Moscow Institute of Physics and Technology

Phystech-school of applied mathematics and computer science (PSAMCS)

ФФПМИ

mipt.ru

Page of school

PSAMCS covers key areas of mathematics, programming, mathematical modelling and data science

Department of Discrete Mathematics	Department of Mathematical Foundations of Control	Department of Algorithms and Programming Technologies	Department of Theoretical and Applied Problems of Innovation	Department of Analysis of Systems and Decisions
• Combinatorics • Mathematical logic • Discrete analysis • Introduction to data science • Computational complexity • Mathematical statistics • Geometry in programming applications • Dynamic systems • Statistical methods in econometrics • Graph theory • Random graphs • Combinatorial geometry • and more	• Abstract algebra and coding theory • Data bases • Probability theory • Computational models • Formal systems • Convex and discrete optimization • Stochastic processes • Methods of optimal control • Differential geometry • Applied statistics • and more	Programming on: • C++ • Python • Java Subjects: • Algorithms and data structures • Machine learning • Applied data analysis • Software design • Parallel programming • Object-oriented programming practices • System programming • and more	• Infrastructure of innovation support • Mathematics and software of VR-systems • Neural networks • Basics of data transfer and storage infrastructure • Technological projects management • Patent law • Intellectual property management • and more	• Mathematical models in economy • Game theory • Experimental economy • Decision support systems • Mathematical control theory • System analysis in market economy • Mathematical models • Ergodic theory • and more

BACHELOR'S PROGRAM | COMPUTER SCIENCE

MIPT MOSCOW INSTITUTE OF PHYSICS AND TECHNOLOGY

1ST SEMESTER

- History of Russia
- Russian as a Foreign Language
- English I
- Health Concepts & Strategies
- Foundations of programming I
- Basics of mathematical logic I
- Number theory
- Geometry
- Introduction to Calculus

2ND SEMESTER

- Analytic geometry
- Single Variable Calculus
- Russian as a Foreign Language
- English I
- Combinatorics and Graphs I
- Data structures and Algorythms I
- Foundations of programming II

3RD SEMESTER

- Linear Algebra
- Multivariable Calculus
- Russian as a Foreign Language
- Combinatorics and Graphs II
- Data structures and Algorythms II
- Python programming
- Operating system I
- C++ programming practice

4TH SEMESTER

- Fourier Analysis
- Russian as a Foreign Language
- Differential Equations
- Combinatorics and Graphs III
- Data structures and Algorythms III
- TeX
- Data bases
- Operating system II

5TH SEMESTER

- Functional Analysis
- Ordinary Differential Equations
- Russian as a Foreign Language
- Functional Analysis
- Probability Theory
- Introduction to Optimization
- Parallel and Disrtibuted Computing I

6TH SEMESTER

- Functional Analysis
- Parallel and Disrtibuted Computing II
- Russian as a Foreign Language
- Computability and complexity
- Statistics
- Convex optimization

7TH SEMESTER

- Russian as a Foreign Language
- Machine learning I
- In-dept elective
- Personal Research Project
- PYTHON math stat practice

8TH SEMESTER

- Philosophy
- Life safety
- Information theory
- Web-graphs
- In-dept elective
- Pre-graduation Practice

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NANYANG TECHNOLOGICAL UNIVERSITY
SINGAPORE

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AY2021-22 CURRICULUM
FOR COMPUTER ENGINEERING

SUMMARY OF ACADEMIC UNIT REQUIREMENT						
Year of Study	Core	MPE	ICC		BDE	Total AU
			C-Core	F-Core		
1	25	0	9	3	0	**37**
2	27	0	8	0	3	**38**
3	10	0	0	12	6	**28**
4	8	12	0	0	12	**32**
Total	**70**	**12**	**17**	**15**	**21**	**135**

Suggested Course Schedules

YEAR 1 SEMESTER 1				
Course Code	**Course Title**	**Type**	**AU**	**Pre-Requisite**
SC1003	Introduction to Computational Thinking & Programming	C	3	Nil
SC1005	Digital Logic	C	3	Nil
SC1013	Physics for Computing	C	2	Nil
MH1810	Mathematics I	C	3	Nil
EG1001	Engineers in Society	C	2	Nil
CC0003	Ethics & Civics in a Multi-Cultural World	C-Core	2	Nil
CC0005	Healthy Living & Wellbeing	C-Core	3	Nil
HW0001	Introduction to Academic Communication	-	0	For student who failed QET
			18	

YEAR 1 SEMESTER 2				
Course Code	**Course Title**	**Type**	**AU**	**Pre-Requisite**
SC1004	Linear Algebra for Computing	C	3	MH1810, SC1003
SC1006	Computer Organisation & Architecture	C	3	SC1005
SC1007	Data Structures & Algorithms	C	3	SC1003
MH1812	Discrete Mathematics	C	3	Nil
SC1015	Introduction to Data Science & AI	F-Core	3	SC1003
CC0001	Inquiry and Communication in an Interdisciplinary World	C-Core	2	Nil
CC0002	Navigating the Digital World	C-Core	2	Nil
			19	

YEAR 2 SEMESTER 1				
Course Code	**Course Title**	**Type**	**AU**	**Pre-Requisite**
SC2000	Probability and Statistics for Computing	C	3	MH1810
SC2001	Algorithm Design and Analysis	C	3	SC1007, MH1812
SC2002	Object Oriented Design and Programming	C	3	SC1003
SC2104	Sensors, Interfacing & Digital Control	C	3	SC1006
SC2107	Microprocessor System Design and Development	C	3	SC1006
CC0006/ CC0007	Sustainability: Human Society Economic & Environment / Science	C-Core	3	Nil
ML0004	Career & Entrepreneurial Development for the Future World	C-Core	2	Nil
			20	

YEAR 2 SEMESTER 2				
Course Code	**Course Title**	**Type**	**AU**	**Pre-Requisite**
SC2103	Digital System Design	C	3	SC1005
SC2005	Operating Systems	C	3	SC1006, SC1007
SC2006	Software Engineering	C	3	SC2002
SC2008	Computer Networks	C	3	SC1004, SC2000
CC0007/ CC0006	Science & Technology for Humanity / Sustainability: Human	C-Core	3	Nil
	Broadening & Deepening Elective	BDE	3	
			18	

YEAR 3 SEMESTER 1				
Course Code	**Course Title**	**Type**	**AU**	**Pre-Requisite**
SC3102	Signal, Systems and Transform	C	3	SC1004
SC3103	Embedded Programming	C	3	SC2107
SC2079	Multidisciplinary Design Project	C	4	Year 3 standing
	Effective Communication 2	F-Core	2	
	Broadening & Deepening Elective	BDE	3	Nil
	Broadening & Deepening Elective	BDE	3	Nil
			18	

YEAR 3 SEMESTER 2				
Course Code	**Course Title**	**Type**	**AU**	**Pre-Requisite**
SC3079	Professional Internship	F-Core	10	Year 3 standing
			10	

YEAR 4 SEMESTER 1				
Course Code	**Course Title**	**Type**	**AU**	**Pre-Requisite**
SC4079	Final Year Project	C	4	Year 4 standing
SC3xxx/SC4xxx	Major Prescribed Elective	MPE	3	Year 3 standing
SC3xxx/SC4xxx	Major Prescribed Elective	MPE	3	Year 3 standing
	Broadening & Deepening Elective	BDE	3	
	Broadening & Deepening Elective	BDE	3	
			16	

YEAR 4 SEMESTER 2				
Course Code	**Course Title**	**Type**	**AU**	**Pre-Requisite**
SC4079	Final Year Project	C	4	*Continue from
SC3xxx/SC4xxx	Major Prescribed Elective	MPE	3	Year 3 standing
SC3xxx/SC4xxx	Major Prescribed Elective	MPE	3	Year 3 standing
	Broadening & Deepening Elective	BDE	3	
	Broadening & Deepening Elective	BDE	3	
			16	

CE Major Prescribed Electives & Focus Areas (Minimum three within a group)

EF Area	Code	Title	Prerequisite
Artificial Intelligence	SC4000	Machine Learning	SC1004, SC1007, SC2000 (Year 3 standing)
	SC4001	Neural Networks and Deep Learning	SC1004, SC1007, SC2000 (Year 3 standing)
	SC4002	Natural Language Processing	SC2001 (Year 3 standing)
	SC4003	Intelligent Agents	SC1004, SC1007, SC2000 (Year 3 standing)
	SC4132	IoT – Tiny ML	SC2107 (Year 3 standing)
	SC4061	Computer Vision	NIL (Year 3 standing)
Security	SC3010	Computer Security	SC2005
	SC4010	Applied Cryptography	MH1812 (Year 3 standing)
	SC4011	Security Management	SC2006 (Year 3 standing)
	SC4012	Software Security	SC2005, SC2006 (Year 3 standing)
	SC4033	Network Security	SC2008(Year 3 standing)
	SC4013	Application Security	SC2005, SC2008 (Year 3 standing)
	SC4014	Concepts and Techniques for Malware Analysis	SC2005 (Year 3 standing)
	SC4015	Cyber Physical System Security	SC1006 (Year 3 Standing)
Data Science	SC4020	Data Analytics and Mining	SC2001 (Year 3 standing)
	SC4021	Information Retrieval	SC2001(Year 3 standing)
	SC4022	Network Science	SC2001 (Year 3 standing)
	SC4024	Data Visualisation	SC1003, SC2000 (Year 3 standing)
IoT	SC4031	IoT - Communications and Networking	SC2008 (Year 3 standing)
	SC4132	IoT – Tiny ML	SC2107 (Year 3 standing)
	SC4015	Cyber Physical System Security	SC1006 (Year 3 Standing)
Networking	SC3030	Advanced Computer Networks	SC2008
	SC4030	Wireless and Mobile Communication	SC2008 (Year 3 standing)
	SC4031	IoT - Communications and Networking	SC2008 (Year 3 standing)
	SC4032	Information Theory	SC2008(Year 3 standing)
No Focus	SC3050	Advanced Computer Architecture	SC1006
	SC4050	Parallel Computing	SC1006, SC2001 (Year 3 standing)
	SC4051	Distributed Systems	SC2005, SC2008 (Year 3 standing)
	SC4052	Cloud Computing	SC2005, SC2008 (Year 3 standing)
	SC4053	Blockchain Technology	MH1812, SC1007, SC2008 (Year 3 standing)
	SC4054	Simulation and Modelling	SC1007, SC2000

AY2021-22 CURRICULUM
COMPUTER SCIENCE

SUMMARY OF ACADEMIC UNIT REQUIREMENT

Year of Study	Major Core	MPE	ICC		Broadenng and Deepening Electives (BDE)	Total AU
			Common Core (CC)	Foundational Core (CC)		
1	25	0	9	3	0	**37**
2	21	3	8	0	6	**38**
3	4	9	0	12	3	**28**
4	8	12	0	0	12	**32**
Total	**58**	**24**	**17**	**15**	**21**	**135**

