MSc Mechatronic Systems Engineering

Programme Specification

1. Programme title	MSc Mechatronic Systems Engineering
2. Awarding institution	Middlesex University
3a. Teaching institution	Middlesex University
3b. Language of study	English
4a. Valid intake dates	September
4b. Mode of study	FT/PT
4c. Delivery method	☒ On-campus/Blended ☐ Distance Education
5. Professional/Statutory/Regulatory body	N/A
6. Apprenticeship Standard	N/A
7. Final qualification(s) available	MSc Mechatronic Systems Engineering PgDip Mechatronic Systems Engineering PgCert Mechatronic Systems Engineering
8. Year effective from	2022-3

9. Criteria for admission to the programme

We normally require a second class honours degree 2:2 or above in computer science, science or engineering disciplines. We also encourage applications from experienced engineers or graduates from wider engineering disciplines.

Candidates with other degrees are welcome to apply provided they can demonstrate appropriate levels of relevant experience. Candidates without formal qualifications need to demonstrate relevant work experience and the ability to study at postgraduate level.

It is also highly desirable to be familiar with a relevant high level programming language such as C or Python prior to joining the programme.

Successful applicants must have competence in the English language. For international applicants whose first language is not English, the requirement is that they have IELTS 6.5 (with a minimum of 6.0 in each component) or TOEFL internet-based 87 (with at least 21 in listening & writing, 22 in speaking and 23 in reading).

10. Aims of the programme

The programme aims to:

- Consolidate student knowledge in developing Mechatronic Systems and their applications in a wide range of applications.
- Provide students with a thorough grounding in software and hardware skills and techniques in mechatronic systems integration including digital skills.
- Develop advanced skills in designing, simulating, testing and validating mechatronic systems.
- Build on students' academic and scientific skills in researching, experimenting and presenting their work.
- Equip students with the technical and practical skills sought after by employers in automation, digital manufacturing and systems integration sectors.

11. Programme outcomes*

A. Knowledge and understanding	**Teaching/learning methods**
On completion of this programme, the successful student will have knowledge and understanding of: 1. Applying a comprehensive knowledge of relevant subject principles (engineering, statistics, mathematics, management) to the solution of complex problems in mechatronic systems. 2. Critically analysing hardware and software requirements of mechatronic or robotics systems and related control methods for effective system level solutions. 3. Designing, developing and testing control solutions for automated smart systems, including machine learning. 4. Formulating and critically analysing complex mechatronics systems and to offer conclusions and recommendations for performance and/or efficiency improvements.	Students gain knowledge and understanding through a combination of lectures and practical lab sessions, directed reading, independent study, coursework and research. Formative and post-assessment feedback is provided on all assessed coursework. The industry partners selected are renowned for their excellent training material and online resource, which will form some of the specialist curriculum material. **Assessment methods** Students' knowledge and understanding are assessed by project work, hands-on-tasks, coursework, oral and visual presentations and project reports (individual and group).

5. Developing a system hierarchy for mechanical, electrical and software integration solutions, including data communications. 6. Formulating and applying fundamental simulation techniques using a systems approach to real-world manufacturing processes and systems. 7. Designing solutions for complex problems to address stakeholder needs (user, business, societal, environmental, cultural, diversity, inclusion, etc.), as well as complying with constraints such as commercial, legal, professional and industry standards.	
B. Skills On completion of this programme, the successful student will be able to: 1. Select and apply computational and analytical techniques to model complex problems related to mechatronic systems. 2. Build, test and optimise integrated mechatronic system solutions using appropriate tools and techniques. 3. Produce digital models with integrated data flow between physical and virtual systems and their behaviour. 4. Carry out technical literature reviews and critically evaluate these to solve complex problems related to the programme. 5. Design and implement AI/ML solutions in mechatronic or robotic systems. 6. Evaluate the business, environmental and societal impact of solutions to complex problems and manage their impact by considering using Product Lifecycle Management approaches, including Product Data management and Application Lifecyle Management. 7. Work effectively as a reflective practitioner as a member of a team as well as an individual and assess own and team performance. 8. Communicate complex technical and academic content effectively in both oral and written forms to a technical and non-technical audience.	**Teaching/learning methods** Students learn skills through a combination of lectures, practical project work, participation in workshops, directed reading, independent study, facilitated discussion, individual and collaborative work and research. Analyses and critical thinking are strengthened through participation in discussions and independent study. Formative and post-assessment feedback is provided on all assessed coursework. **Assessment methods** Students' skills are assessed by a combination of individual and collaborative lab and other coursework, project work, including both software and hardware development, reports and presentations.

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

12. 1 Overall structure of the programme

Full Time:

Term 1	PDE4432 Robot Control 30 credits	PDE4431 Robot Manipulation 15 credits	**PDE4511** Digital Product Modelling and Visualisation 15 credits	**Exit stage PgCert**
Term 2	PDE4433 Machine Learning for Robotics 15 credits	**PDE4514** Product Lifecycle Management and Industry 4.0 15 credits	**PDE4515** Mechatronic Systems Integration Group Project 30 credits	**Exit stage PgDip**
Term 3	**PDE4519** Individual Project 60 credit			**Full MSc**

Part-time:

PART TIME - YEAR 1

Term 1	**PDE4511** Digital Product Modelling and Visualisation 15 credits	PDE4431 Robot Manipulation 15 credits	**Exit stage PgCert**
Term 2	PDE4433 Machine Learning for Robotics 15 credits	**PDE4514** Product Lifecycle Management and Industry 4.0 15 credits	

PART TIME - YEAR 2

Term 1	PDE4432 Robot Control 30 credits	**Exit stage PgDip**
Term 2	**PDE4515** Mechatronic Systems Integration Group Project 30 credits	
Term 3	**PDE4519** Individual Project 60 credits	**Full MSc**

12.2 Levels and modules		
Level 7		
COMPULSORY	OPTIONAL*	PROGRESSION REQUIREMENTS
Students must take all of the following: PDE4431 PDE4432 PDE4433 PDE4511 PDE4514 PDE4515 PDE4519		Students must pass 120 credits (all modules in Term 1 and 2) to continue with the final individual 60-credit project PDE4519. Term 2 modules can nevertheless be undertaken before passing Term 1 modules.

