Imperial College London

Programme Specification (Master's Level)

MSc Control Systems

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 intended as a reference point for prospective students, current students, external examiners and academic and support staff involved in delivering the programme and enabling student development and achievement.

Programme Information				
Award(s)	MSc			
Programme Title	Control Systems			
Programme Code	J9U4			
Awarding Institution	Imperial College London			
Teaching Institution	Imperial College London			
Faculty	Faculty of Engineering			
Department	Department of Electrical and Electronic Engineering			
Associateship	City and Guilds of London Institute (ACGI)			
Mode and Period of Study	1 academic year full-time			
Cohort Entry Points	Annually in October			
Relevant QAA Benchmark Statement(s) and/or other external reference points	Master's Degree in Engineering			
Total Credits	ECTS:	90	CATS:	180
FHEQ Level	Level 7			
EHEA Level	2nd cycle			
External Accreditor(s)	IET http://www.theiet.org/			
Specification Details				
Student cohorts covered by specification	2016-17 entry			
Person responsible for the specification	Dr David Angeli, MSc Course Director			
Date of introduction of programme	October 1978			
Date of programme specification/revision	June 2016			

Updated: Matt, 12/09/2017

Description of Programme Contents

This course will introduce students to the major aspects of control theory and its application to the design of control systems. Students will develop your skills in use of the standard computer packages for control design.

In response to the growing demands of the chemical, oil, aerospace, aeronautical, power and defence industries, control theory has developed into a well-established body of knowledge that many engineers need to acquire. Additional areas of application include:

- industrial automation
- robotics
- mechanical systems
- biomedical control

Learning Outcomes

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

Knowledge and Understanding of:

1. Fundamental concepts and principles underpinning control system theory and design, including those associated with linear and non-linear deterministic systems, stochastic systems, modelling, optimisation, control system design, on-line control.
2. The essential facts, concepts, principles and theories relevant to the student's chosen area of research for the individual project;
3. Information retrieval as a research technique;
4. Management and communication skills, including problem definition, project design, decision processes, written reports, scientific publications.

Intellectual (thinking) skills - able to:

1. (Analysis) model systems mathematically and apply relevant theory to study their properties and performance;
2. (Synthesis) apply control concepts and theory to the solution of control problems;
3. (Computing) apply computational principles and techniques to control problems;
4. (Evaluative) plan, conduct and report on a programme of original research.

Practical skills – able to:

1. Formulate mathematical models of systems and identify the parameters of such models from observations using appropriate statistical techniques;
2. Solve control analysis and synthesis problems using appropriate statistical, frequency-response and state-space methods;
3. Analyse and interpret computed results;
4. Write programs using at least one common language (Matlab);
5. Understand the literature so personal knowledge and skills can be kept up-to-date;
6. Define problems and design /manage associated projects;
7. Write effective technical reports

Transferable skills – able to:

1. Communicate effectively, as a result of clear and precise thinking, using presentations, web-pages and written reports;
2. Apply knowledge skills to new control problems;
3. (Management skills) formulate problem definitions; design and evaluate projects using objective criteria;
4. Transfer techniques and solutions from one discipline to another;
5. Use Information and Communications Technology;
6. Manage resources and time;
7. Learn independently with open-mindedness and critical enquiry;
8. Learn effectively for the purpose of continuing professional development.

Entry Requirements	
Academic Requirement	A high first class (1st) Honours degree (75%+) in electrical engineering or a related subject.
Non-academic Requirements	N/A
Interview for applicants are not required.	
English Language Requirement	IELTS 6.5 with a minimum of 6.0 in each element or equivalent
The programme's competency standards document can be found at: http://www.imperial.ac.uk/electrical-engineering/study/undergraduate/applicants-with-disabilities/	
Learning & Teaching Strategy	
Scheduled Learning & Teaching Methods	• Lectures • Problem solving classes • Tutorial sessions
E-learning & Blended Learning Methods	• Hardware laboratory • Software laboratory
Project and Placement Learning Methods	• Group projects • Individual projects • Industrial placement
Assessment Strategy	
Assessment Methods	• Written examinations • Coursework software or hardware deliverable • Oral and poster presentations • Reports
Academic Feedback Policy	
Feedback to all submitted coursework is expected within two weeks	

Mechanisms for providing prompt feedback to students on their performance in course work and examinations and processes for monitoring that these named processes are effective:

- All coursework is promptly marked
- Meeting of individual students with course directors to discuss exams, research project and career aims
- General remarks are communicated by broadcast emails to all Course students
- More details given to representatives in the Staff – Student Committee

Course questionnaire evaluation of taught components

Re-sit Policy

The College's Policy on Re-sits is available at: http://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: http://www.imperial.ac.uk/student-records-and-data/for-current-students/undergraduate-and-taught-postgraduate/exams-assessments-and-regulations/

Assessment Structure

Marking Scheme

Final Degree Classifications

An MSc degree will be awarded to students obtaining:

- at least 40% for each of the 8 modules counted for the computation of the examinations average
- at least 50% for the laboratory work average
- at least 50% for both the project and examinations average

MSc degree with **merit** will be awarded to students obtaining

- at least 40% for each of the 8 modules counted for the computation of the examinations average
- at least 50% for the laboratory work average
- at least 60% for both the project and examinations average

MSc degree with **distinction** will be awarded to students obtaining

- at least 40% for each of the 8 modules counted for the computation of the examinations average
- at least 50% for the laboratory work average
- at least 70% for both the project and examinations average

Module Weightings

Module	% Module Weighting
Minimum of 4 modules from elective group (A)*	5.55% each
Modules from elective group (B)*	5.55% each
C1 Lab	11.1%
Individual Research Project	44.4%

***Please note that there are seven elective group (A) modules. You must choose a <u>minimum of four elective (A) module</u>s.**

Please note that if you opt to take nine modules, the best selection of eight modules will be considered among all those including at least 4 elective group (A) modules, when calculating the final degree classification.