Suggested Course Schedules

YEAR 1 SEMESTER 1				
Course Code	**Course Title**	**Type**	**AU**	**Pre-Requisite**
SC1003	Introduction to Computational Thinking & Programming	C	3	Nil
SC1005	Digital Logic	C	3	Nil
SC1013	Physics for Computing	C	2	Nil
MH1810	Mathematics I	C	3	Nil
MH1812	Discrete Mathematics	C	3	Nil
CC0003	Ethics & Civics in a Multi-Cultural World	C-Core	2	Nil
CC0005	Healthy Living & Wellbeing	C-Core	3	Nil
HW0001	Introduction to Academic Communication	-	0	For student who failed QET
			19	

YEAR 1 SEMESTER 2				
Course Code	**Course Title**	**Type**	**AU**	**Pre-Requisite**
SC1004	Linear Algebra for Computing	C	3	MH1810, SC1003
SC1006	Computer Organisation & Architecture	C	3	SC1005
SC1007	Data Structures & Algorithms	C	3	SC1003
EG1001	Engineers in Society	C	2	Nil
SC1015	Introduction to Data Science & AI	FC	3	SC1003
CC0001	Inquiry and Communication in an Interdisciplinary World	C-Core	2	Nil
CC0002	Navigating the Digital World	C-Core	2	Nil
			18	

YEAR 2 SEMESTER 1				
Course Code	**Course Title**	**Type**	**AU**	**Pre-Requisite**
SC2000	Probability and Statistics for Computing	C	3	MH1810
SC2001	Algorithm Design and Analysis	C	3	SC1007, MH1812
SC2002	Object Oriented Design and Programming	C	3	SC1003
SC2005	Operating Systems	C	3	SC1006, SC1007
CC0006/	Sustainability: Human Society Economic & Environment / Science	C-Core	3	Nil
ML0004	Career & Entrepreneurial Development for the Future World	C-Core	2	Nil
	Broadening & Deepening Elective	BDE	3	
			20	

YEAR 2 SEMESTER 2				
Course Code	**Course Title**	**Type**	**AU**	**Pre-Requisite**
SC2006	Software Engineering	C	3	SC2002
SC2207	Introduction to Database	C	3	SC2001
SC2008	Computer Networks	C	3	SC1004, SC2000
SC3000	Artificial Intelligence	MPE-1	3	SC1007, SC1015, SC2000
CC0007/	Science & Technology for Humanity / Sustainability: Human	C-Core	3	Nil
	Broadening & Deepening Elective	BDE	3	
			18	

YEAR 3 SEMESTER 1				
Course Code	**Course Title**	**Type**	**AU**	**Pre-Requisite**
SC3010	Computer Security	MPE-1	3	SC2005
SC30xx	Major Prescribed Elective	MPE-1	3	Year 3 standing
SC30xx	Major Prescribed Elective	MPE-1	3	Year 3 standing
SC2079	Multidisciplinary Design Project	C	4	Year 3 standing
HW0288	Engineering Communication	F-Core	2	Nil
	Broadening & Deepening Elective	BDE	3	Nil
			18	

YEAR 3 SEMESTER 2				
Course Code	**Course Title**	**Type**	**AU**	**Pre-Requisite**
SC3079	Professional Internship	F-Core	10	Year 3 standing
			10	

YEAR 4 SEMESTER 1				
Course Code	**Course Title**	**Type**	**AU**	**Pre-Requisite**
SC4079	Final Year Project	C	4	Year 4 standing
SC4xxx	Major Prescribed Elective	MPE-2	3	Year 3 standing
SC4xxx	Major Prescribed Elective	MPE-2	3	Year 3 standing
	Broadening & Deepening Elective	BDE	3	Nil
	Broadening & Deepening Elective	BDE	3	Nil
			16	

YEAR 4 SEMESTER 2				
Course Code	**Course Title**	**Type**	**AU**	**Pre-Requisite**
SC4079	Final Year Project	C	4	*Continue from
SC4xxx	Major Prescribed Elective	MPE-2	3	Year 3 standing
SC4xxx	Major Prescribed Elective	MPE-2	3	Year 3 standing
	Broadening & Deepening Elective	BDE	3	
	Broadening & Deepening Elective	BDE	3	
			16	

CS Major Prescribed Electives

Group	Code	Title
Artificial Intelligence	SC3000	Artificial Intelligence*
	SC4000	Machine Learning
	SC4001	Neural Networks and Deep Learning
	SC4002	Natural Language Processing
	SC4003	Intelligent Agents
Security	SC3010	Computer Security*
	SC4010	Applied Cryptography
	SC4011	Security Management
	SC4012	Software Security
	SC4013	Application Security
	SC4014	Concepts and Techniques for Malware Analysis
	SC4015	Cyber Physical System Security
	SC4016	Cyber Threat Intelligence
Data Management and Analytics	SC3020	Database System Principles
	SC4020	Data Analytics and Mining
	SC4021	Information Retrieval
	SC4022	Network Science
	SC4023	Big Data Management
	SC4024	Data Visualisation
Networking and Mobility	SC3030	Advanced Computer Networks
	SC4030	Wireless and Mobile Communication
	SC4031	IoT - Communications and Networking
	SC4032	Information Theory
	SC4033	Network Security
Software Engineering and Programming	SC3040	Advanced Software Engineering
	SC4040	Advanced Topics in Algorithms
	SC4041	Programming Languages
	SC4242	Compiler Techniques
Systems and Architecture	SC3050	Advanced Computer Architecture
	SC4050	Parallel Computing
	SC4051	Distributed Systems
	SC4052	Cloud Computing
	SC4053	Blockchain Technology
	SC4054	Simulation and Modelling
Visual and Interactive Computing	SC3060	Computer Graphics and Visualisation
	SC3061	Human-Computer Interaction
	SC4060	Virtual and Augmented Reality
	SC4061	Computer Vision

CS Specialization Tracks (Minimum five within a group)

ARTIFICIAL INTELLIGENCE
SC3000 Artificial Intelligence
SC4000 Machine Learning
SC4001 Neural Networks and Deep Learning
SC4002 Natural Language Processing
SC4003 Intelligent Agents
SC4020 Data Analytics and Mining
SC4061 Computer Vision

SECURITY
SC3010 Computer Security
SC4010 Applied Cryptography
SC4011 Security Management
SC4012 Software Security
SC4013 Application Security
SC4014 Concepts and Techniques for Malware Analysis
SC4015 Cyber Physical System Security
SC4016 Cyber Threat Intelligence
SC4033 Network Security

DATA SCIENCE
SC3020 Database System Principles
SC4020 Data Analytics and Mining
SC4021 Information Retrieval
SC4000 Machine Learning
SC4002 Natural Language Processing
SC4022 Network Science
SC4023 Big Data Management
SC4024 Data Visualisation

AY2021-2022 Curriculum
Data Science & Artificial Intelligence

Year of Study	Major		Interdisciplinary Collaborative Core		Broadening and Deepening Elective	Total AU
	Core	Prescribed Electives (MPE)#	Common Core (CC)	Foundational Core (FC)		
1	16	0	9	3	6	**34**
2	26	0	8	2	0	**36**
3	10	6	0	10	3	**29**
4	8	12	0	0	12	**32**
Total	**60**	**18**	**17**	**15**	**21**	**131**

#MPE to fulfill requirement: minimum 6 MPEs and 18AUs

Suggested Study Plan

YEAR 1 SEMESTER 1

Course Code	Course Title	Type	AU	Pre-Requisite
SC1003	Introduction to Computational Thinking & Programming	C	3	Nil
MH1805	Calculas	C	4	Nil
MH1812	Discrete Mathematics	C	3	Nil
CC0001	Inquiry and Communication in an Interdisciplinary World	CC	2	Nil
CC0002	Navigating the Digital World	CC	2	Nil
	Broadening & Deepening Elective	BDE	3	
			17	

YEAR 1 SEMESTER 2

Course Code	Course Title	Type	AU	Pre-Requisite
SC1007	Data Structures & Algorithms	C	3	SC1003
SC2002	Object Oriented Design and Programming	C	3	SC1003
SC1015	Introduction to Data Science & AI	FC	3	SC1003
CC0003	Ethics & Moral Reasoning in a Multi-Cultural World	CC	2	Nil
CC0005	Healthy Living & Mental Well-being in an Aging Society	CC	3	Nil
	Broadening & Deepening Elective	BDE	3	Nil
			17	

YEAR 2 SEMESTER 1

Course Code	Course Title	Type	AU	Pre-Requisite
SC2001	Algorithm Design and Analysis	C	3	SC1007, MH1812
SC2006	Software Engineering	C	3	SC2002 (Corequisite)
MH2500	Probability and Introduction to Statistics	C	4	MH1805
MH2802	Linear Algebra for Scientists	C	3	Nil
CC0006	Sustainability: Human Society Economic & Environment	CC	3	Nil
ML0004	Career and Entrepreneurial Development for the Future World	CC	2	Nil
			18	

YEAR 2 SEMESTER 2

Course Code	Course Title	Type	AU	Pre-Requisite
SC2207	Introduction to Database Systems	C	3	SC2001 (Corequisite)
SC3000	Artificial Intelligence	C	3	SC1007, SC1015, MH2500
MH3500	Statistics	C	4	MH2500
MH3511	Data Analysis with Computer	C	3	MH2500
HW0218	Scientific Communication	FC	2	CC0001
CC0007	Science & Technology for Humanity	CC	3	Nil
			18	

YEAR 3 SEMESTER 1

Course Code	Course Title	Type	AU	Pre-Requisite
SC4000	Machine Learning	C	3	SC1007, MH2802
SC4020	Data Analytics and Mining	C	3	SC2001
MH2100	Calculus III	C	4	MH1805
MH/SC4xxx	Major Prescribe Elective	MPE	6	Year 3 standing
	Broadening & Deepening Elective	BDE	3	Nil
			19	

YEAR 3 SEMESTER 2				
Course Code	**Course Title**	**Type**	**AU**	**Pre-Requisite**
SD3079	Professional Internship	FC	10	Year 3 standing
			10	

YEAR 4 SEMESTER 1				
Course Code	**Course Title**	**Type**	**AU**	**Pre-Requisite**
SC4079	Final Year Project	C	4	Year 4 standing
MH/SC4xxx	Major Prescribe Elective	MPE	6	Year 3 standing
	Broadening & Deepening Electives	BDE	6	
			16	

YEAR 4 SEMESTER 2				
Course Code	**Course Title**	**Type**	**AU**	**Pre-Requisite**
SC4079	Final Year Project	C	4	Year 4 standing
MH/SC4xxx	Major Prescribe Elective	MPE	6	Year 3 standing
	Broadening & Deepening Electives	BDE	6	
			16	

SCSE Elective Focus Areas (For AY21/22)

a. Artificial Intelligence (For CE & CS)
b. Cyber Security (For CE & CS)
c. Data Science and Analytics (For CE & CS)
d. High Performance Computing (For CE & CS)
e. Network and Mobility (For CE & CS)
f. IoT and Edge Computing (For CE)
g. Cyber Physical Systems (For CE – phasing out)

Note:
i. Courses indicated in () are currently not offered. They are included here for those who had cleared them earlier.

