

**Programme Specification**

**Title of Course:** MSc Mechatronic Systems

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| **Date first produced** | January 2013 |
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| **Version number** | 2 |
| **Faculty** | Engineering, Computing and the Environment |
| **School** | Engineering and The Environment |
| **Department**  | Mechanical Engineering |
| **Delivery Institution** | Kingston University |

This Programme Specification is designed for prospective students, current students, academic staff, and employers. It provides a concise summary of the main features of the programme and the intended learning outcomes that a typical student might reasonably be expected to achieve and demonstrate if they take full advantage of the learning opportunities that are provided. More detailed information on the learning outcomes and content of each module can be found in the course VLE site and in individual Module Descriptors.

**SECTION 1: GENERAL INFORMATION**

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| **Award(s) and Title(s):** | MSc Mechatronic SystemsMSc Mechatronic Systems (With Professional Placement) |
| **Intermediate Awards(s) and Title(s):** | MSc Mechatronic Systems Studies, PgDip, PgCert |
| **FHEQ Level for the Final Award:** | Masters award level 7 |
| **Awarding Institution:** | Kingston University |
| **Location:** | Roehampton Vale |
| **Language of Delivery:** | English |
| **Modes of Delivery:** | Full time and Part time |
| **Available as:** | Full field |
| **Minimum period of registration:** | 1 year FT, 2 yearswith Professional Placement and 2 years PT  |
| **Maximum period of registration:** | 2 years FT and 4 years PT |
| **Entry Requirements:**  | Applicants for this course are normally required to have a good honours degree in a relevant engineering discipline. Exceptionally applicants with substantial relevant industrial experience who do not have an honours degree may be considered. Such applicants must demonstrate strong motivation to complete the course and the ability to work at this level.International applicants are required to satisfy the Admissions Officer that they have reached an equivalent academic standard as those required for home students.Each application is assessed on an individual basis and may be subject to additional requirements, such as undertaking short course(s), work experience and/or English language qualification(s). Meeting minimum entry requirements does not automatically guarantee a placeEnglish language requirements Non-UK applicants will usually be required to provide certificated proof of English language competence before commencing their studies. For this course the minimum requirement is Academic IELTS of 6.5 overall, with 6.0 in Writing and 5.5 in Reading, Listening and Speaking. Other equivalent qualifications will also be considered. For further information, including other acceptable qualifications (such as WAEC and NECO from Nigeria and Ghana, and Indian CBSE) and pre-sessional English courses; see the KU website: <http://www.kingston.ac.uk/international/studying-at-kingston/language-requirements/> |
| **Programme Accredited by:** | Institution of Mechanical Engineers |
| **QAA Subject Benchmark Statements:** | All subject benchmark statements can be found [here](http://www.qaa.ac.uk/quality-code/subject-benchmark-statements). For PG provision where there is no QAA subject benchmark make reference to the [QAA Master’s Degree Characteristics](http://www.qaa.ac.uk/quality-code/the-existing-uk-quality-code/part-a-setting-and-maintaining-academic-standards). |
| **Approved Variants:** | To comply with Engineering Council regulations, compensation cannot be applied to any module within this programme. |
| **UCAS Code:** | *N/A* |

**SECTION 2: THE COURSE**

1. **Aims of the Course**

The main aims of the MSc Advanced Product Engineering and Manufacturing

* Provide a “period of further learning” which is a requirement of the Institution of Mechanical Engineers for Chartered Engineer status for students with an accredited BEng.
* Provide students with knowledge, skills, and a critical appreciation of the principles of operation and the main components of mechatronic systems: control systems, modelling and simulation of mechanical and robotic devices, image and signal processing, artificial intelligence methods and embedded software engineering.
* Provide students with the ability of conceiving, designing, prototyping, and producing creative mechatronic systems solutions.
* Provide students with the professional attitudes, entrepreneurial spirit, and many transferable skills necessary to develop and exploit their technical abilities in the furtherance of their careers within the evolving mechatronic systems industry.
* Adopt a disciplined engineering approach and sound practical skills in the development and deployment of mechatronic systems using modern engineering design tools, methods, and standards.
* Acquire specialised knowledge and skills in selected areas of mechatronics. For example, digital image and signal processing, machine learning, modelling and simulation, and industrial control.
* Demonstrate an understanding of the major technical, economic, organizational, and human factors which guide the design, implementation, and management of mechatronic systems.
* Practise the theoretical concepts and knowledge acquired using the taught modules in a substantial research or industrial based project.
* Initiate, plan and sustain a disciplined personal effort with academic rigour during the project, leading to an original, individual, and innovative academic dissertation.
1. **Intended Learning Outcomes**

The course provides opportunities for students to develop and demonstrate knowledge and understanding specific to the subject, key skills, and graduate attributes in the following areas. The programme outcomes are referenced to the QAA subject benchmarks for master’s level Engineering (2015) and the Framework for Higher Education Qualifications in England, Wales, and Northern Ireland (2008), and relate to the typical student.