12.3 Non-compensatable modules	
Module level	**Module code**
7	PDE4431
7	PDE4432
7	PDE4433
7	PDE4511
7	PDE4514
7	PDE4515
7	PDE4519

13. Information about assessment regulations

This programme will run in line with general University Assessment Regulations.

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

N/A

15. Future careers / progression

Graduates from the programme will be expected to enter into employment that requires high-level skills in mechatronic system design and integration with highly specialised practical skills in automated production solutions that are much sought after worldwide. The programme content will be enriched by keeping industrial partners' engagement active and offering sponsored projects. This will also help to support the students regarding current opportunities and future trends in their relevant employment sectors.

16. Particular support for learning (if applicable)

- Dedicated robotics and mechatronics facilities equipped with the latest industrial automation equipment and an integrated, flexible manufacturing system (Cyber Physical).
- Access to industry partner's training resources.
- Dedicated support provided by specialist Graduate Academic Assistants (GAAs).
- My Learning and dedicated CAD/CAM equipment, electronics manufacturing and prototyping facilities.
- Inspiring guest speakers from industry and academia.
- Academic Writing, English Language Support and Numeracy support offered by the Learner Enhancement Team.

17. HECos code(s)	100170
18. Relevant QAA subject benchmark(s)	QAA Subject Benchmark Statement Engineering (2019). Engineering Council standards UK-SPEC/AHEP 2020, 4th edition

19. Reference points

- QAA Framework for Higher Education Qualifications
- QAA Characteristic Statement for Master's Degrees
- Middlesex University Regulations
- Made Smarter Review 2017
- UK Industrial Strategy – Building Britain for the future 2017
- Mission-Oriented UK Industrial Strategy Report, 2019
- Engineering UK report 2020
- Tackling challenges, building prosperity, ISCF, UKRI, 2021

20. Other information

Middlesex University is a member of the Connected Curriculum Project organised by Siemens and Festo to link industry practices to the academic curriculum.

Middlesex University is also a member of GAMBICA, a trade organisation representing industry organisations in Automation, Control and Process Industries.

The department of Design Engineering is a member of the Engineering Professors Council and SEFI (European Society for Engineering Education)

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.

21. Curriculum map for *[MSc Mechatronic Systems Engineering]*

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	
A1	Applying a comprehensive knowledge of relevant subject principles (engineering, statistics, mathematics, management) to the solution of complex problems in mechatronic systems.
A2	Critically analysing hardware and software requirements of mechatronic or robotics systems and related control methods for effective system level solutions.
A3	Designing, developing and testing control solutions for automated smart systems, including machine learning.
A4	Formulating and critically analysing complex mechatronics systems and to offer conclusions and recommendations for performance and/or efficiency improvements.
A5	Developing a system hierarchy for mechanical, electrical and software integration solutions, including data communications.
A6	Formulating and applying fundamental simulation techniques using a systems approach to real world manufacturing processes and systems.
A7	Designing solutions for complex problems to address stakeholder needs (user, business, societal, environmental, cultural, diversity, inclusion, etc.), as well as complying with constraints such as commercial, legal, professional and industry standards.
Skills	
B1	Select and apply computational and analytical techniques to model complex problems related to mechatronic systems.
B2	Build, test and optimise integrated mechatronic system solutions using appropriate tools and techniques.
B3	Produce digital models with integrated data flow between physical and virtual systems and their behaviour.
B4	Carry out technical literature reviews and critically evaluate these to solve complex problems related to the programme.
B5	Design and implement AI/ML solutions in mechatronic or robotic systems.
B6	Evaluate the business, environmental and societal impact of solutions to complex problems and manage their impact by considering using Product Lifecyle Management approaches, including Product Data management and Application Lifecyle Management.
B7	Work effectively as a reflective practitioner as a member of a team as well as an individual and assess own and team performance.
B8	Communicate complex technical and academic content effectively in both oral and written forms to a technical and non-technical audience.

	Programme outcomes													
A1	A2	A3	A4	A5	A6	A7	B1	B2	B3	B4	B5	B6	B7	B8
	Highest level achieved by all graduates													
7	7	7	7	7	7	7	7	7	7	7	7	7	7	7

Module Title	Module Code	A1	A2	A3	A4	A5	A6	A7		B1	B2	B3	B4	B5	B6	B7	B8
Robot Manipulation	PDE4431	X	X							X	X						
Robot Control	PDE4432	X	X							X			X				X
Machine Learning for Robotics	PDE4433	X		X	X		X			X				X			
Digital Product Modelling and Visualisation	PDE4511	X					X			X		X					
Product Lifecycle Management and Industry 4.0	PDE4514				X			X					X		X	X	X
Mechatronic Systems Integration Group Project	PDE4515	X	X	X		X	X	X		X	X	X			X	X	X
Individual Project	PDE4519	X	X	X	X	X		X		X	X	X	X	X			X