Courses in each Elective Focus Area

a. Artificial Intelligence (CE & CS)
- **Cx4001** - Virtual and Augmented Reality
- **Cx4003** - Computer Vision
- **Cx4041** - Machine learning
- **Cx4042** - Neural Network and Deep Learning
- **Cx4045** - Natural Language Processing
- **Cx4046** - Intelligent Agents
- **CE4172** - Internet of Things: Tiny Machine Learning

b. Cyber Security (CE & CS)
- **Cx4010** Applied Cryptography
- (Cx4024 Cryptography & Network Security)
- **Cx4055** Cyber Physical System Security
- **Cx4062** Computer Security
- **Cx4064** Security management
- (Cx4065 Digital Forensics)
- **Cx4067** Software Security
- (Cx4068 Application Security)
- **Cx4069** Concepts and Techniques for Malware Analysis
- **Cx4070** Cyber Threat Intelligence

c. Data Science and Analytics (CE & CS)
- **Cx4031** - Database System Principles
- **Cx4032** - Data Analytics and Mining
- **Cx4034** - Information Retrieval
- **Cx4041** - Machine Learning
- **Cx4062** - Computer Security
- **Cx4071** – Network Science
- (Cx4073 – Data Science for Business)
- **CZ4123** – Big Data Management

d. High Performance Computing (CE & CS)
- **Cx4013** Distributed System
- **Cx4015** Simulation and Modelling
- **Cx4016** Advanced Topics in Algorithms
- **(**Cx4011 Parallel Computing)

e. Network and Mobility (CE & CS)

- **Cx4013** Distributed System
- (Cx4021 Pervasive Networks)
- **Cx4022** Personal Mobile Networks
- **Cx4023** Advanced Computer Networks
- (Cx4024 Cryptography & Network Security)
- **Cx4171** Internet of Things: Communications and Networking

f. IoT and Edge Computing (CE)

- **Cx4055** Cyber Physical System Security
- **Cx4171** Internet of Things: Communications and Networking
- **CE4172** Internet of Things: Tiny Machine Learning

g. Cyber Physical Systems (CE) – Phasing out

- **Cx4055** Cyber Physical System Security
- (CE4056 Cyber-Physical Systems Design)
- (Cx4057 Real-Time Computing)
- (CE4058 Cyber-Physical Software Development)

AY2021-22 CURRICULUM FOR COMPUTER SCIENCE
2ND MAJOR IN ENTREPRENEURSHIP

SUMMARY OF ACADEMIC UNIT REQUIREMENT							
Year of Study	Major		ET	Interdisciplinary Collaborate Core		BDE	Total AU
	Core	MPE		C-Core	F-Core		
1	19	0	6	9	3	0	**37**
2	24	0	6	8	0	0	**38**
3	7	6	3	0	12	0	**28**
4	8	18	10	0	0	0	**36**
Total	**58**	**24**	**25**	**17**	**15**	**0**	**139**

Suggested Study Plan

YEAR 1 SEMESTER 1				
Course Code	**Course Title**	**Type**	**AU**	**Pre-Requisite**
SC1003	Introduction to Computational Thinking & Programming	C	3	Nil
SC1013	Physics for Computing	C	2	Nil
MH1810	Mathematics I	C	3	Nil
MH1812	Discrete Mathematics	C	3	Nil
ET9211	Technopreneurial Mindset	C	3	Nil
CC0003	Ethics & Civics in a Multi-Cultural World	C-Core	2	Nil
CC0005	Healthy Living & Mental Wellbeing	C-Core	3	Nil
HW0001	Introduction to Academic Communication	-	0	For student who failed QET
			19	

YEAR 1 SEMESTER 2				
Course Code	**Course Title**	**Type**	**AU**	**Pre-Requisite**
SC1005	Digital Logic	C	3	Nil
SC1007	Data Structures & Algorithms	C	3	SC1003
SC1015	Introduction to Data Science & AI	F-Core	3	SC1003
EG1001	Engineers in Society	C	2	Nil
ET5213	Managing New Ventures	C	3	Nil
CC0001	Inquiry and Communication in an Interdisciplinary World	C-Core	2	Nil
CC0002	Navigating the Digital World	C-Core	2	Nil
			18	

YEAR 2 SEMESTER 1				
Course Code	**Course Title**	**Type**	**AU**	**Pre-Requisite**
SC1004	Linear Algebra for Computing	C	3	MH1810, SC1003
SC1006	Computer Organisation & Architecture	C	3	SC1005
SC2001	Algorithm Design and Analysis	C	3	SC1007, MH1812
SC2002	Object Oriented Design and Programming	C	3	SC1003
ET9212	Entrepreneurial Ecosystems	C	3	Nil
CC0006/ CC0007	Sustainability: Human Society Economic & Environment / Science	C-Core	3	Nil
ML0004	Career & Entrepreneurial Development for the Future World	C-Core	2	Nil
			20	

YEAR 2 SEMESTER 2				
Course Code	**Course Title**	**Type**	**AU**	**Pre-Requisite**
SC2000	Probability and Statistics for Computing	C	3	MH1810
SC2005	Operating Systems	C	3	SC1006, SC1007
SC2006	Software Engineering	C	3	SC2002
SC2207	Introduction to Database	C	3	SC2001
ET9214	Financing Entrepreneurial Ventures	C	3	ET9213
CC0007/ CC0006	Science & Technology for Humanity / Sustainability	C-Core	3	Nil
			18	

YEAR 3 SEMESTER 1				
Course Code	**Course Title**	**Type**	**AU**	**Pre-Requisite**
SC2008	Computer Networks	C	3	SC1004, SC2000
SC2079	Multidisciplinary Design Project	C	4	Year 3 standing
SC3000	Third Year Major Prescribe Elective - Artificial Intelligence	MPE-1	3	SC1007, SC1015, SC2000
SC3010	Third Year Major Prescribe Elective - Computer Security	MPE-1	3	SC2005
ET-E1	Entrepreneurship Elective 1	C	3	TBC
HW0288	Engineering Communication	F-Core	2	CC0001
			18	

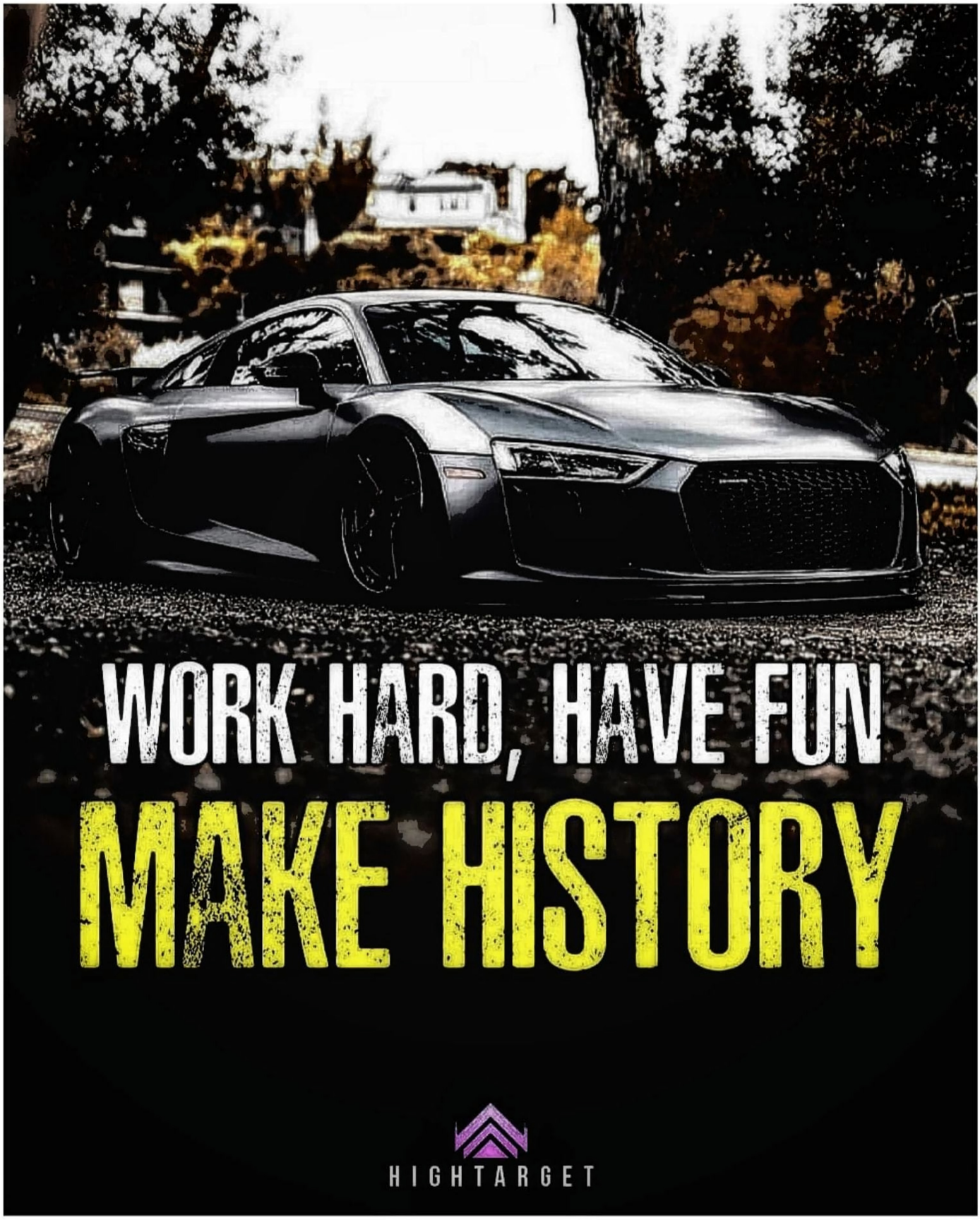
YEAR 3 SEMESTER 2				
Course Code	**Course Title**	**Type**	**AU**	**Pre-Requisite**
SC3079	Professional Internship	F-Core	10	Year 3 standing
			10	

YEAR 4 SEMESTER 1				
Course Code	**Course Title**	**Type**	**AU**	**Pre-Requisite**
SC4079	Final Year Project	C	4	Year 4 standing
SC30xx	Third Year Major Prescribe Elective	MPE-1	3	Year 3 standing
SC30xx	Third Year Major Prescribe Elective	MPE-1	3	Year 3 standing
SC4xxx	Final Year Major Prescribe Elective	MPE-2	3	Year 3 standing
ET-E2	Entrepreneurship Elective 2	C	3	TBC
ET-E3	Entrepreneurship Elective 3	C	3	TBC
			19	

YEAR 4 SEMESTER 2				
Course Code	**Course Title**	**Type**	**AU**	**Pre-Requisite**
SC4079	Final Year Project (*Continue from previous Semester)	C	4	Year 4 standing
SC4xxx	Final Year Major Prescribe Elective	MPE-2	3	Year 3 standing
SC4xxx	Final Year Major Prescribe Elective	MPE-2	3	Year 3 standing
SC4xxx	Final Year Major Prescribe Elective	MPE-2	3	Year 3 standing
ET-E4	Entrepreneurship Elective 4	C	4	TBC
			17	

official info(documents) collected and compiled by Tanweer Muhammad. tanveer1248@gmail.com

NANYANG TECHNOLOGICAL UNIVERSITY
SINGAPORE


WORK HARD, HAVE FUN
MAKE HISTORY
HIGHTARGET


TANVEER2021

UNIVERSITY OF CAMBRIDGE

For more information contact one of the College admissions offices or:

Cambridge Admissions Office
01223 333308
admissions@cam.ac.uk
www.undergraduate.study.cam.ac.uk

www.cst.cam.ac.uk undergraduate.admissions@cl.cam.ac.uk 01223 763505

Computer Science

Computer science is a fast-moving field that brings together disciplines including mathematics, engineering, the natural sciences, psychology and linguistics. Our course provides you with skills highly prized in industry and for research.