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| **Programme Learning Outcomes** |
|  | **Knowledge and Understanding****On completion of the course students will be able to:** |  | **Intellectual skills – able to:****On completion of the course students will be able to:** |  | **Subject Practical skills** **On completion of the course students will be able to:** |
| A1 | Demonstrate a critical awareness of the current developments in the mechatronics in a variety of application areas such as robotics | B1 | Learn independently, think logically and critically, and demonstrate a systematic approach to problem-analysis and to finding solutions. | C1 | Design, implement and test the major components required for a practical mechatronic system for applications such as robotics, assistive technologies, avionics, and automotive engineering. |
| A2 | Design and deploy mechatronic systems showing a detailed understanding of principles and practical techniques of modelling and simulation | B2 | Critically analyse, evaluate, and communicate research in the chosen area. | C2 | Analyse and specify user requirements for mechatronic systems. |
| A3 | Reflect on the ethical legal and professional issues in the deployment of mechatronic systems. | B3 | Identify current issues and trends in the areas of electronic, mechanical, software and control systems. | C3 | Express jointly mechanical, electronic, software and control designs using a standard notation and to select and apply a suitable modelling and simulation/ CAD software to coordinate the development and deployment of mechatronic systems. |
|  |  | B4 | To reflect on their experiences and identify opportunities for incremental future improvement. |  |  |

In addition to the programme learning outcomes identified overleaf, the programme of study defined in this programme specification will allow students to develop a range of Key Skills as follows:

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| **Key Skills** |
| **Self-Awareness Skills** | **Communication Skills** | **Interpersonal Skills** | **Research and information Literacy Skills** | **Numeracy Skills** | **Management & Leadership Skills** | **Creativity and Problem-Solving Skills** |
| Take responsibility for own learning and plan for and record own personal development | Express ideas clearly and unambiguously in writing and the spoken work | Work well with others in a group or team | Search for and select relevant sources of information | Collect data from primary and secondary sources and use appropriate methods to manipulate and analyse this data | Determine the scope of a task (or project) | Apply scientific and other knowledge to analyse and evaluate information and data and to find solutions to problems |
| Recognise own academic strengths and weaknesses, reflect on performance, and progress and respond to feedback | Present, challenge and defend ideas and results effectively orally and in writing | Work flexibly and respond to change | Critically evaluate information and use it appropriately | Present and record data in appropriate formats | Identify resources needed to undertake the task (or project) and to schedule and manage the resources | Work with complex ideas and justify judgements made through effective use of evidence |
| Organise self effectively, agreeing and setting realistic targets, accessing support where appropriate and managing time to achieve targets | Actively listen and respond appropriately to ideas of others | Discuss and debate with others and make concession to reach agreement | Apply the ethical and legal requirements in both the access and use of information | Interpret and evaluate data to inform and justify arguments | Evidence ability to successfully complete and evaluate a task (or project), revising the plan where necessary |  |
| Work effectively with limited supervision in unfamiliar contexts |  | Give, accept, and respond to constructive feedback | Accurately cite and reference information sources | Be aware of issues of selection, accuracy and uncertainty in the collection and analysis of data | Motivate and direct others to enable an effective contribution from all participants |  |
|  |  | Show sensitivity and respect for diverse values and beliefs | Use software and IT technology as appropriate |  |  |  |

1. **Outline Programme Structure**

This programme is part of the University Postgraduate Regulations (PR). Programmes in the PR are made up of modules which are designated at level 7. Single modules in the framework are valued at 30 credits and the programme consists of 4 subject specific single modules (3 core & 1 optional) and the capstone project module valued as 2 single modules (60 credits). A Postgraduate Certificate (PgCert) or Postgraduate Diploma (PgDip) may be offered as an exit award, with the minimum requirement for a PgCert of 60 credits and PgDip of 120 credits. The MSc award is achieved with 180 credits completed of (all modules and the final individual project).

