Programme Information		
Programme Title	Programme Code	HECoS Code
Future Power Networks	H6U7	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 - H6U7D	N/A	N/A	N/A	60	120
PG Certificate - H6U7C	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		Masters Degree in Engineering	
FHEQ Level		Level 7	
EHEA Level		2nd Cycle	
External Accreditor(s) (if applicable)			
External Accreditor 1:	The Institution of Engineering and Technology (IET)		
Accreditation received:	2018	Accreditation renewal:	2029
Collaborative Provision			
Collaborative partner	Collaboration type	Agreement effective date	Agreement expiry date
N/A	N/A	N/A	N/A
Specification Details			

Programme Lead	Dr Yunjie Gu
Student cohorts covered by specification	2025-26 entry
Date of introduction of programme	2015/16
Date of programme specification/revision	January 25

Programme Overview

Decarbonisation of the electric power sector is the key towards achieving the 'net-zero' emission targets that several nations around the world have committed to. This necessitates radical changes in the way the electric power networks are planned, operated, and controlled in future which is the focus of this MSc programme. You will learn about the unique set of challenges posed by the rapidly changing power generation mix with increasing fractions of clean energy sources such as wind and solar. You will study the enabling technologies and the system-level solutions to facilitate the decarbonisation of the electric power sector in a secure and cost-effective way. You will know about the role of digital technologies, big data application and cyber security in decarbonisation of power grids.

Throughout the programme there are many opportunities for you to work on your own as well as part of a team in group work; experiences which test your communication, leadership, and interpersonal skills as well as your technical competence, time, and project management skills are developed throughout the programme.

The programme has three components. The taught component is delivered during the autumn and spring terms. You have to take 2 compulsory modules and 6 elective modules with at least 4 elective modules from the 'power' area (group A electives). There are 7 elective modules related to 'power' (group A electives) and 6 elective modules outside 'power' (e.g., control, optimisation, probability and stochastic processes) (group B electives) to choose from. The compulsory modules are designed to provide core knowledge on the topics of fundamental importance to future power networks and discuss how that core knowledge can be used to analyse and address the challenges facing future power networks. The taught component is assessed by written examination held during the summer term and/or coursework during the term. The coursework could be individual or group work.

The second component is the research project where you will work individually on a research topic in the area of your interest. This is an opportunity to build upon and apply the knowledge gained through the taught modules. The research project runs as a part-time activity from December to May and then full time from May to the start of September. It may be possible for projects to be carried out partly at an external organisation and with co-supervision from the industry, requests will be considered on a case by case basis

The third component is laboratory work designed to provide practical experience into the operation of a microgrid in autonomous or islanded mode. This would involve a live demonstration on a bench-scale microgrid prototype at the Maurice Hancock Smart Energy Laboratory or a simulation-based study.

The Future Power Networks MSc programme is delivered by research-leading academics with backgrounds in power systems, power electronics, control, and power economics. The programme draws upon their diverse portfolio of research and their experience in providing advice and guidance to the UK and overseas governments, international agencies, and industry. The teaching is supported by guest speakers from industry to enable you to connect your learning to the ongoing developments in practice. This would also provide you the networking opportunity to enhance your career prospects in industry.

The graduates from this MSc programme generally take up a career within the transmission or distribution network operators, power technology developers and equipment manufacturers, power/energy consulting companies or pursue PhD research in the UK and worldwide.

Learning Outcomes

On completion of the MSc in Future Power Networks course, you will be able to:

1. Demonstrate a thorough conceptual understanding of power systems, power electronics and control theory.
2. Recognise the challenges associated with deep decarbonisation of the electric power sector.

3. Critically evaluate various technology options that are critical for secure operation of a low (or zero) carbon electric power system.
4. Assess the role of digital technologies and data science applications in facilitating a cost-effective transition to a zero-carbon electricity system
5. Model and analyse the steady-state and dynamic behaviour of electric power networks with different generation mixes.
6. Appreciate the main considerations behind the planning and operation of electric power systems with high fractions of clean energy sources.
7. Appraise and apply mathematical and computational concepts underpinning the behaviour of low-carbon power systems
8. Evaluate and solve common power engineering problems in a skilled and confident way, independently and as part of a team
9. Employ advanced skills to conduct a piece of independent research that demonstrates a contribution to knowledge in a research area of interest.
10. Interpret state-of-the-art technical and scientific publications related to a research topic and critically review the results of others as well as your own.
11. Approach challenges with curiosity and creativity while keeping the practical constraints in mind.
12. Innovatively apply your know-how and skills to tackle complex real-world problems.
13. Display a strong sense of personal and professional identity.

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 (5) 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 degree programme. The Graduate Attributes are available at: https://www.imperial.ac.uk/about/education/our-graduates/

Entry Requirements	
Academic Requirement	Normally a first-class UK Bachelor's Degree with Honours in Electrical Engineering (or a comparable qualification recognised by the university) and basic knowledge of power systems, power electronics and control systems. We do that by looking at the applicants' marks in relevant modules from their undergraduate degrees to gauge their background in these areas. For further information on entry requirements, please go to www.imperial.ac.uk/study/apply/postgraduate-taught/entry-requirements/accepted-qualifications/
Non-academic Requirements	None
English Language Requirement	Standard requirement (PG) Please check for other Accepted English Qualifications
Admissions Test/Interview	No admission test is required but a shortlisted applicant may be invited for a face-to-face or virtual online interview, if necessary

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

Learning & Teaching Approach

Learning and Teaching Delivery Methods

You will experience different learning and teaching delivery methods that most likely include:

- **Lectures:** Typically delivered to the entire cohort ranging from 1-2 hours in length as timetabled. Lectures will be delivered as traditional style lectures, flipped classroom and online learning supported through pre-recorded lectures. Most lectures involve student engagement with questions posed to the class and, in

others, a lecturer may include small-group exercises or discussions to reinforce learning of the recently covered material.