Computer Science at Cambridge

Cambridge was a pioneer of computer science and continues to lead its development. There are more than 1,000 specialist computing and advanced technology companies and commercial laboratories in the area (known as 'Silicon Fen'). A number of local firms and start-ups support our teaching and employ our graduates, in areas from chip design to mathematical modelling and AI.

Our course is broad and deep – giving skills to create future technology. All aspects of modern computer science are covered, along with the underlying theory and foundations in economics, law and business. You also develop practical skills, such as programming (in various languages, eg OCaml, Java, C/C++, Prolog) and hardware systems (eg chip design using Verilog).

Facilities and work experience

Our students benefit from the Department's cutting-edge research and extensive facilities. The purpose-built Department of Computer Science and Technology is packed with the latest technology, advanced lecture theatres, dedicated practical rooms, and even a café.

Group projects during the course, where small teams of students deliver a product to an external client, ensure relevant industrial experience. Projects can lead to commercialisation, licensing or employment.

Careers

Our graduates' knowledge and skills embody principles which will outlast today's technology, making them highly sought after by industry and commerce alike.

Many of our graduates go on to work as programmers or software development professionals, with others pursuing further study and careers in teaching and research. Many graduates have founded companies or gained employment in software, hardware, the games industry, finance, communications and commerce.

To get an idea of what's currently on offer to our graduates, visit: **www.cst.cam.ac.uk/supporters-club**.

"I'd never studied Computer Science formally, so didn't know what to expect. I'm convinced I made the best choice and can't imagine enjoying another course more!"

Chloë

Fact file

Duration Three years – BA (Hons)
Four years – MEng

2020 entry Applications per place: 12
Number accepted: 119

Typical offers require

A Level A*A*A
IB 40-42 points, with 776 at Higher Level

Other qualifications See p149-50

No prior knowledge of programming required

All Colleges require
A Level/IB Higher Level Mathematics
Some Colleges require
A Level Further Mathematics;
IB Higher Level Physics

Admission assessment
Pre-interview written assessment (see p41 and **www.cam.ac.uk/assessment**)

Colleges Available at all Colleges

Location
Map reference W (see p154-5)

Open days 2021
College open days (sciences)

Cambridge Open Days – see p152-3

Related courses

Engineering	65
Linguistics	84
Management Studies	112
Natural Sciences	99

Course outline

Teaching is provided through lectures, practical classes and supervisions. In Year 1, you can typically expect 20 hours of teaching every week, including up to 12 lectures and practical classes.

In Years 1 and 2, assessment is currently by three-hour examinations taken in the final term of each year. In Year 3, students are assessed by coursework and three-hour examinations. Practical work is undertaken and assessed in all years of the degree programme.

Please note that successful applicants are required to do some preparatory reading and complete a pre-arrival online course before the start of the first term. Students will be sent details after their place is confirmed.

Year 1 (Part IA)

You take four papers, including three compulsory Computer Science papers – covering topics such as foundations of computer science (taught in OCaml), Java and object-oriented programming, operating systems, and digital electronics, graphics, interaction design – and the Mathematics paper from Part IA of Natural Sciences (**www.natsci.tripos.cam.ac.uk**).

Year 2 (Part IB)

You take four papers, spanning core topics:

- theory – including logic and proof, computation theory
- systems – including computer design, computer networking
- programming – including compiler construction, advanced algorithms
- applications and professionalism – including artificial intelligence, graphics, security

You also undertake a group project that reflects current industrial practice.

Year 3 (Part II)

You choose from a large selection of topics which allows you to concentrate on an area of interest to you, such as computer architecture, applications (including bioinformatics and natural language processing) or theory. New topics inspired by current research interests include cloud computing, data science and robotics.

All students also work on a substantial project demonstrating their computer science skills, writing a 10,000 word dissertation on it. Projects are often connected with current Cambridge research and many utilise cutting-edge technology.

Year 4 (Part III, optional integrated Masters)

The fourth year is designed for students considering a career in academic or industrial research. You explore issues at the very forefront of computer science and undertake a substantial research project.

Progression to Part III is dependent on Part II examination achievement. Successful completion of Part III leads to the MEng qualification, as well as the BA degree attained at the end of Part II.

www.imperial.ac.uk/study/ug

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Imperial College London
South Kensington Campus
London SW7 2AZ

Imperial College London UCAS institution code: **I50**

Programme Information		
Programme Title	Programme Code	HECoS Code
BEng Electronic and Information Engineering	HG65	For Registry Use Only

Award	Length of Study	Mode of Study	Entry Point(s)	Total Credits	
				ECTS	CATS
BEng Electronic and Information Engineering[1]	3 years	Full-Time	Annually in October	180	360

[1]If you leave before completing the BEng Electronic and Information Engineering programme, you may be offered the following exit awards at the discretion of the Board of Examiners provided that you have met the minimum ECTS requirements for that award in line with College Regulations: Certificate in Higher Education in Electrical and Electronic Engineering (45 ECTS at level 4, 60 ECTS total), Diploma in Higher Education in Electrical and Electronic Engineering (45 ECTS at level 5, 120 ECTS total) or BEng Electrical and Electronic Engineering (Ordinary) (30 ECTS at level 6, 150 ECTS total). These exit awards are not accredited.

Ownership			
Awarding Institution	Imperial College London	Faculty	Faculty of Engineering
Teaching Institution	Imperial College London	Department	Electrical and Electronic Engineering
Associateship	City and Guilds of London Institute (ACGI)	Main Location(s) of Study	South Kensington

External Reference	
Relevant QAA Benchmark Statement(s) and/or other external reference points	Bachelor's award in Electronic and Information Engineering
FHEQ Level	Level 6
EHEA Level	1st Cycle

External Accreditor(s) (if applicable)			
External Accreditor 1:	Institution of Engineering and Technology		
Accreditation received:	2018	Accreditation renewal:	2023

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

Specification Details	
Programme Lead	Director of Undergraduate Studies
Student cohorts covered by specification	2020-21 entry

Date of introduction of programme	2019
Date of programme specification/revision	2020

Programme Overview

ABOUT THE DEPARTMENT

The Department's main objectives are to deliver high quality teaching and conduct internationally leading research. We see educating the next generation of engineers as a key role, and our graduates are highly valued by industry and commerce around the world. Our undergraduate degrees are aligned to our research strengths, and we are proud of the depth of analytical treatment and the specialised optional subjects we offer within our degree programmes. Our research feeds especially into the 4th year MEng where members of staff bring their research into the classroom and devise exercises in line with research expectations. The department carries out research across a wide range of topics, and targets both fundamental advances and practical applications of science and technology. The quality and impact of our research are demonstrated by our many highly cited publications, the personal recognition of our researchers through awards and honours, and the commercial adoption of our results and innovations.

The Electronic and Information Engineering discipline is considered interdisciplinary in character because Electrical and Information Engineers work in a wide range of areas including renewable power and smart grids, robotics including machine learning as well as the hardware and control systems, communication systems such as 5G and signal processing, e.g. wearable medical diagnostic devices. Design and analysis of systems is at the core of this programme and you will be offered multiple opportunities to develop your skills in this area. The programme offers technical rigour and depth in a wide range of modern engineering topics. Due to our different streams and extensive list of elective modules in later years, you shape your own specialisation route.

Click on further information to go to the department's website.

ABOUT THE BEng PROGRAMME

The department offers both a three-year BEng programme and four-year integrated Master's MEng programme. Both degree programmes involve substantial group and individual project work. The BEng programme will prepare you to go into the employment market or to proceed with further education elsewhere. Additional features of the MEng programme (but not the BEng programme) include the opportunity to take either and industrial placement or consultancy group project. The MEng stream also offers a wider range of advanced, research-orientated elective modules in the 4th year. It is also possible for students on the MEng to spend a year abroad. For more information on the MEng stream please see the MEng programme specifications.

This programme specification describes the academic path given in figure 1, below.

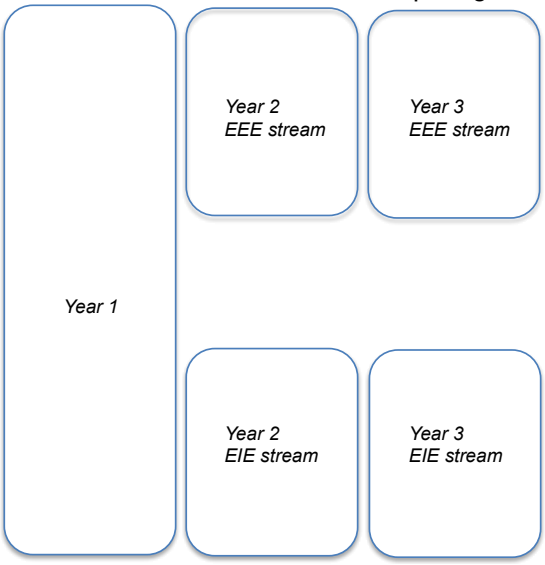

Figure 1: BEng programme structure with the different streams opening up after the 1st year. The colour filled boxes relate to this programme specification. For the other streams, please refer to the appropriate programme specification.

After the first year you will be able to choose between the Electrical and Electronic Engineering (EEE) stream and the Electronic and Information Engineering (EIE) stream. EEE focuses more on the physics behind electrical engineering, whilst EIE is oriented towards information processing. This document describes the EIE stream.

