Programme Specification

BEng Robotics

1. Programme title	**BEng Robotics**
2. Awarding institution	Middlesex University
3. Teaching institution	Middlesex University
4. Details of accreditation by professional/statutory/regulatory body	
5. Final qualification	Bachelor of Engineering (Hons)
6. Year of validation **Year of amendment**	
7. Language of study	English
8. Mode of study	FT/TKSW

9. Criteria for admission to the programme

Admission to the BEng (Hons) Robotics programme will require 280 UCAS tariff points normally including a minimum of 200 points from at least two science or numerate based subjects.

In addition Middlesex University general entry requirements apply as outlined in the university's regulation B2. Applicants whose first language is not English are required to achieve 6.0 in IELTS overall (with a minimum of 5.5 in each component) or an equivalent qualification recognised by Middlesex University. The equivalence of qualifications from outside UK will be determined according to NARIC guidelines.

We welcome applicants with a wide variety of educational experience including: A/AS levels, AVCE, BTEC National Diploma, Access Certificates, Scottish Highers, Irish Leaving Certificates (Higher Level), International Baccalaureate and a large number of equivalent home and overseas qualifications. Application from mature applicants with suitable life skills and experiences are also welcomed.

10. Aims of the programme

This programme aims to produce professional and competent Robotics Engineers capable of playing an active role in formulating, meeting the challenges and opportunities arising in contemporary industrial and commercial practice.

This program is designed to further enhance problem solving and design skills through a variety of robotics projects and hands-on laboratory sessions. Students will cultivate comprehensive knowedge and understanding of specialised robotics programming and control capabilities, which are developed and enhanced progressively through the course.

This programme explores the principles underlying the design and implementation of up-to-date robotics systems needed in a variety of problem domains and provides the opportunity of realising such systems.

11. Programme outcomes

Knowledge and understanding

On completion of this programme the successful student will have knowledge and understanding of :

Scientific principles and related engineering disciplines to enable the modelling and analyse complex engineering systems, processes and products and collect and analyse data and draw conclusions for the innovative solution of unfamiliar or novel engineering design problems using future developments and technologies.
Concepts, principles and theories of the design process and an appreciation of their limitations.
The application of a systems approach to solving complex engineering problems within the context of Robotics.
Analytical techniques and engineering science relevant to Design Engineering within the context of Robotics.
The issues involved in systems engineering and the range of approaches used in industry to manage the resulting complexity.
Developing new technologies and applications relevant to Robotics.
Current commercial, management and business practices and their limitations relating to engineering and to new product development.
Professional and ethical responsibilities of engineers.
The role and limitations of common

Teaching/learning methods

Students gain knowledge and understanding takes place through a combination of lectures, seminars, exercise classes, design build and test projects, forensic deconstruction, CAE and IT workshops, laboratory classes, industrial visits, group and individual project work, experimenting, constructing, analysing, assessing and discussing and self-study.

Assessment methods

Students' knowledge and understanding is assessed by technical reports, coursework assignments, essays, presentations, and practical in-class tests.

ICT tools and limitations to common ICT tools and ability to specify requirements for computer- based engineering design tools to solve unfamiliar problems. 10. Characteristics of particular materials, equipment, processes and products.	
Cognitive (thinking) skills On completion of this programme the successful student will be able to: Analyse and solve engineering problems using appropriate techniques and through critical thinking. Model and analyse relevant engineering systems. Fully engage with the design process. Select and apply appropriate computer based methods for solving design engineering problems. Fully evaluate external influences on the design process. Design innovative systems, components or processes.	**Teaching/learning methods** Students learn cognitive skills through design projects, problem solving activities and through report writing. **Assessment methods** Students' cognitive skills are assessed by the products and systems design, with particular reference to their engagement with the design process and by coursework comprised of reports and essays.
Practical skills On completion of the programme the successful student will be able to: Plan, manage and undertake a design project, team or individual, including establishing user needs and technical specification, concept generation and evaluation, embodiment and detail design	**Teaching/learning methods** Students learn practical skills through design projects, specific skills inputs and set exercises.