Indicative Module List											
Code	Title	Core/ Elective	L&T Hours	Ind. Study Hours	Place-ment Hours	Total Hours	% Written Exam	% Course-work	% Practical	FHEQ Level	ECTS
EE9-CS1-1	Control Engineering	ELECTIVE (B)	20	105	0	125	0%	100%	0%	7	5
EE9-CS1-2	Design of Linear Multivariable Control Systems	ELECTIVE (A)	20	105	0	125	75%	25%	0%	7	5
EE9-CS1-3	Discrete-time Systems and Computer Control	ELECTIVE (A)	20	105	0	125	75%	25%	0%	7	5
EE9-CS2-1	Stability and Control of Non-linear Systems	ELECTIVE (A)	20	105	0	125	75%	25%	0%	7	5
EE9-CS3-1	Mathematics for Signals and Systems	ELECTIVE (B)	20	105	0	125	100%	0%	0%	7	5
EE9-CS3-2	Optimisation	ELECTIVE (A)	20	105	0	125	75%	25%	0%	7	5
EE9-CS4-1	Predictive Control	ELECTIVE (A)	20	105	0	125	0%	100%	0%	7	5
EE9-CS5-1	Probability and Stochastic Processes	ELECTIVE (B)	20	105	0	125	85%	15%	0%	7	5
EE9-CS5-2	Systems Identification	ELECTIVE (A)	20	105	0	125	75%	25%	0%	7	5
EE9-CS5-3	Estimation and Fault Detection	ELECTIVE (A)	20	105	0	125	75%	25%	0%	7	5
EE9-CS6-1	Modelling and Control of Multi-body Mechanical Systems	ELECTIVE (B)	20	105	0	125	75%	25%	0%	7	5
EE9-CS6-2	Power System Dynamics, Stability and Control	ELECTIVE (B)	20	105	0	125	100%	0%	0%	7	5
EE9-CS7-1	Topics in Control Systems	ELECTIVE (B)	10	115	0	125	0%	100%	0%	7	5

Indicative Module List											
Code	Title	Core/ Elective	L&T Hours	Ind. Study Hours	Place-ment Hours	Total Hours	% Written Exam	% Course-work	% Practical	FHEQ Level	ECTS
EE9-CS7-2	Game Theory	ELECTIVE (B)	20	105	0	125	100%	0%	0%	7	5
EE9-CS7-21	Wavelets and Applications	ELECTIVE (B)	20	105	0	125	75%	25%	0%	7	5
EE9-CS7-22	Traffic Theory & Queuing Systems	ELECTIVE (B)	20	105	0	125	100%	0%	0%	7	5
EE9-CS723	Coding Theory	ELECTIVE (B)	20	105	0	125	100%	0%	0%	7	5
EE9-CS7-24	Intelligent Data and Probabilistic Inference	ELECTIVE (B)	20	105	0	125	85%	15%	0%	7	5
EE9-CS7-25	Distributed Computation and Networks: A Performance Perspective	ELECTIVE (B)	20	105	0	125	0%	100%	0%	7	5
EE9-CS7-26	Information Theory	ELECTIVE (B)	20	105	0	125	100%	0%	0%	7	5
EE9-CS7-27	Real-time Digital Signal Processing	ELECTIVE (B)	20	105	0	125	0%	100%	0%	7	5
EE9-CS7-28	Machine Learning for Computer Vision	ELECTIVE (B)	20	105	0	125	0%	100%	0%	7	5
EE9-CS7-29	Pattern Recognition	ELECTIVE (B)	20	105	0	125	0%	100%	0%	7	5
EE9-CPRJ	C1 LAB	CORE	2	248	0	250	0%	100%	0%	7	10
EE9-CPRJ	Individual Research Project	CORE	0	1000	0	1000	0%	100%	0%	7	40

Supporting Information
The Programme Handbook is available at: http://www.imperial.ac.uk/electrical-engineering/study/current-students-course-handbook/#m
The Module Handbook is available at: http://intranet.ee.ic.ac.uk/electricalengineering/eecourses_t4/crslistpg.asp?c=C1
The College's entry requirements for postgraduate programmes can be found at: www.imperial.ac.uk/study/pg/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: https://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". http://www.imperial.ac.uk/admin-services/secretariat/college-governance/charters-statutes-ordinances-and-regulations/
Imperial College London is regulated by the Higher Education Funding Council for England (HEFCE) http://www.hefce.ac.uk/reg/register/