In the first year you will be taught the fundamental principles in engineering. In the first year you will be taught the fundamental principles in engineering. In the second year you will specialise more in information processing and computer engineering related fundamentals. In the third year, you will be able to take advanced specialised topics, which will give you the most direct route to a specialist professional engineering career or enable you to go into further education. You will also have access to some modules offered by other engineering departments and some non-engineering topics such as management and entrepreneurship as well as languages and other modules offered by the Business School and Imperial Horizons.

In the third year of the accredited BEng degree, you will be required to complete an Individual Project.

TRANSFERRING BETWEEN PROGRAMMES
All stream changes should be discussed with your personal tutor or the senior tutor and must be approved by the EIE Course Director.

All Programmes
All programmes within the department have a common first year. It is therefore possible to transfer between the EIE and EEE streams up until the end of your first year.

BEng to MEng
Year two is common between the EIE MEng and EIE BEng. You can choose at any point up until end of year two to change between MEng and BEng. Before stream changes at this stage, you will need to contact the international office concerning any visa requirements (click on International Office to go to their webpage). To progress to year four of the MEng, you must have achieved a minimum of 50% overall (weighted average of years 1 to 3).

ABOUT OUR TEACHING
We use a variety of teaching methods that include large group lecture sessions, workshops, small group exercise sessions, as well as 3-to-1 tutorial sessions. For practical skills you will participate in laboratory sessions with a partner from the same year group, and in the group projects within a larger team of 6-7 people.

Your learning will be supported by online tools such as blackboard for self-assessment and for-credit tests, Maple TA for mathematics support, virtual labs to prepare you for lab sessions and video recordings to demonstrate how certain equipment needs to be used. Members of staff are experts in their field and bring their research and industrial expertise into the classrooms. You can find out more about the connections between our research and teaching here: http://www.imperial.ac.uk/electrical-engineering/study/undergraduate/explore/teaching-staff/

Graduate and Undergraduate Teaching Assistants are involved in our tutor schemes, small group teaching and laboratory teaching.

The BEng programme has been designed based upon a number of key principles:

- **Competence in the fundamental principles of mathematics and electrical/electronic/ information engineering**: You will develop a firm grasp of the fundamental concepts and principles, be able to model complex systems analytically, and analyse and optimise these models.
- **Competence in computer engineering**: You will acquire a high level of competence in both programming and in using the latest computing technologies.
- **Pro-active learning**: You will learn how to learn by yourself and acquire the skill and discipline of lifelong learning.
- **Design Proficiency**: You will develop your ability to incorporate concepts into design of new products or processes, to provide innovations.
- **Development of professional and transferrable skills**: You will learn how to work in groups, develop your ability to communicate scientific/engineering ideas orally or in written form, and to develop general problem-solving skills.
- **Flexibility of provision**: We aim to provide you with a wide variety of options in the third and fourth years of the programme in order to allow you to specialise in specific areas in electrical/electronic/ computer engineering.

Benefits of accreditation
This programme is professionally accredited by the Institution of Engineering and Technology (IET) on behalf of the Engineering Council for the purposes of fully meeting the academic requirement for registration as an Incorporated Engineer and partly meeting the academic requirement for registration as a Chartered Engineer.

Achieving a professionally accredited degree demonstrates to employers that you have achieved an industry-recognised standard of competency.

Like our MEng degrees, our BEng degree counts towards the educational requirements for becoming a Chartered Engineer (CEng). A CEng is a highly respected qualification earned by professionals working in engineering, which can lead to higher earning potential and better career prospects. It also brings international recognition of your qualification, which is particularly useful when preparing for a career abroad.

While our MEng degrees fully satisfy the educational requirements of this professional qualification, BEng graduates will need to undertake further study on graduation to demonstrate that their knowledge is at Master's degree level.

Learning Outcomes

At the end of the three year BEng programme you will be able to:

Science and Mathematics

1. Explain the fundamental concepts, mathematical abstractions, physical principles and applied techniques that underpin electronic and computer engineering in depth.
2. Solve familiar problems using established methodologies as well as deriving, adapting and applying new ones with guidance.

Engineering Analysis

3. Apply analytic principles and techniques, software engineering skills, as well as commercial software packages, to critically analyse, design, implement and simulate engineering systems incorporating both hardware and software, justifying approaches and recommending alternative ones in line with design criteria.
4. Interpret abstraction and justify the use of computational techniques, and be able to identify appropriate components to automate and optimise systems and processes.

Design

5. Communicate, interact and work with peers and professionals from other disciplines, as well as non-specialist stakeholders and manage work in terms of project plans, deliverables and costs.
6. Generate creative and innovative design for products, systems, components or processes to fulfil new needs.

Economic, legal, social, ethical and environmental context

7. Explain the role of business processes in engineering, including the commercial, societal and legal framework within which industry operates and advise stakeholders on their implications.
8. Incorporate ethical, sustainability and environmental issues into your professional conduct, and integrate these into your engineering practice.

Engineering Practice

9. Manage projects in both interdisciplinary and multidisciplinary environments by using relevant practical and laboratory skills on your own or as a member or leader in a team.
10. Design relevant systems, components or processes that meet specified industrial requirements and constraints while keeping within public health and safety, cultural, societal, and environmental constraints. Work proactively with others to formulate solutions to the implications of ethical dilemmas.

Exit awards are only granted at the discretion of the Board of Examiners in line with College Regulations. None of the exit awards are accredited. Should you wish to pursue recognition as a professional computer engineer after withdrawing, a full review of your academic formation and possibly further study will be necessary to support your application for professional registration.

On completion of Year Two (Diploma in Higher Education exit award) you will be able to:

Science and Mathematics

1. Explain the fundamental concepts, mathematical, physical principles and techniques that underpin electronic and computer engineering.
2. Solve familiar problems using established methodologies as well as deriving, adapting and applying new ones with guidance.

Engineering Analysis

3. Apply analytic principles and techniques, software engineering skills to analyse, design,

implement and simulate electronic engineering systems, justifying approaches in line with design criteria.

Design

4. Communicate, interact and work with peers and professionals from other disciplines and manage work in terms of project plans, deliverables and costs.

Economic, legal, social, ethical and environmental context

5. Explain the role of business processes in engineering, including the commercial, societal and legal framework within which industry operates and advise stakeholders on their implications.
6. Have an insight into ethical, sustainability and environmental issues related to your professional conduct.

Engineering Practice

7. Manage projects by using relevant practical and laboratory skills on your own or as a member in a team.

On completion of Year One (Certificate in Higher Education exit award) you will be able to:

Science and Mathematics

1. Describe and recall the fundamental concepts, mathematical, physical principles and techniques that underpin electronic and information engineering.
2. Solve familiar problems using established methodologies with guidance.

Engineering Analysis

3. Apply analytic principles and techniques, software engineering skills to analyse and simulate electronic engineering systems, recognising the approaches needed in line with design criteria.

Design

4. Communicate, interact and work with peers and manage work in terms of project plans, deliverables and costs.

Economic, legal, social, ethical and environmental context

5. Recognise the need for a commercial, societal and legal framework for business processes in engineering.
6. Have an insight into ethical, sustainability and environmental issues related to your professional conduct.

Engineering Practice

7. Manage projects by using relevant practical and laboratory skills on your own or as a member in a team.

The Imperial Graduate Attributes are a set of core competencies that 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	Minimum entry standard is A*AA: A* in mathematics A in physics A in another subject with a preference to science-related subjects. For non A-level students, a comparable qualification recognised by the College – e.g. for International Baccalaureate: a minimum grade of 38 and 6 in both Mathematics and Physics at higher level. For further information on entry requirements, please go to https://www.imperial.ac.uk/study/ug/apply/requirements/ugacademic/
Non-academic Requirements	N/A
English Language Requirement	Higher requirement Please check for other Accepted English Qualifications
Admissions Test/Interview	If you look likely to meet our entry requirements, and your personal statement shows a clear motivation for electronic and information engineering, we will invite you to participate in an interview either here at Imperial, or by Skype. Applicant days are held on Wednesday afternoons between November

	and March. On these days you will meet some key members of staff and our students will show you around the department. You will be allocated a 30 minutes slot with a member of the academic staff who will quiz you on your UCAS statement, your interests and your mathematics and/or physics knowledge. Interviews are aimed at getting to know you better and ensuring our department is the right place for you to study. Interviews can also happen via skype if you cannot attend an applicant day.

The programme's competency standards documents can be found at:
http://www3.imperial.ac.uk/electricalengineering/teaching/undergraduate/teaching

Learning & Teaching Approach

Teaching Delivery Methods
Your course material will be delivered in different ways, including large cohort lectures in lecture theatres, team-based-learning in smaller groups, flipped classroom approaches, workshops, video recordings for online learning and laboratory work in software, hardware and embedded systems. In addition, tutorials in groups of 3-4 students will support you in analysing your progress and allow you to discuss problems in a more personal environment. Work in the laboratories is done in small teams and will teach you experimental skills, data management and how to work with other people. Team-based-learning will focus mainly on developing analytical skills in solving both well defined as well as open-ended engineering problems. You will be expected to carry out preparation work before lectures and laboratories. Revision of material is a continuous process and keeping up with new contents is key to understanding and remembering engineering concepts and how they link together.

Design and build projects
The aim of the laboratories is to add a practical aspect to the taught modules, to teach you experimental skills, including the safe use of equipment and how to choose components and encourages you to develop robust data recording and analysis skills. Design and build projects aim to bring all the taught concepts and the hard- and software skills together in order to deal with more complex systems that solve an engineering problem supported by a team of 5-8 students. These projects will also allow you to improve your team working skills together with obtaining expertise in management of time and cost. The design and build project will be mainly student-driven in order to allow you liberty in personal development and self-paced assimilation of contents. There will be group projects in the 1st and 2nd year. In the 3rd year you will carry out an individual project.

Professional and transferable skills
Throughout your programme, you will also attend workshops designed to develop transferable skills (e.g. career development, team building, ethical behaviour, and report-writing and presentation skills). These will be complemented by options to develop individual interdisciplinary interests by choosing electives in humanities, business and management studies and other STEM subjects from across the College. Professional Engineering is a topic that is integrated in all projects (group, individual and industrial) and is assessed by a Professional Portfolio that needs to be completed in the fourth year.

Independent learning
Independent study is an important part of higher education and we expect you to invest at least two to three hours of independent study for every contact hour. E-learning tools, books in the library and online digital information will support independent study. You are advised to read widely around the topic to expand your knowledge. The aim of independent study is not only to assimilate taught material but also to become an independent learner who, after graduation, can take responsibility for your future learning and development.

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 equates to an expected total study time of 25 hours. Of course, assimilation of new topics is different for everyone and therefore some students will need more or less time to achieve the same learning outcomes.