work, verification and review. Evaluate technical risk with an awareness of the limitations of possible solutions. Use relevant laboratory and test equipment. Create CAD models and make physical models and prototypes. Interface different technologies to develop integrated systems. Apply engineering design techniques, taking into account of a selection of commercial and industrial constraints. Apply and integrate knowledge and understanding of other engineering and non-engineering disciplines to support engineering design activities.	**Assessment methods** Students' practical skills are assessed by individual and group projects, lab reports, coursework assignments and practical tests.
Graduate skills On completion of this programme the successful student will be able to: Communicate effectively in writing, verbally, graphically and through presentations to groups. Apply mathematical methods, computer models, and a scientific approach to solving problems in engineering design. Demonstrate leadership skills and the ability to work effectively as a member of a team. Write computer programmes and use CAE software and general IT tools and provide technical documentation.	**Teaching/learning methods** Students acquire graduate skills through design projects, competitions, problem solving activities, presentations, and through report writing. **Assessment methods** Students' graduate skills are assessed by coursework assignments including design reports, laboratory reports, other written reports, problems

5. Learn independently and to adopt a critical approach in investigation. 6. Use technical literature and other information sources effectively including electronic media.	sheets, case studies, software programs, industrial placement, group and individual project reports.

12. Programme structure (levels, modules, credits and progression requirements)

12. 1 Overall structure of the programme

Year 1				
AY	**PDE1400** Design Engineering Projects 1 [30]	**PDE1410** Physical Computing: Electronics [30]	**PDE1420** Physical Computing: Programming [30]	**PDE1430** Formal Systems[30]
Year 2				
AY	**PDE2400** Design Engineering Projects 2 [30]	**PDE2410** Engineering in Context [30]	**PDE2420** Control Systems [30]	**PDE2440** Robotics and Mechatronics [30]
Year 3	**PDE3250** - Thick Sandwich (compulsory for TKSW only) Placement			

Year 3/4		
Term 1	**PDE3432** Mobile Robots and Manipulators [30]	**PDE3433** Advanced Robotics [30]
Term 2	**PDE3400** Design Engineering Major Project [60]	

12.2 Levels and modules

Starting in academic year 2010/11 the University is changing the way it references modules to state the level of study in which these are delivered. This is to comply with the national Framework for Higher Education Qualifications. This implementation will be a gradual process whilst records are updated. Therefore the old coding is bracketed below.

Level 4 (1)

COMPULSORY	OPTIONAL	PROGRESSION REQUIREMENTS
Students must take all of the following: Students must take all of the following: PDE1400 Design Engineering Projects 1 [30] PDE1410 Physical Computing: Electronics [30] PDE1420 Physical Computing: Programming [30] PDE1430 Formal Systems [30]	N/A	Students must pass all level 4 modules to progress.

Level 5 (2)		
COMPULSORY	OPTIONAL	PROGRESSION REQUIREMENTS
Students must take all of the following: PDE2400 Design Engineering Projects 2 [30] PDE2410 Engineering in Context [30] PDE2420 Control Systems [30] PDE 2440 Robotics and Robotics [30]	N/A:	TKSW -To progress on to a placement year students must pass all modules at level 5. FT/PT – Students must pass all level 4 and 5 modules to progress.

Level 6 (3) TKSW mode only		
COMPULSORY	OPTIONAL	PROGRESSION REQUIREMENTS
TKSW mode only Students must take PDE3250 Industrial Placement (120 credits – for Diploma of Industrial Studies.)	N/A	
Level 6 (3)		
COMPULSORY	OPTIONAL	PROGRESSION REQUIREMENTS
Students must take all of the following: PDE3432 Mobile Robots and Manipulators [30] PDE3433 Advanced Robotics [30] PDE3400 Design Engineering Major project [60]	N/A	

12.3 Non-compensatable modules (note statement in 12.2 regarding FHEQ levels)	
Module level	**Module code**
6	PDE3400

13. Curriculum map

See attached.