The programme is accredited by the Institution of Mechanical Engineers (IMechE) to Engineering Council regulations. The award of the accredited MSc requires completion of all modules without any compensation; however, 30 credits of compensation is allowed under University Postgraduate Regulations and, in the event that no further resit opportunities are available, compensation may be applied, and the award of MSc Mechatronic Systems Studies made. This award is not accredited with the IMechE.

The course offers the PG Certificate, PG Diploma and MSc Mechatronic Systems Studies only as an exit award.

All students will be provided with the University regulations and specific additions that are sometimes required for accreditation by outside bodies (e.g., professional, or statutory bodies that confer professional accreditation).

Full details of each module will be provided in module descriptors and student module guides.

Students on placement must complete a portfolio assessment which includes a reflection on how the theories they have learnt during their teaching year have helped them in their placement and demonstrate ability to apply their teaching in a real-world situation.

**Duration and academic year structure**

* The maximum duration of the MSc is one year full-time two years (with professional placement) and two-four years part-time.
* Students may commence in September, January, or March.
* The taught modules will normally run from September to May each year.
* Part-time students will normally complete their taught modules over two years and then complete their project.

Students on placement must complete a portfolio assessment which includes a reflection on how the theories they have learnt during their teaching year have helped them in their placement and demonstrate ability to apply their teaching in a real-world situation.

To successfully complete the MSc, students must pass three core modules, one option module, and complete an individual project which is normally industry/research related with distinctive emphasis of industrial applications.

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| **Level 7** |
| **Core modules** | **Module code** | **Credit** **Value** | **Level**  | **Teaching Block** |  |
| Engineering Research Techniques, Entrepreneurship and Quality Management | ME7711 | 30 | 7 | 1&2 |  |
| Control Systems with Embedded Implementation | ME7731 | 30 | 7 | 1 |  |
| Mechatronic Design and Automation | ME7732 | 30 | 7 | 2 |  |
| Engineering Individual Project |  ME7761 | 60 | 7 | 2 |  |
| **Option modules** |  |  |  |  | **Pre-requisites** |
| Advanced Control and Robotics | ME7736 | 30 | 7 | 2 |  |
| Machine Learning and Artificial Intelligence | CI7520 | 30 | 7 | 2 |  |
| Advanced CAD/CAM Systems | ME7722 | 30 | 7 | 1&2 |  |
| Professional Placement  | CI7900 | 120 |  |  |  |

Students exiting the programme with 60 credits are eligible for the award of PgCert.

Students exiting the programme with 120 credits are eligible for the award of PgDip.

Students exiting the programme with 30 credits compensation are eligible for the award of MSc Mechatronic Systems Studies.

1. **Principles of Teaching, Learning and Assessment**

The principles of teaching, learning and assessment are in line with the University's strategy. The fields are designed to give students a balanced portfolio of theoretical and practical experience, embracing diversity and individuality.

Industry specialists allied with lecturers and guest speakers and mature students contribute to our courses, reinforcing the theoretical aspects and provide an informative insight into industry, promoting innovation and creativity, whilst offering an insight into entrepreneurial culture. The module lecturers, experts in the field of control, embedded electronics, solid modelling, mechanical motion, materials, manufacturing, etc. are embedding their latest research and relevant case studies to enrich content on the taught modules in the spirit of Kingston University; 'research informed teaching' ethos. Furthermore, the practical workshops, open forums, company visits, and group presentations introduced into the modules provide students with a detailed understanding of the approaches taken in industry, aiding development of students' employability through the course.

Taught materials, knowledge gained from the practical and case studies embedded within each module give student specialised knowledge, tools, and techniques. It will equip them with skills and methods for extracting and synthesising the information. These activities promote rigour, curiosity, excellence, originality, and breadth of knowledge. They must then further explore and exploit the information given, research and define outcomes accurately to produce detailed solutions and innovative work for each module and project dissertation.

It is recognised that teamwork is a very important aspect in industry, and this is implemented in the modules. The course ensures that the students are exposed to team working through group presentations, joint report writing, joint research and lab work, promoting consideration, courtesy, and collegiality.

The course teams are aware of the need for effective communication, both written and verbal, and take pride in the fact that the courses provide, in this regard, a means of preparing the students for their longer-term career plans and CPD. Apart from the project itself, each student has to give verbal presentations during the modules, normally to the student’s peer group and module leader. Students are also helped with verbal communication skills through seminars, tutorials, and discussion groups. Most modules are assessed by written assignments which are designed to improve students’ research and evaluation skills.