Year 1 and 2:
The ECTS allocated to each module are defined in the programme structure. Normally for 5 ECTS you will have 20 hours of lectures, 10 hours of team based learning, and 20 hours of laboratories. For every hour of face-to-face support you will be expected to spend two to three hours in self-study, supported by videos, online

self-assessment, course notes and lecture hand-outs. This estimation includes tests and exam preparation time. For the laboratory, preparation/revision time will be less but you are expected to spend an hour of preparation for each hour of lab. Preparation for labs will include engaging in the virtual labs, watching the support videos in your own time and reading around the topic. The Electronics Design Projects run over 7 weeks in the summer term. Timetabled hours will be allocated to Engineering Practice within the project module. Access to laboratories will be timetabled. You will receive help to get organised and how to manage the time spent on the project with the members of your team. A member of staff will follow and guide your progress but will not micromanage. We estimate that you will have to spend about 200 hrs on the project. The ratio of self-study to face-to-face time will increase from Year 1 to Year 3 since we expect you to develop towards becoming independent learners.

Year 3:

Modules have 5 ECTS with approximately 20 hours of face-to-face lecture time, and 5 hours of revision support for exam assessed modules. Video recordings support a move to a more self-learning style. Support outside the timetable is available upon request and is delivered by both the academic lead as well as the GTAs. You are expected to spend a significant amount of time in self-study – approximately 163 hours/module.

For modules that are assessed by coursework, an additional 10 hours face-to-face time will be put in place to support the hardware or software labs for the coursework. Coursework-assessed modules are mainly done in teams and it is expected that a team spends an additional 163 hour/module on coursework outside the face-to-face time. Help from lab technicians and GTAs can be obtained upon request. To be successful with multiple coursework assessment modules that run in parallel, good time management skills will be required to fulfil these obligations.

You must take an I-Explore or I-STEM module and complete an individual project in your 3rd and final year.

Members of staff define the Final Year Projects (Year 3). You will be expected to take initiative to progress with the work and apply good project management skills. Although meetings with your supervisor are not timetabled, both you and your supervisor should mutually agree on suitable times to meet on a regular basis.

Department of Computing

Please read their programme specifications for more details as the DoC modules might differ from the approach in the Electrical and Electronic Engineering Department. In general DoC modules have a similar workload, and also provide similar support.

Assessment Strategy

Assessment Methods

Year 1 and 2:

- Formative assessment (in-process, low stakes evaluations that give you an insight in your understanding and progress but that do not count towards the marks of your final degree) will be conducted through different techniques, including online self-assessment, key skills assessments, tutorial sessions

- Summative assessment (assessments that evaluate your understanding of engineering concepts and gives the department an insight into how well you master these). Summative assessments will count towards your final degree and will take one or more of the following forms:
  1. Online in-class confidence tests that evaluate your understanding of the fundamental principles explained in the modules. This will be closed-book tests and will in general be organised during the mid-term weeks.
  2. Laboratory tests evaluate your lab skills and also your understanding of the key concepts in each module and test your engineering competence. Your logbooks of your lab experiments support your lab orals. Laboratory tests will happen in the mid-term weeks and the last week of each term.
  3. Some modules will not have online tests, confidence test marks will come from the team-based-learning (TBL) tests or from portfolios.
  4. Module level exams. Exams will be closed book but formulae sheets are made available during the exams when needed. Exams are organised in the beginning of the summer term, unless otherwise specified in the module description. Some modules will not be examined but will be fully assessed by coursework.

Thus each module assessment will consist of[1]:

Tests per module	Type	Term and number	% Weighting in module
Written (online)	Confidence test	Autumn term x 1	10
Written (online)	Confidence test	Spring term x 1	10
Practical (lab)	Competence test	Autumn/Spring x 2	30
Written	Exams	Summer x 1	50

5. Projects are mainly assessed via reports, presentations and portfolios that evaluate your mastery of concepts across module boundaries. These will also evaluate Engineering Practice.

In year 1 the module weighting is: 5 ECTS - 8.2%, 7.5 ECTS - 12.5%, 10 ECTS - 16.7%.
In year 2 the module weighting is: 5 ECTS - 8.5%, 7.5 ECTS - 12.5%, 10 ECTS - 16.5%.

Year 3

- Formative assessment will be available as feedback on reports and professional portfolios.

- Summative assessment might take any of the following forms:
  1. Individual tests (online, oral, written).
  2. Alternative methods (demonstrations, presentations, reports, peer assessments, automated source code evaluation)

Assessment type	Individual tests	Alternative methods
Exam-based	80%	20%
Coursework-based	20%	80%

The number and type of assessments depend on the optional module choice. Coursework consists of mini-projects that are module specific and are normally done in small groups. The actual ratio may vary slightly and full details will be in the individual module specifications.
For year 3, on average 50% of the assessments will be exam based and 50% will be based on alternative assessment methods.

Test	% Weighting in year
Individual tests	30
Alternative methods	30
Final year project	40

For year 3, each elective module carries 10% of the marks. The compulsory EEE modules also carry 10% of the marks. The I-Explore module does not carry marks but must be passed to graduate.

Department of Computing
Please read their programme specifications for more details as they might differ from the approach in the Electrical and Electronic Engineering Department

Academic Feedback Policy

Formative feedback (unmarked)
Will be via online self-assessment opportunities, team-based-learning approaches (in class and online), comments on reports and portfolios, in-class module feedback, automated self-assessment of code, and feedback via tutorials.
In Years one and two, weekly mathematics homework will be set on paper or e.g. MapleTA and feedback will be made available within a week. The first year modules Mathematics and Software for Engineers will both be supported by extra, small group work and 1-to-1 tutorials.

Laboratory demonstrators will be available for help and feedback during the laboratory session.
For your final year project, you will receive feedback during an interview on approach and progress from your second marker at an interim stage.

Summative assessments (marks count towards degree)
Will be via online assessment with automatic feedback, comments on reports and portfolios and in-class module test feedback. Feedback on exams is in the form of grades and annotated example answers that will be made available after the September Examiners' Meeting. Summative feedback on laboratory orals and presentations will be provided during the sessions.

[1] Unless otherwise specified in the module description.

Important note: You will have an opportunity to take some optional modules from the Department of Computing. Please read their programme specifications for more details as they might differ from the approach in the Electrical and Electronic Engineering Department.

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		
This section should outline any additional costs relevant to this programme that are not included in students' tuition fees.		
Description	Mandatory/Optional	Approximate cost
Laptop computer	Optional	The recommendation is that you bring your own laptop to join the bring-your-own-devices (BYOD) scheme. The Department runs a free laptop loan scheme for those students without laptop or those who forgot to bring their laptop to College.
Computer software	Optional	The College/Department gives all students access to the required software that support the modules. In those cases where external GPU time is needed, the department runs a refund scheme.

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 when implemented in session. Updated versions will be on-line at the start of the academic year.

Programme Structure[2]					
Year 1 – FHEQ Level 4 **You study all core modules.**					
Code	Module Title	Core/ Elective	Group*	Term	Credits
	Mathematics 1A	Core		1	7.5
	Mathematics 1B	Core		2	5
	Topics in Electrical Engineering	Core		1&2	7.5
ELEC40002	Programming for Engineers	Core		1&2	10
ELEC40003	Analysis and Design of Circuits	Core		1&2	10
ELEC40004	Digital and Computer Architecture	Core		1&2	10
ELEC40006	Electronics Design project 1	Core		3	10
				Credit Total	60
Year 2 - FHEQ Level 5 **You study all core modules.**					
Code	Module Title	Core/ Elective	Group	Term	Credits
	Mathematics 2	Core		1	5
	Discrete Mathematics	Core		1	5
	Instruction Architectures and Compilers	Core		1&2	7.5
	Software Systems	Core		1	7.5
	Information Processing	Core		1&2	10
	Communications	Core		2	7.5
	Control Systems	Core		2	7.5
	Computer Engineering Design Project	Core		3	10
				Credit Total	60

[2] **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.

Year 3 - FHEQ Level 6 **You must take the Core Individual Project module. You must choose at least 3 modules from group A+B, and at least 2 computing modules from group DoC. In total you must take 7 modules from the combined A+B+DoC group. You must take one iExplore module.**					
Code	Module Title	Core/ Elective	Group	Term	Credits
	Advanced Mathematics for Signals and Systems	Elective	A	1	5
	Artificial Intelligence	Elective	A	1	5
	Machine Learning	Elective	A	1	5
	Communication Systems	Elective	A	1	5
	Communication Networks	Elective	A	1	5
	Digital Signal Processing	Elective	A	1	5
	Control Engineering	Elective	A	1	5
	Embedded Systems	Elective	B	2	5
	Digital Systems Design	Elective	B	2	5
	Advanced Signal Processing	Elective	B	2	5
	Real Time Digital Signal Processing	Elective	B	2	5
	Principles of Classical and Modern Radar	Elective	B	2	5
	High Level Programming	Elective	B	2	5
	Deep Learning	Elective	B	2	5
	Computing Modules	Elective	DoC	1&2	5
	I-Explore	Compulsory	C	1 and/or 2	5 or 7.5
	Individual Project	Core	P	1,2,3	20
Credit Total					60 or 62.5

* ‘Group’ refers to module grouping (e.g. a group of electives from which one/two module(s) must be chosen).

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.

Progression and Classification

Progression
In order to progress to the next level of study, you must have passed all modules 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 40.00%, including where a module(s) has been compensated, in order for you to progress to the next year of the programme.

Compensation
Compensation is the practice of allowing marginal failure of one or more modules, on the basis of good overall academic performance. A compensated module will receive the pass mark. Core modules cannot be compensated.

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 the weightings are:

Year 1	7.50%
Year 2	35.00%
Year 3	57.50%

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

First	70.00% or above for the average weighted module results
Upper Second	60.00% or above for the average weighted module results
Lower Second	50.00% or above for the average weighted module results
Third	40.00% or above for the average weighted module results

Please find the full Academic Regulations at https://www.imperial.ac.uk/about/governance/academic-governance/regulations/. Please follow the prompts to find the set of regulations relevant to your programme of study.

Programme Specific Regulations

As an accredited degree, students on this programme are subject to the standards set by the Engineering Council in relation to compensation: a maximum of 15 ECTS credits can be compensated across the entire programme.

Supporting Information
The Programme Handbook is available at: http://www3.imperial.ac.uk/electricalengineering/teaching/undergraduate
The Module Handbook is available at: http://www3.imperial.ac.uk/electricalengineering/teaching/undergraduate
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: 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**
Addition of new modules: Principles of Classical and Modern Radar	Yes - DTC	10/2019	
Clarification of 1st year module assessment	Yes - DTC	11/2019 & 12 Feb 2020	
Major change to module organisation in year 1.	Yes - DTC	12 Feb 2020	
All other modifications are related to small changes in word use in text and re-organisation of 4th year modules between autumn and spring term.	Chair's action		

Programme Information		
Programme Title	Programme Code	HECoS Code
Computing	G400	For Registry Use Only

Award BSc	Length of Study	Mode of Study	Entry Point(s)	Total Credits	
				ECTS	CATS
BEng (Hons)	3 years	Full time	October	180	360
BEng (Ordinary)	3 years	Full time	*none (exit award only)	150	300
DipHE	2 years	Full time	*none (exit award only)	120	240
CertHE	1 year	Full time	*none (exit award only)	60	120

Please refer to the Progression and Classification section at the end of this document for information on transferring between Computing degree programmes.

