UNIVERSITY of BRADFORD
Faculty of Engineering and Informatics

MSc Automotive Systems Engineering Specification

https://www.bradford.ac.uk/courses/pg/automotive-systems-engineering/

Academic Year:	2022/23
Degree Awarding Body:	The University of Bradford
Target Degree Award:	Master of Science in Automotive Systems Engineering [Framework for Higher Education Qualifications (FHEQ) Level 7]
Interim/exit Awards:	MSc Engineering (Automotive) [FHEQ Level 7]; Postgraduate Diploma Automotive Systems Engineering [FHEQ Level 7]; Postgraduate Certificate Automotive Systems Engineering [FHEQ Level 7]
Programme Admissions:	September
Programme duration:	12 months full time
Subject Benchmark Statement:	Engineering (QAA 2015)
Programme Accrediting Body:	IMechE – Institution of Mechanical Engineers

Please note: This programme specification has been published in advance of the academic year to which it applies. Every effort has been made to ensure that the information is accurate at the time of publication, but changes may occur given the interval between publishing and commencement of teaching. Any change which impacts the terms and conditions of an applicant's offer will be communicated to them. Upon commencement of the programme, students will receive further detail about their course and any minor changes will be discussed and/or communicated at this point.

Minor Modification Schedule

1. June 2021: Annual changes for 2021 academic year
2. February 2022: Annual changes for 2022 academic year
3. October 2022: Confirmed accreditation by IMechE

Introduction

The systems engineering approach treats the product (in this case the vehicle) as a complex system and set of sub-systems with a particular function or set of functions including new demands on user interaction, safety, performance, and so on. It is a top-down approach to vehicle engineering which drives innovative new methods to vehicle design. The increasing complexity and interconnectivity of vehicle sub-systems now opens up the possibility for the subsystems to interact to meet the required function rather than the systems themselves, such as steering or brakes, dictating the available functions.

Systems engineering encompasses the need to model, analyse, characterise and control the behaviour and interactions between these subsystems. This 'systems' approach to Automotive Engineering has enjoyed increasing popularity within industry, especially with the advance of connected and autonomous vehicles, to the extent that vehicle manufacturers are internally restructuring to make best use of the systems engineering approach. This creates a new demand for Engineers and Computer Scientists trained in

this manner. As an automotive systems engineer, students will be capable of modelling and working on complex scalable multidisciplinary systems which transcend the traditional disciplines typically found within an automotive company. The skills and knowledge that the students will hold will enable them to work within a truly global industry.

Graduates will be able to view the vehicle as a complex set, and subset, of systems that interact to deliver the required vehicle functions and customer requirements. Often this involves systems interacting in new ways, or even reconfiguring at a software level, to deliver new, novel and sustainable solutions, functions and features. The systems engineering approach requires the ability to model the systems, and interactions between systems, that exist within the modern automobile. Through studies on the course students will gain a deep knowledge of automotive systems and technologies together with a broad comprehension of computer science techniques and their application within the automotive systems engineering context. Having gained these skills, students will enter an industry that is experiencing rapid and dramatic change where the skills that they possess are in high demand and will position them at the forefront of development.

This programme is targeted at Engineers who wish to both broaden and deepen their knowledge to prepare them for working in a multidisciplinary Automotive Systems Engineering environment. Students on the Programme will have the opportunity to study a range of Automotive Engineering and Computer Science based modules in order to develop the multidisciplinary competencies that will enable them to work on complex automotive systems engineering projects. Student exposure to Automotive Systems Engineering will further be developed via a 40-credit automotive Team Project (including seminar series on systems engineering, based upon material developed for industry) and a 60-credit Individual Research Project focusing on key areas of research expertise within the Automotive Research Centre.

Learning with and as part of a research community

The Faculty aims to produce postgraduates who aspire to challenging careers at the forefront of the automotive industry, whether this is within an automotive OEM working on the broad integration of complex vehicle level systems, or within a Tier-1 supplier with a system level focus. These aims are achieved by.

- Providing a supportive, structured environment in which students are encouraged to develop independent learning skills.
- Developing subject knowledge and understanding, developing discipline skills and developing personal transferable skills.
- Enabling graduates to pursue programmes of further study, or to move directly into responsible employment with a minimum of additional training.

The Faculty places equal emphasis on both teaching and research. We have particular research strengths in automotive engineering (especially systems and components design, experimental testing, manufacturing quality, reliability, failure mode avoidance, quality improvement and modelling); materials engineering (including the creation of complex components from powders, composites, and polymers); computer modelling and design

(creation, virtual testing, and prototyping). We conduct this research jointly with many companies including Ford, Jaguar Land Rover, Sinopec. MSc students can expect to interact with the Faculty's research activity via their Masters Research Project.