The individual project provides a challenge to the candidate to undertake a real-world problem because most projects are industrially orientated. Students will be given close guidance to select a project which is relevant to the chosen field. During the project, the student will be expected to apply the knowledge learnt during the course to achieve agreed deliverables, whilst satisfying any given constraints. Key skills in communication, presentation, literature search, problem analysis, project planning, report writing, and solution justification are all part of the learning objectives defined in the field. The project work is normally aligned with the research field of the staff involved and often leads to students publishing of join papers with their project supervisor.

Students also have a range of opportunities to participate in extra-curricular activities based around clubs and societies (e.g., Formula Student Club and Engineering society), which offer further opportunities to develop their communication skills, teamwork, and ability to apply their theoretical knowledge to hands-on activities.

A combination of assessment methods will be used throughout the course. These elements include module assignments, module examinations, in-class tests, experiment reports, industrial visit reports, seminars, verbal presentations, and the project dissertation. Each module leader is responsible for ensuring that the method of assessment reflects the aims and learning objectives of the module, is demanding, and stimulating and at the appropriate master level.

Formative assessments are embedded into the delivery pattern of all the modules and are designed to help students learn more effectively by giving them feedback to improve their performance and feedforward towards summative assessments. Reflective practice by students and feedback from designated Personal tutors will also form part of the formative assessments. Group activities are an important part of the course teaching and assessment strategy where students learn and improve through peer feedback.

The programme embraces the use of Technology Enhanced Learning (TEL) to engage students actively. Some of the most widely used technologies in problem-solving activities are computer simulations and modelling which encompass Finite Elements Analysis (FEA), Computer Aided Design & Manufacture (CAD/CAM) in the curriculum. Digital tools such as a team’s work file syncs DropBox, VLE assessment and YouTube videos are used to enhance the quality of student learning experience.

The level and content of courses are relevant and satisfy the Engineering Council's guidance and criteria (for further information see the Institute of Mechanical Engineering and Engineering Council links part K).

1. **Support for Students and their Learning**

A personal tutor will be assigned to each student to personalise their learning experience and support their academic and professional development from the first induction day at the university all the way to graduation and their career destination. The personal tutors will help their tutees with issues of transition from UG to Masters and understand how to use feedback on the postgraduate course. They will play an important role in supporting the large community of international students to settle down and take advantage of the university wide support system. They will also encourage students to be proactive in making links between their course and their professional and/or academic aspirations and explore their research interests as well as being part of a wider disciplinary and/or professional community in support of their career choices.

Additionally, Students are supported by a range of other course and/or university level systems, including:

* A Module Leader for each module
* A Course Director to help students understand the programme structure.
* Technical support on use of IT and workshop/lab facilities.
* A designated programme administrator.
* A dedicated employability consultant practitioner.
* An induction programme at the beginning of each new academic session.
* Series of research seminars delivered by internal and external speakers informing students about latest advances in research.
* Invited guest lecturers informing students about latest developments in technology and professional practise.
* Student Voice Committee.
* Canvas - a versatile on-line interactive Virtual Learning Environment (VLE).
* Study Skills Centre that provides academic skills support.
* KU student support facilities that provide advice on issues such as finance, regulations, legal matters, accommodation, etc.
* Disabled student support.
* The Students’ Union.
* KU Careers and Employability Service.
1. **Ensuring and Enhancing the Quality of the Course**

The University has several methods for evaluating and improving the quality and standards of its provision. These include:

* External examiners
* Boards of study with student representation
* Annual Monitoring and Enhancement
* Periodic review undertaken at subject level
* Student evaluation including Module Evaluation Questionnaire (MEQs), level surveys and the National Student Survey (NSS)
* Moderation policies
* Feedback from employers
* Industrial Advisory Board
* Professional body reaccreditation is required every four years

In addition to the University quality systems, the course currency and quality is continuously supported and evaluated by the School's Industrial Advisory Board. The module content and delivery methods are informed by the research and enterprise activities of academic staff. The course is also supported, monitored, and accredited by the Institute of Mechanical Engineers (IMechE), under licence from the UK regulator, the Engineering Council, as meeting the requirements for further learning for a Chartered Engineer (CEng) status for candidates who have already acquired an accredited CEng (Partial) BEng (Hons) degree.

Accreditation is a mark of assurance that the degree meets the standards set by the Engineering Council in the UK Standard for Professional Engineering Competence (UK-SPEC). Some employers recruit preferentially from accredited degrees, and an accredited degree is likely to be recognised by other countries that are signatories to international accords.