*Please note: Only the BEng degree is accredited. The DipHE and CertHE exit awards are not for entry and are unaccredited.

Ownership			
Awarding Institution	Imperial College London	Faculty	Faculty of Engineering
Teaching Institution	Imperial College London	Department	Computing
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		http://www.qaa.ac.uk/docs/qaa/subject-benchmark-statements/sbs-computing-16.pdf	
FHEQ Level		Level 6	
EHEA Level		1st Cycle	
External Accreditor(s) (if applicable)			
External Accreditor 1:	BCS - Chartered Institute for IT		
Accreditation received:	2017	Accreditation renewal:	2020
External Accreditor 2:	Institute of Engineering and Technology		
Accreditation received:	2017	Accreditation renewal:	2020

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. Tony Field
Student cohorts covered by specification	2020-21 entry
Date of introduction of programme	September 19
Date of programme specification/revision	December 20

Programme Overview

Our Computing degree programmes are designed to ensure that you will have detailed exposure to both the theoretical and practical aspects of Computing. At Imperial we see Computing as an engineering discipline where the emphasis is on building complex computer-based systems that work and are fit for purpose.

In the first two years, there is a carefully planned programme of practical laboratory work where you will solve problems of gradually increasing size and complexity. Each problem is designed to teach a specific aspect of Computing and, at the same time, provide exposure to a range of software and hardware platforms and tools appropriate to the problem. The emphasis throughout is on instilling transferable problem-solving skills and independent learning, rather than on the teaching of specific technologies.

The mathematical foundations of computing, which includes various topics in discrete and continuous mathematics, is taught through a series of core modules in the first two years. Follow-on modules in the third year allow you to apply the knowledge and skills gained to build and reason about computer-based systems, with key drivers being correctness, usability, security, reliability and performance.

In the third year you will undertake a group project, which will provide you with experience of what it's like to work as part of a team. You will also have the opportunity to work with external companies and collaborators as part of the project.

You will also undertake a major individual project spanning around eight months. This presents an exciting opportunity for you to apply the technical skills you have learnt throughout the course, under the supervision of an academic adviser. The topics covered by individual projects vary enormously, from the very theoretical to the very practical. Many projects are aligned directly with the Department's cutting-edge research activities.

Students graduate with exceptional practical skills and with the ability to apply their extensive knowledge of key Computing principles to the engineering of complex systems that are fit for purpose, and also to academic and industrial research.

BEng vs MEng
The department offers both a three-year BEng programme and four-year integrated Master's MEng programme in Computing. Both degree programmes involve substantial group and individual project work. The MEng programme includes an industrial placement and also the opportunity to study more research-focused modules in the fourth year.
The BEng programme is professionally accredited by the IET (Institution of Engineering and Technology) and the BCS (the Chartered Institute for IT).

Like our MEng degrees, our BEng degree counts towards the educational requirements for becoming a Chartered Engineer (CEng). A CEng is a highly respected qualification earned by professionals working in engineering, which can lead to higher earning potential and better career prospects. It also brings international recognition of your qualification, which is particularly useful for students preparing for a career abroad.

While our MEng degrees fully satisfy the educational requirements of this professional qualification, BEng graduates will need to undertake further study on graduation to demonstrate that their knowledge is at Master's

degree level.

All applicants for CEng status will also need to demonstrate their ability to meet competences described in the Engineering Council's UK-SPEC.

Learning Outcomes

Upon successful completion of the programme a typical BEng student will be able to:

On completion of year 1 (equivalent to a Cert HE) …

1. Explain the internal architecture of a simple computer
2. Develop and test software solutions to well-specified problems using a variety of programming paradigms.
3. Describe the key characteristics of information systems and use such systems effectively for data storage and retrieval.
4. Use mathematical methods to specify and analyse the behaviour of simple programs.
5. Use continuous mathematics to solve simple problems in applied Computing.
6. Apply basic research methods and communicate findings orally and in writing.
7. Explain the social, ethical and professional principles associated with computer-based technology.

On completion of year 2 (equivalent to a Dip HE), the ILOs above and…

8. Apply software engineering design principles to the development of robust software that is easy to understand, test and maintain.
9. Design, implement and deploy web-based applications that meet the needs of their target users.
10. Specify, design and implement programming languages.
11. Explain the key principles underpinning the design of modern computer and communication systems.
12. Describe formal computational models that underpin Computing and use these to explain the limitations of computers.
13. Explain the relevant laws that impact on the practice of computing.

On completion of the BEng, all the ILOs above and…

14. Design, engineer and extend complex computer-based systems that are fit for purpose using core Computing knowledge and appropriate state-of-the-art technology, methods and thinking.
15. Develop computer-based systems in a manner that respects relevant legal, social, ethical and other professional practices.
16. Select and apply appropriate methods, techniques and tools to ensure correctness, security, reliability, performance, and maintainability of computer-based systems.
17. Apply mathematical methods and scientific reasoning to novel computing-related problems.
18. Demonstrate effective application of Computing in scientific, engineering and industrial domains, as an individual.
19. Demonstrate effective teamwork in the management and delivery of complex projects.
20. Communicate effectively, both orally and in writing, as individuals and as part of a team.

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-levels** Our typical A-level offer is A*AA - A*AAA with an A* in Maths. Typical offers also require STEP I/II. For further recommendations on A-levels, see the tab on Qualification Advice for Computing. We strongly encourage applicants to take Further Maths at A2 level. We also accept the Edexcel International A levels. **International Baccalaureate**

	Our typical IB offer is 42–44 points overall with a 7 in Maths at higher level and a 7 in at least one further relevant subject at higher level. Typical offers also require STEP I/II. For further information on entry requirements, please go to https://www.imperial.ac.uk/study/ug/apply/requirements/ugacademic/ and the Department's admission pages at https://www.imperial.ac.uk/computing/prospective-students/courses/ug/beng-meng-computing/
Non-academic Requirements	N/A
English Language Requirement	Standard requirement Please check for other Accepted English Qualifications
Admissions Test/Interview	All students are required to take an online admissions test that can be sat at various times throughout the admissions cycle. Applicants who are shortlisted will be invited for interview. This will normally be held at Imperial College, although there is provision for interviews to be conducted online.

The programme's competency standards documents can be found at:
http://www.imperial.ac.uk/computing/prospective-students/courses/competence/

Learning & Teaching Approach

Teaching
You will be taught through a combination of lectures, small-group and class-based tutorials, practical laboratory sessions and personal supervision of project work.

The first two years of the programme is made up of core modules[1]. In year 1 the programming and various mathematics modules are backed up with small group tutorials in groups of approximately eight students. A senior undergraduate student will act as an Undergraduate Teaching Assistant for many of these tutorials.

The third year comprises a mixture of compulsory and elective taught modules, and a group project where you will develop a complex application as part of a team of around six students. The ability to work effectively in teams is an essential skill for any aspiring engineer and Computing is no exception. You will also undertake a substantial individual project under the supervision of a member of staff. These require you to use the skills you have learnt to develop a novel piece of software, hardware or theory, often related to a topical research problem in Computing.

There is a spine of professional and transferable skills throughout the three years which includes training in oral and written communication skills and group working, and exposure to important ethical and legal frameworks that will help to govern your activities as a practicing engineer. Your ability to communicate orally and in writing will be assessed as part of various group and individual project activities throughout the degree. When developing software systems in years 2 and 3 you will be expected to conform to relevant computer law, for example relating to software licencing and the use of personal data, and this will also form part of the assessment.

The teaching methods will vary from standard classroom teaching to more active learning, where much of what you learn will be by small-group discussions and in-class problem-solving.

Independent learning
You will be expected to spend significant time on independent study outside of face to face contact time. This will typically include reading journal articles and books, undertaking research online and in the library,

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reviewing lecture notes and watching lecture recordings, working on individual and group projects, working on coursework assignments and revising for exams. There is also a programme of extra-curricular lectures delivered by guest speakers from industry designed to introduce you to some of the key technical challenges in Computing that are being faced by industry.

Overall Workload
Your overall workload consists of face-to-face sessions and independent learning. In the first two years you will spend approximately 20% of your time in lectures and tutorials and approximately 5% in supervised laboratory sessions. The rest of the time is dedicated to independent study. The nominal total workload amounts to 60 ECTS per year and at Imperial, each ECTS credit taken equates to an expected total study time of 25 hours, i.e. approximately 1500 hours per year.

Assessment Strategy

Assessment Methods

You can expect a variety of different types of assessment methods:

- Programming exercises
- Online programming tests
- Written coursework
- Computer-based coursework
- Written examinations
- Computer-based examinations
- Software demonstrations
- Group working
- Written reports
- Research summaries
- Oral presentations

Each examinable module comprises coursework that is designed to help you master key elements of the subject and, in part, to help prepare you for the final assessment, which is typically a written or computer-based examination.

In each of the first two years there is a substantial programme of continuous assessment, which is mostly centred around practical laboratory exercises of growing size and complexity. In the first year there are also online programming tests for each of the major programming languages you will study.

You will receive written feedback on all coursework and laboratory exercises, including online programming tests. You will also receive verbal feedback on many other aspects of your study, such as presentation and problem solving skills and your progress in group and individual projects.

Written examinations are held at the beginning of the summer term for first and second year modules and at the end of the Autumn and Spring terms for third year modules. There are also progress tests at the end of the Autumn term of the first year designed primarily to assess how well you are coping with the mathematical foundations of the subject.

The weighting of coursework varies among modules, with the normal weighting being 15% of each taught module. The various assessments allow you to demonstrate that you have met the intended learning outcomes for each module and these collectively contribute towards your achievement of the programme learning outcomes, detailed above.

Collectively, the assessments are designed to ensure that you have acquired the core knowledge and skills expected of any Computing graduate and also that you are able to use these to solve the type of real-world problems encountered by industry.

Balance of assessment
The approximate percentages below are based on a typical pathway through the course. Note that laboratory work comprises mostly independent study, although supervised laboratory sessions are also timetabled throughout the year.

	Year 1	Year 2	Year 3
Coursework	10	10	7.5
Examination	84	57	42.5
Practical	6	33	50

Academic Feedback Policy

Feedback will be provided in one of a number of formats, including:

- Written, e.g. in the form of specimen solutions, written and/or verbal comments on individual assignments, class-wide feedback.
- Verbal, e.g. during or after face-to-face discussions with an assessor or in a classroom feedback session.
- Peer-to-peer, e.g. from a senior undergraduate teaching assistant, or peer student
- Personal, e.g. from your personal tutor regarding your overall progress.

You will receive feedback on formative, developmental assessments and on summative coursework assessments. Feedback is normally returned within two weeks of submissions, although the turnaround time for final, i.e. summative, assessments may be longer; in those cases, you will be informed in advanced of the planned return date.