The Bradford Graduate

We aim to produce MSc graduates who are imaginative, innovative, versatile and competitive, who will be able to progress rapidly to professional positions of responsibility, and who can provide technical, managerial and entrepreneurial leadership in specialist and interdisciplinary projects.

Upon graduation students will be able to work within the automotive industry as:

- Systems and Feature Integration engineers
- Projects Engineer
- Computer-Aided Engineering (CAE) specialist
- Design Engineer
- Quality, Reliability and Systems Validation Engineer
- or a Research and Development Engineer (R&D).

Transferrable 'systems engineering' skills will allow graduates to work in other industries for example, aerospace where the systems engineering approach is commonly adopted. Students will have the capacity for professional growth to continue the path to Chartered Engineer (CEng) status. Students will develop high-level professional and interpersonal skills gained from learning through a team-based environment. An education where students have spent their time conceiving, designing, implementing and operating solutions to problems that they have tackled as part of a learning team. Students will be adept at working with complex value-added engineering systems and will be familiar with experimentation and system thinking and will have a solid understanding of the business and enterprise context. We value sustainability at Bradford and to that end we have embedded sustainable development across all of our programmes. In a future where sustainability will be increasingly important students will have a sound understanding of the challenges and the potential for solutions in a world where the action of human industry is creating new pressures on resources.

All our programmes are designed to provide three progression routes for graduates. Upon graduation students will be equipped to be employed as an engineer in industry. Alternatively, students could pursue a research career since they will have highly developed research skills and their personal tutor can help them identify postgraduate research opportunities here at Bradford or elsewhere. The third route open to students on graduation is to develop their own business. As a Bradford engineering graduate, they will have the skills to design and develop products processes or systems that could have serious commercial potential. We have a long track record of supporting and developing new companies and helping graduates on those first steps as an entrepreneur.

In addition, the ability of an engineer to think clearly, logically and ethically is widely appreciated by many other professions and studies at Bradford may well be a stepping-

stone to an alternative career in financial services, teaching, law, and other professions: engineering graduates from Bradford have a real foundation for life.

The University

The University of Bradford has four overarching strategic objectives: excellence; internationalisation; equality and diversity; and sustainability. We believe in doing research and teaching to deliver career opportunities for our students as well as for economic development and job creation.

The Faculty of Engineering and Informatics strongly believes that each programme subscribes to these four objectives through the three key streams of the University vision:

- The creation of knowledge through fundamental and applied research.
- The dissemination of knowledge by teaching students from all backgrounds.
- The application of knowledge for the prosperity and wellbeing of people.

The lecturers at Bradford are active researchers in their fields of expertise, developing new knowledge, contributing to peer-reviewed journals and books. This research permeates to their teaching practice giving students access to world leading professionals, equipment and ideas within the University's academic themes of Innovative Engineering, Advanced Healthcare and Sustainable Societies. The programmes of study will include research with an emphasis on application, experiential learning and real-world engagement. This will make a major contribution to student's skill set, in the skills and attributes for enhanced employability.

We recognise that society benefits from the talents of all, and that the development of creative, collaborative engineers, skilled in communication and teamwork is vital. Diverse engineering teams are known to be more innovative. We help students to contribute to and learn from the varied perspectives of their tutors and peers. We want to equip our graduates with the knowledge and skills to respond to the many different needs of our businesses and communities.

The University recognises the importance of providing pastoral support, taking into consideration all aspects of our students' journeys and development. All students are allocated a personal academic tutor, with whom they meet regularly to discuss and receive guidance on their learning and development. The University also operates a wide range of support services covering areas such as disability, counselling, faith advisors and careers.

The University of Bradford is well known for attracting students from a wide variety of backgrounds, experiences and countries. The University of Bradford encourages and supports women in engineering, and the Faculty is instrumental in organising events to celebrate occasions including International Women in Engineering Day (INWED), the UN International Day of Women and Girls in Science, and International Women's Day. We are members of WISE - https://www.wisecampaign.org.uk/ - whose long-term vision is for gender balance in STEM, and we signpost students to networking events and specific upskilling opportunities offered via the organisation.