1. **Employability and work-based learning**

The course is designed with close consultation with the School’s Industrial Advisory Board, hence taking on board the latest requirements of industry for graduates. Employability skills are developed throughout the delivery of the modules, particularly as part of capstone individual project. Furthermore, students are equipped with business, management, and entrepreneurial skills to enhance their employability potential globally. Delivery of many modules involves industrial speakers, who introduce students to latest industrial requirements.

Throughout the course students have access to a dedicated employment coordinator; attend specially arranged employer seminars, university career workshops and research seminars, to prepare them for the world of work once graduated.

Students who successfully complete the MSc will have acquired a significant research background and analytical skills in the broader issues of design problem solving relating to Mechatronic Systems. The market for Mechatronic Systems Engineers is continually growing and this course, with its balance of theory and applied specialist learning prepares graduates well for the senior technical and management positions in a range of fields such as:

* Avionics
* Defence
* Automotive Engineering
* Satellite technologies
* Robotics
* Healthcare technologies
* Manufacturing
* Transportation systems
* Computer hardware
* Electrical machines
* Oil & gas
* Alternative fuels generation

The breadth of knowledge and ability gained by the graduates will prepare them to take on the roles such as:

* Systems Engineer/Manager
* System Architect
* Systems Engineering Consultant
* Project Manager
* Researcher (There is also an opportunity to undertake further research for a PhD qualification).

Our recent graduates were recruited by companies such as Delphi, Airbus or gained a fully funded PhD grant in the UK and abroad. Their project work has been recognized in both academia and industry with a recent example of an industrial project prize, Autocar-Courland's Next Generation Award sponsored by Jaguar Land Rover, Toyota, Peugeot, and McLaren

**Work-based learning**

The full-time course is an intense 12 month programme which does not allow for work placements within the course. However, the programme can be undertaken on a part-time basis which enables students to reflect upon their own personal experience of working in an applied setting, to focus on aspects of this experience so that they can clearly relate to theoretical concepts and to evaluate the relationship between theory and practice.

The 2-year version of the programme is designed to include work-based learning through assessments and the reflective report. Many of the students on the programme are already working and they can use that experience to relate to theoretical concepts and to evaluate the relationship between theory and practice.

Work placements are actively encouraged - although it is the responsibility of individual students to source and secure such placements. This allows students to reflect upon their own personal experience of working in an applied setting, to focus on aspects of this experience that they can clearly relate to theoretical concepts and to evaluate the relationship between theory and practice.

While it is the responsibility of individual students to secure such placements, the Careers and Employability Service support offers each student support at all stages of the application process, including writing CVs, completing application forms, participating in mock interviews, assessment centre activities and psychometric tests. The process of applying for a placement gives students the opportunity to experience a real-life, competitive job application process.

The business experience period enables students to apply their learning in the real-world work environment, to reflect upon their own personal experience of working in an applied setting, to focus on aspects of this experience that they can clearly relate to theoretical concepts and to evaluate the relationship between theory and practice. Students will be assessed during and at the end of this period, normally through a portfolio. This will be marked as pass/fail.

Students who undertake work-based placements often benefit greatly from the experience, gaining real experience and work achievements

1. **Other sources of information that you may wish to consult**

*Engineering Council UK-SPEC*

<https://www.engc.org.uk/ukspec>

*Institution of Mechanical Engineers IMechE*

<http://www.imeche.org/Home>

*Kingston University Web site:*

<http://www.kingston.ac.uk/postgraduate-course/mechatronic-systems-msc/>

1. **Development of Course Learning Outcomes in Modules**

This table maps where course learning outcomes are **summatively** assessed across the modules for this course. It provides an aid to academic staff in understanding how individual modules contribute to the course aims, a means to help students monitor their own learning, personal and professional development as the course progresses and a checklist for quality assurance purposes.

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|  | **Module Code** |  | ME7711 | ME7731 | ME7732 | ME7761 | ME7736 | ME7722 | CI7520 |
| **Programme Learning Outcomes** | **Knowledge & Understanding** | A1 |  | S | S | S | S | S | S |
| A2 | S |  |  | S | S | S |  |
| A3 |  |  |  | S |  |  | S |
| **Intellectual Skills** | B1 | S |  | S | S |  |  | S |
| B2 | S |  | S | S |  | S |  |
| B3 | S | S | S | S |  | S | S |
| B4 |  | S |  | S |  | S | S |
| **Subject Practical Skills** | C1 |  | S | S | S | S | S | S |
| C2 |  |  | S | S | S | S |  |
| C3 |  | S |  | S | S | S |  |

**Students will be provided with formative assessment opportunities throughout the course to practise and develop their proficiency in the range of assessment methods utilised.**