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

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					
Year 1 – FHEQ Level 4					
Code	Module Title	Core/ Elective	Group*	Term	Credits
COMP40001	Introduction to Computer Systems	Core	N/A	1	5
COMP40002	Mathematics 1: Foundations	Core	N/A	1	5
COMP40003	Logic	Core	N/A	1	5
COMP40004	Discrete Mathematics	Core	N/A	1	5
COMP40005	Introduction to Computer Architecture	Core	N/A	2	5
COMP40006	Reasoning about Programs	Core	N/A	2	5
COMP40007	Introduction to Databases	Core	N/A	2	5
COMP40008	Graphs and Algorithms	Core	N/A	2	5
COMP40009	Computing Practical 1	Core	N/A	1, 2, 3	20
				Credit Total	60
Year 2 – FHEQ Level 5					
In addition to the core modules you must select one module from the two electives.					
Code	Module Title	Core/ Elective	Group	Term	Credits
	Algorithm Design and Analysis	Core	N/A	1	5
	Software Engineering Design	Core	N/A	1	5
	Models of Computation	Core	N/A	1	5
	Operating Systems	Core	N/A	1	5
	Networks and Communications	Core	N/A	2	5
	Compilers	Core	N/A	2	5
	Mathematics 2: Probability and Statistics	Core	N/A	2	5
	Computing Practical 2	Core	N/A	1, 2	15
	2nd Year Computing Group Project	Core	N/A	3	5
	Introduction to Model-based Artificial Intelligence	Elective	N/A	2	5
	Mathematics 3: Computational Techniques	Elective	N/A	2	5
				Credit Total	60

Year 3 - FHEQ Level 6
In addition to the core and compulsory modules you must select a total of six modules from the list of electives below. At most one of these can be from the Business School. The placement constitutes the equivalent of 15 ECTS of load in the third year, but this does not contribute to the final degree classification.

Code	Module Title	Core/ Elective	Group	Term	Credits
	Software Engineering Group Projects	Core		1	10
	Individual Project	Core		1, 2, 3	20
	I-Explore	Compulsory		1&/or 2	5
	Systems Verification	Elective		2	5
	Logic-Based Learning	Elective		2	5
	Concurrency	Elective		1	5
	Computer Vision	Elective		1	5
	Computer Graphics	Elective		2	5
	Custom Computing	Elective		2	5
	Advanced Databases	Elective		1	5
	Computer Architecture	Elective		1	5
	Communicating Computer Science in Schools	Elective		2	5
	Network and Web Security	Elective		2	5
	Advanced Computer Architecture	Elective		2	5
	Robotics	Elective		1	5
	Simulation and Modelling	Elective		1	5
	Pervasive Computing	Elective		2	5
	Performance Engineering	Elective		2	5
	Operations Research	Elective		1	5
	Distributed Algorithms	Elective		2	5
	Information and Coding Theory	Elective		1	5
	Type Systems for Programming Languages	Elective		1	5
	Introduction to Machine Learning	Elective		2	5
	Business School Modules (maximum one)	Elective		1 or 2	5
				ECTS Total	60

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.

In addition you must have achieved at least 50.00% in Computing Practical 1 in order to progress to the second year.

The overall weighted average for each year must be 40.00%, 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 7.50%, Year Two at 35.00% and Year Three at 57.50%.

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

i)	First	70.00% or above for the average weighted module results
ii)	Upper Second	60.00% or above for the average weighted module results
iii)	Lower Second	50.00% or above for the average weighted module results
iv)	Third	40.00% or above for the average weighted module results

Transferring from the BEng programme to the MEng programmes
Due to the shared core content in the first two years of all Computing degree programmes, it is possible to transfer from the BEng to an MEng programme at any point up until the beginning of the third year.

You must have achieved an overall average of 60.00% in Year Two in order to progress to the third year of one of the MEng programmes.

Please find the full Academic Regulations at https://www.imperial.ac.uk/about/governance/academic-governance/regulations/. Please follow the prompts to find the set of regulations relevant to your programme of study.

Programme Specific Regulations

As an accredited degree, students on the BEng programme are subject to the standards set by the Engineering Council in relation to compensation: a maximum of 15 ECTS credits can be compensated across the entire programme.

Supporting Information
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: 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

Manchester Metropolitan University

UNDERGRADUATE
COURSE BROCHURE 2021

COMPUTING

WHICH COURSE **TO STUDY AT** MANCHESTER MET

Choice and flexibility

Our courses will give you the specific skills to start your career with confidence, delivered by a team of experts.

AI AND DATA SCIENCE BSc (Hons)

Data is everywhere. It is at the heart of organisations and shapes our society. Harness the power of Artificial Intelligence and study the science of collecting, analysing and using data to discover its benefits.

A degree in AI and Data Science will equip you with the knowledge and skills to acquire, curate, manage, analyse, and make inferences from data for solving real-world problems.

In your first year, you will study core computing topics such as programming and databases, as well as specialist subjects such as mathematics, statistics, and the principles and practice of data science. As you move into your second year you'll progress onto more advanced topics, such as applied predictive modelling, algorithms and data structures, machine learning (a key topic in artificial intelligence), and the theory and implementation of alternative database models. In your final year, you'll be ready to meet complex subjects such as deep learning, high-performance computing and big data, and you'll turn your hand to a large-scale technical project. Alongside these subjects, you will be developing your communication and team working skills.

FEATURES AND BENEFITS

- The Department is an academic partner of the Oracle Academy, recognising our expertise in the field of database and data science.
- The four-year placement route gives you the opportunity to spend your third year on an industry placement, boosting your employment prospects on graduation.
- You will experience what it's like to work as part of a professional team, finding solutions to complex problems via group projects. You can also get involved with extracurricular work to further apply your skills, such as hackathons, gaming events and the Students' Union Computing Society.

Units may typically include:

YEAR 1

Core units:

- Databases
- Graduate Skills
- Mathematics and Statistics for Data Science
- Mathematics for Computing
- Principles and Practice of Data Science
- Programming
- Team Project

YEAR 2

Core units:

- Algorithms and Data Structures
- Applied Predictive Modelling
- Database Model and Implementation
- Industry and Community Engagement
- Machine Learning
- Thematic Project

YEAR 3

Core units:

- Data Governance and Management
- Deep Learning
- High Performance Computing and Big Data
- Research Methods
- Synoptic Project

Option units:

- Mobile Computing
- Rapid Applied Problem Solving
- Research in Computing
- User Experience and Interaction Design

THE LATEST INFORMATION ABOUT OUR COURSES, INCLUDING THE MOST UP-TO-DATE LIST OF UNITS, CAN BE FOUND ONLINE AT **MMU.AC.UK/COURSES**

CYBER SECURITY BSc (Hons)

Hacking, data breaches and online fraud are frequently headline news. Join the fight against cybercrime with the skills to investigate and protect the digital world.

As computing technology becomes more integral to our homes, workplaces and public services, cybercrime is increasingly widespread and dangerous. With this degree, you'll be part of the solution as you learn to investigate breaches and harness secure systems.

You'll specialise in identifying different cyber security attacks and mitigation techniques, detecting and responding to network-based intrusions, ethical hacking and testing approaches, and applied cryptography. And because the private data of individuals is involved, you'll also explore the legal and ethical implications and how they relate to cyber security.

Throughout our BSc (Hons) Cyber Security degree, you'll gain a broad understanding of core computing subjects, such as programming, mathematics for computing, databases, networks and operating systems. Extensive group work will develop your ability to think logically and use your initiative to critically analyse problems. By the time you graduate, you'll have a set of skills that are in high demand in our technology-led world, across both the public and private sectors.

FEATURES AND BENEFITS

- The Department of Computing and Mathematics is an academic partner of the Chartered Institute of Information Security (CIISec). This partner status recognises our expertise in the field of information and cyber security.
- You will study a curriculum designed in conjunction with industry to equip you with the range of skills and strengths that employers demand.
- The four-year placement route gives you the opportunity to spend your third year on an industry placement, boosting your employment prospects on graduation.

Units will typically include:

YEAR 1

Core units:

- Databases
- Forensics Fundamentals
- Graduate Skills
- Mathematics for Computing
- Programming
- Security Fundamentals
- Team Project

YEAR 2

Core units:

- Cyber Security Governance
- Ethical Hacking
- Incident Response
- Industry and Community Engagement
- Networks
- Operating Systems
- Security Auditing
- Thematic Project

YEAR 3

Core units:

- Applied Cryptography
- Emerging Issues in Security, Privacy and Forensics
- Network Security
- Research Methods
- Synoptic Project

Option units:

- Mobile Computing
- Rapid Applied Problem Solving
- Research in Computing
- User Experience and Interaction Design

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SOFTWARE ENGINEERING BSc (Hons)

From mobile phones to computer networks, nothing works without software. Learn how to develop and manage the software systems that run our world today.

Study Software Engineering with us and you'll build the essential skills you need to work with software systems – opening the door to a range of career opportunities. You'll cover all aspects of software development with a focus on the methodical approach to error-free design and build.

In your first year, you'll start with the core principles of computer architecture, databases, web design and programming. You'll then begin to specialise, with areas of study like software design and development processes, full-stack web development and advanced programming.

As you progress you'll develop knowledge of cloud computing, full-stack web development, software testing, as well as advanced development skills in a range of programming languages. You'll also tackle team-based projects and a large-scale software project in your final year. This will help you to build vital project management skills, as well as giving you a sound understanding of the role of software development tools within the software life cycle.

FEATURES AND BENEFITS

- There is an option to take a four-year placement route where you can spend your third year on industrial placement, boosting your employment prospects on graduation.
- You will experience what it's like to work as part of a professional team, finding solutions to complex problems via group projects. You can also get involved with extracurricular work to further apply your skills, for example, gaming events, hackathons and the Students' Union Computing Society.
- This course shares a common first year with our BSc (Hons) Computer Science and BSc (Hons) Applied Computing courses, allowing you to transfer between these courses after Year 1 as you develop your areas of interest.
- Our excellent facilities include teaching laboratories equipped with high-specification PCs with specialist, industry-standard software running on either Windows or Linux.

Units may typically include:

YEAR 1

Core units:

- Computer Architecture
- Databases
- Graduate Skills
- Mathematics for Computing
- Programming
- Team Project
- Web Development

YEAR 2

Core units:

- Advanced Programming
- Full-Stack Web Development
- Industry and Community Engagement
- Software Design and Architecture
- Software Development Processes
- Thematic Project

YEAR 3

Core units:

- Cloud Computing
- Programming Languages and Paradigms
- Research Methods
- Software Testing and Quality Assurance
- Synoptic Project

Option units:

- Mobile Computing
- Rapid Applied Problem Solving
- Research in Computing
- User Experience and Interaction Design

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QUERIES & DISCUSSIONS
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