14. Information about assessment regulations

Please refer to the University Regulations.

15. Placement opportunities, requirements and support (if applicable)

Students on the TKSW mode take a placement (36 to 48 weeks) at the end of year 2. A dedicated Employability Advisor helps in the search for an appropriate employer and provides students with appropriate Placement. They also provide students with appropriate guidance and support in preparation for, during and after placement. The placement forms the basis for an assessed report based on the organisation. At the start of the placement students are allocated an individual supervisor who provides support and advice for the duration of the project.

Students following a TKSW placement year are supported through the process of securing a placement, which includes the legal and QAA requirements for placement learning, via tutorial support and the University Placement office.

16. Future careers (if applicable)

As a BEng Robotics graduate you will have excellent career prospects; there are many opportunities for employment, primarily in private sector engineering

companies. These range from small independent companies working in highly specialised fields, to large multinational companies involved in a wide range of activities. With the growth of robotics beyond its initial commercial application in industrial automation there are many fields where robotics is an emerging solution for complex tasks.

To support students in this activity during their students are encouraged to develop a commercial approach to design engineering via supported live projects with industrial partners and industrial placements. They undertake contextual studies into the nature and contexts of the profession. They interact with a variety of guest lecturers with professional backgrounds. They are supported in developing their exit portfolio, a CV and a career entry plan.

Through these experiences they come to understand design in a commercial context, the nature of the design industries and to plan for their own career entry and development.

17.

Meeting the learning outcomes of this programme requires active participation in the subject and all practical sessions. Supporting this level of active participation is achieved via regular contact with academic staff, productive and informed support from technical staff, supports provided by Graduate Academic Assistants (GAAs), Student Learning Assistants (SLAs) and the use of online learning materials where appropriate.

The subject provides extensive studio, laboratory and workshop facilities where students can engage with their coursework assignments in a supported and productive environment. These areas are shared with other subjects and programmes.

18. JACS code (or other relevant coding system)	H150 – Engineering Design
19. Relevant QAA subject benchmark group(s)	Engineering

20. Reference points

The following reference points were used in designing the programme:

QAA Engineering subject benchmark statement (2015)
QAA Framework for Higher Education Qualifications in England, Wales and Northern Ireland;
Middlesex University Regulations;
Middlesex University Learning and Quality Enhancement Handbook;
UK Standard for Professional Engineering Competence;
Chartered Engineer and Incorporated Engineer Standard, Engineering Council UK, 2014;

The Accreditation of Higher Education Programmes, Engineering Council UK, 2014;
IED Engineering Design Specific Learning Outcomes for EC(UK) Accredited Degree Programmes.

21. Other information

Please note programme specifications provide a concise summary of the main features of the programme and the learning outcomes that a typical student might reasonably be expected to achieve if s/he takes full advantage of the learning opportunities that are provided. More detailed information about the programme can be found in the rest of your programme handbook and the university regulations.

Appendix 2: Curriculum Map

Curriculum map for *BEng Robotics*

This section shows the highest level at which programme outcomes are to be achieved by all graduates, and maps programme learning outcomes against the modules in which they are assessed.

Programme learning outcomes

Knowledge and understanding		Practical skills	
A1	Scientific principles and related engineering disciplines to enable the modelling and analyse complex engineering systems, processes and products and collect and analyse data and draw conclusions for the innovative solution of unfamiliar or novel engineering design problems using future developments and technologies. .	C1	Plan, manage and undertake a design project, team or individual, including establishing user needs and technical specification, concept generation and evaluation, embodiment and detail design work, verification and review.
A2	Concepts, principles and theories of the design process and an appreciation of their limitations.	C2	Evaluate technical risk with an awareness of the limitations of possible solutions.

