requirements for postgraduate programmes can be found at: www.imperial.ac.uk/study/apply/postgraduate-taught/entry-requirements/accepted-qualifications/</p>
<p>The College's Quality & Enhancement Framework is available at: www.imperial.ac.uk/registry/proceduresandregulations/qualityassurance</p>
<p>The College's Academic and Examination Regulations can be found at: www.imperial.ac.uk/about/governance/academic-governance/regulations</p>
<p>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/</p>
<p>Imperial College London is regulated by the Office for Students (OfS) www.officeforstudents.org.uk/advice-and-guidance/the-register/</p>
<p>This document provides a definitive record of the main features of the programme and the learning outcomes that you may reasonably be expected to achieve and demonstrate if you take 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.</p>