Our Faculty website has a specific page highlighting Women in Engineering for further information, visit: https://www.bradford.ac.uk/ei/women-in-engineering/

We contribute to Bradford Science Festival each year and participate in activities to celebrate national Science Week. The University has held Bronze Athena Swan accreditation (recognition of the Universities activities to advance women's careers in science, technology, engineering, medicine and mathematics) on an institutional level since 2015, demonstrating our commitment to striving for gender equality. In May 2021, the Faculty were successful in being awarded Bronze Athena Swan Accreditation.

Programme Aims

In summary, the programme is intended to:

A1. Give technical depth in the discipline of Automotive Systems Engineering.

A2. Provide breadth through the integration of skills and knowledge from computer science.

A3. Develop and enhance research skills.

Upon graduation students will have the capacity for meaningful interdisciplinary interaction, a leadership role, and professional growth, which may include Chartered Mechanical Engineer (CEng) status.

Programme Learning Outcomes

To be eligible for the FHEQ Level 7 award of Postgraduate Certificate, students will be able to:

1. Demonstrate a comprehensive knowledge of relevant scientific principles in the discipline of Automotive Systems Engineering, applying knowledge (possibly at discipline forefront), understanding, and skills to work with (incomplete or uncertain) information, quantifying the effect of this on the design, and using theory or experiment to mitigate deficiencies.

2. Select and apply appropriate advanced modelling and analysis methods and computational tools to critically evaluate complex and multidisciplinary problems, including within an automotive engineering context, generate (optimised) solutions, and assess their limitations, robustness, and effects of changes in design parameters.

3. Evidence advanced level knowledge of a wide range of engineering materials and components and their relevance and application within an automotive context.

4. Critically evaluate current problems and/or new insights informed by the forefront of the disciplines of both automotive and automotive systems engineering and apply and adapt knowledge and comprehensive understanding of design processes and methodologies in unfamiliar situations.

5. Work effectively in a team in order to meet shared objectives on projects of an automotive systems engineering nature.

6. Evidence awareness of the need for a high level of professional and ethical conduct in engineering, evidencing business and management practices relevant to engineering and engineers.

Additionally, to be eligible for the FHEQ Level 7 award of Postgraduate Diploma, students will be able to:

7. Demonstrate a critical evaluation of concepts relevant to the engineering and computer science disciplines and apply them effectively (including in engineering projects).

8. Integrate engineering knowledge and insight to investigate new and emerging technologies in the field of automotive engineering, applying professional judgements to balance risks, cost, benefits, safety, reliability and environmental impact.

9. Evidence self-direction, independent learning, and originality of thought to generate innovative designs for products, systems, components or processes to fulfil new needs.

10. Use software packages in the advanced analysis, design, evaluation, and optimisation of complex engineering systems.

11. Apply skills in problem solving, communication, information retrieval, working effectively with general IT facilities to develop, monitor and update a plan for the solution of both technical and personnel contributions to meeting organisational need.

12. Plan self-learning to improve performance as a foundation for lifelong learning/CPD, and exercise initiative and personal responsibility in professional practice, which may be as a team member or leader, evidence good negotiation, written and oral communication skills.

Additionally, to be eligible for the FHEQ Level 7 Degree award of Master, students will be able to:

13. Plan, implement, monitor and adjust on an on-going basis, a self-directed individual research programme of work, evidencing collection and critical analysis of research data, use or adaptation of appropriate analysis tools to tackle unfamiliar problems (for example, those with uncertain or incomplete data or specification), innovation, and application of relevant skills, reflection, and research methodologies in the production of an advanced technical report.

Learning and Teaching Strategy

The programme's teaching and learning strategy takes into consideration the learning outcomes, the nature of the subject and the student intake, and the need for students to take greater responsibility for their own learning as they progress through the Programme.

Our strategy begins with the end in mind. We want students to become great engineers; that means great problem solvers, great team-workers with an inquisitive and curious mind. This should mean that by the end of their study with us they can move seamlessly into the world of work, academic research or become an entrepreneur.

The teaching and learning methods have been selected to engage students in developing their knowledge and understanding of engineering fundamentals through formal learning opportunities such as lectures and tutorials, experiential learning through practical classes and lab sessions and informal and social learning through team-working in projects and competitions.

Study with us will include formal lectures (including those from Visiting Lecturers), but these will always be interactive and two way. We want to develop student's understanding of the vast array of opportunities open to today's professional engineer and therefore we look to incorporate aspects of real-world engineering problems and solutions where possible. To this end we make use of case studies, practical demonstrations, and provide lots of opportunities for students to design their own solutions.