A3	The application of a systems approach to solving complex engineering problems within the context of Robotics.	C3	Use relevant laboratory and test equipment.
A4	Analytical techniques and engineering science relevant to Design Engineering within the context of Robotics.	C4	Create CAD models and make physical models and prototypes.
A5	The issues involved in systems engineering and the range of approaches used in industry to manage the resulting complexity.	C5	Interface different technologies to develop integrated systems.
A6	Developing new technologies and applications relevant to Robotics.	C6	Apply engineering design techniques, taking into account of a selection of commercial and industrial constraints.
A7	Current commercial, management and business practices and their limitations relating to engineering and to new product development.	C7	Apply and integrate knowledge and understanding of other engineering and non-engineering disciplines to support engineering design activities.
A8	Professional and ethical responsibilities of engineers.		

A9	The role and limitations of common ICT tools and limitations to common ICT tools and ability to specify requirements for computer-based engineering design tools to solve unfamiliar problems.		
A10	Characteristics of particular materials, equipment, processes and products		
Cognitive skills		Graduate Skills	
B1	Analyse and solve engineering problems using appropriate techniques and through critical thinking.	D1	Communicate effectively in writing, verbally, graphically and through presentations to groups.
B2	Model and analyse relevant engineering systems.	D2	Apply mathematical methods, computer models, and a scientific approach to solving problems in engineering design.
B3	Fully engage with the design process.	D3	Demonstrate leadership skills and the ability to work effectively as a member of a team.
B4	Select and apply appropriate computer based methods	D4	Write computer programmes and use CAE software and

	for solving design engineering problems.		general IT tools and provide technical documentation.
B5	Fully evaluate external influences on the design process.	D5	Learn independently and to adopt a critical approach in investigation.
B6	Design innovative systems, components or processes.	D6	Use technical literature and other information sources effectively including electronic media.

Programme outcomes																											
A 1	A 2	A 3	A 4	A 5	A 6	A 7	A 8	A 9	A 10	B 1	B 2	B 3	B 4	B 5	B 6	C 1	C 2	C 3	C 4	C 5	C 6	C 7	D 1	D 2	D 3	D 4	D 5	D 6
Highest Level Achieved																												
6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	5	6	6	6

Module Title	Module Code by Level	Programme outcomes																												
		A 1	A 2	A 3	A 4	A 5	A 6	A 7	A 8	A 9	A 10	B 1	B 2	B 3	B 4	B 5	B 6	C 1	C 2	C 3	C 4	C 5	C 6	C 7	D 1	D 2	D 3	D 4	D 5	D 6
Design Engineering Projects 1	PDE1400							Y	Y			Y	Y	Y	Y		Y	Y		Y	Y			Y	Y	Y	Y	Y	Y	Y
Physical Computing: Electronics	PDE1410				Y							Y	Y							Y	Y					Y			Y	
Physical Computing: Programming	PDE1420				Y					Y		Y			Y					Y		Y			Y	Y	Y	Y	Y	
Formal Systems	PDE1430				Y							Y	Y				Y									Y			Y	
Design Engineering Projects 2	PDE2400		Y	Y				Y	Y	Y	Y	Y	Y	Y	Y	Y	Y			Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Engineering in Context	PDE2410		Y			Y		Y	Y							Y				Y			Y	Y	Y		Y		Y	Y
Control Systems	PDE2420	Y			Y	Y				Y		Y	Y		Y		Y	Y		Y		Y			Y	Y		Y		Y
Robotics and Robotics	PDE 2440	Y	Y	Y		Y	Y			Y		Y		Y	Y		Y	Y	Y	Y	Y	Y	Y		Y			Y	Y	
Industrial Placement	PDE3250					Y		Y	Y			Y	Y	Y				Y					Y		Y	Y	Y		Y	

Mobile Robots and Manipulators	PDE3432	Y			Y		Y			Y			Y		Y			Y		Y		Y			Y	Y			Y	Y
Advanced Robotics	PDE3433	Y	Y			Y				Y		Y	Y		Y			Y		Y	Y	Y			Y	Y		Y	Y	Y
Design Engineering Major project	PDE3400	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		Y	Y	Y