- **Quizzes:** These will be deployed in some modules where you will have the opportunity of testing your knowledge through short exercises and quizzes. These exercises are used as part of formative learning and practice; for you to test your understanding of concepts taught and your ability to build on and apply that knowledge.
- **Computer sessions:** 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 Graduate Teaching Assistants (GTAs) to assist you in your learning.
- **Laboratory:** You will benefit from live experimental demonstration of a prototype microgrid in our 'state of the art' Maurice Hancock Smart Energy laboratory. To prepare you for the laboratory part a software-based exercise is set at the start of the module to reinforce your learning and understanding of the steady-state and dynamic behaviour of a microgrid.
- **Individual Research Project:** You will be working on a research project of your choice, supervised by one or more members of our academic staff, who are renowned experts 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 research outputs that contribute to knowledge and understanding.

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 reports, 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 elective 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 College London, each ECTS credit taken equates to an expected total study time of 25 hours. Therefore, the expected total study time is 2,250 hours per year for an average student.

The Department expects you to allocate approximately 4 hours in self-study for every hour spent in lectures and tutorials for a typical lecture-based module.

The pattern of work is greatly dependent on your selected elective modules, however on average you can expect to spend about 200 hours in lectures over the autumn and spring terms, while devoting a further 800 hours to independent study. You will spend approximately 250 hours on laboratory work. You will also be expected to spend 1,000 hours on research work for your Individual Research Project, starting from the spring term but full time from May until the end of August/start of September.

Assessment Strategy

Assessment Methods

A range of summative and formative assessment methods are utilised throughout the programme to maximise your 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, 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 Future Power Networks 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 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.

Imperial'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

Imperial's Policy on Re-sits is available at: www.imperial.ac.uk/about/governance/academic-governance/academic-policy/exams-and-assessment/

Mitigating Circumstances Policy

Imperial'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
N/A	N/A	N/A

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 the 2 compulsory modules and both core (group C) modules.
You must choose at least 4 elective modules from group A with a total of 6 elective modules from groups A and B.

Code	Module Title	Core/ Compulsory/ Elective	Group	Term	Credits
ELEC70044	Smart Grid and Data Science	Compulsory	C	Autumn	5
ELEC70064	Selected Topics in Power Systems	Compulsory	C	Autumn	5
ELEC70047	HVDC Technology and Control	Elective	A	Autumn	5
ELEC70075	Power System Economics	Elective	A	Autumn	5
ELEC70076	Sustainable Electrical Systems	Elective	A	Spring	5
ELEC70074	Power System Dynamics, Stability and Control	Elective	A	Autumn	5
ELEC70087	Stability of Low-Carbon Power Systems	Elective	A	Spring	5
ELEC70099	Electric Vehicle Technologies (not running in 2025-26)	Elective	A	Spring	5
ELEC70112	Power System Planning	Elective	A	Spring	5
ELEC70098	Optimisation	Elective	B	Autumn	5
ELEC70086	Topics in Control Systems	Elective	B	Spring	5
ELEC70048	Probability and Stochastic Processes	Elective	B	Autumn	5
ELEC70091	Stability and Control of Non-linear Systems	Elective	B	Autumn	5
ELEC70006	Design of Linear Multivariable Control Systems	Elective	B	Spring	5
ELEC70092	Systems Identification and Learning	Elective	B	Autumn	5
ELEC70100	Individual Research Project in FPN	Core	C	Autumn-Summer	40
ELEC70088	Laboratory in FPN	Core	C	Spring	10
				Credit Total	90

Important notice: The range of electives available in a given year is dependent on staff availability (influenced by sabbaticals, retirements and resignations). Where possible, you will be given notice of which options are available to you ahead of making module choices.
The department reserves the right to cancel an elective module if the number of registered students is low.

[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.

Progression and Classification

Classification of Postgraduate Taught Awards

Award of a Postgraduate Certificate (PG cert):
To qualify for the award of a Postgraduate Certificate, you must have accumulated at least 30 ECTS credits at Level 7 or above.

Award of a Postgraduate Diploma (PG Dip):

To qualify for the award of a Postgraduate Diploma you must have:

a) accumulated at least 60 ECTS credits at Level 7 or above
b) no more than 10 credits as a Compensated Pass.

Award of a Master's Degree (MSc):
To qualify for the award of a postgraduate degree you must have:

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

Classification of Postgraduate Taught Awards

The university 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.

ELEC70088 Laboratory in FPN 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
The Programme Handbook is available from the department.
The Module Handbook is available from the department.
Imperial's entry requirements for postgraduate programmes can be found at: www.imperial.ac.uk/study/apply/postgraduate-taught/entry-requirements/accepted-qualifications/
Imperial's Quality & Enhancement Framework is available at: www.imperial.ac.uk/registry/proceduresandregulations/qualityassurance
Imperial's Academic and Examination Regulations can be found at: www.imperial.ac.uk/about/governance/academic-governance/regulations
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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 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.