As part of our focus on building a learning experience which will prepare students for the world of work our curriculum has been developed using the Conceive Design Implement Operate (CDIO) framework. This means that our learning strategy will be to encourage students to work in teams to Conceive potential solutions, Design new products processes or services, Implement (or model) and test those designs, and Operate the product or solution. In line with the CDIO philosophy students will have numerous opportunities to be an active learner, to work as an engineer on real-world projects. Students midway through the programme will operate analytical instruments, under supervision, during the initial phase of their research project.

Assessment Strategy

In the same way that our teaching and learning strategy is designed to prepare students for the world of work, academic research or entrepreneurship, our assessment methods incorporate a wide range of different methods designed to meet the needs of industry, accrediting bodies (where applicable) as well as prepare students for a potential academic research career.

Assessment is a key part of the learning process, and it is only through challenging themselves to express what they have learned or put it to practical use, that students can complete the learning journey and assess for themselves if they have understood what they have been taught and are able to apply and use those skills and knowledge.

There are two forms of assessment. Formative assessment provides an opportunity for our staff to give students feedback during their learning. This feedback is designed to help and guide learning. All the modules will have some formative assessment, and this may take various forms including discussions or questioning from the supervisor, tests, practical activities, et cetera. These formative activities are crucial if students are to make best use of their learning experience and they are designed to prepare students for their summative assessment.

Summative assessment is how we grade the work on a module and the details of this assessment will be available from the beginning of the module so that students understand how the grade will be determined.

Each assessment on the programme is tailored to the specific learning outcomes and is structured to ensure that the learning is embedded by application of knowledge to real world examples. Project work will often be assessed on the basis of the quality of the product produced as part of the project. We use practical tests to assess practical skills and written reports to show the depth of understanding of concepts and ideas. Practical skills are often assessed via individual and group technical reports with the laboratory work linked with the taught modules. The methods of assessment of transferable skills are built into the structure of the examinations, case studies, laboratory demonstrations and project work.

Curriculum

The curriculum map shows the modular units for this programme, which extends over 12 months. It is made up of a taught element of 120 credits and an individual research project element of 60 credits. Please note that the curriculum may change, subject to the University's programme approval, monitoring and review procedures, as improvements are made each year. More detail, including learning outcomes, is available for each unit in the module handbooks.

The taught element is structured in the form of 20, 40 and 60 credit modules over the 2 semesters forming the "Academic Year" of September-May. The summer forms the third study period where students will complete & submit their MSc Project within a "Full Year".

Table 1: MSc Automotive Systems Engineering Programme Modules

Study Period	Code	Title	Credit	Level
Semester 1	ENM7005-B	Modelling and Optimisation	20	FHEQ 7
Semester 1	COS7049-B	Statistical Applications of Industrial Big Data	20	FHEQ 7
Academic Year	ENG7011-D	Systems Engineering Design Team Project	40	FHEQ 7
Semester 2	MAE7031-B	Automotive Tribology and Noise Vibration and Harshness	20	FHEQ 7
Semester 2	MAE7030-B	Vehicle Powertrain and Dynamics	20	FHEQ 7
Full Year	ENG7002-E	MSc Project	60	FHEQ 7

Students will be eligible to exit with the award of **Postgraduate Certificate** if they have successfully completed 60 credits and achieved the award learning outcomes.

Students will be eligible to exit with the award of **Postgraduate Diploma** if they have successfully completed at least 120 credits and achieved the award learning outcomes.

Students will be eligible to exit with the award of **Degree of Master** if they have successfully completed ENG7002-E, at least 180 credits and achieved the award learning outcomes. Students will be eligible for the **Automotive Systems Engineering Master's Degree** award if they have achieved the additional requirements for an accredited award.

Assessment Regulations

Whilst this Programme conforms to the general principles set out in the standard University Taught Postgraduate Assessment Regulations which are available at the link www.bradford.ac.uk/regulations/ the following exceptions apply to these regulations:

- To gain an accredited MSc Automotive Systems Engineering award, 160 credits must have a minimum mark of 50% with the remaining 20 credits with marks at a minimum of 40%.
- Students who achieve a mark between 40%-49% in up to 60 credits worth of modules will be permitted one supplementary assessment attempt to support them to remain on the accredited MSc Automotive Systems Engineering with no more than 2 attempts in any module.
- If the above requirements are not met, but the University's postgraduate regulations are otherwise complied with, then a non-accredited Master's degree titled Engineering (Automotive) will be conferred.

Admission Requirements

We take into consideration a number of factors when assessing your application. It's not just about your grades; we take the time to understand your personal circumstances and make decisions based on your potential to thrive at university and beyond.

In addition to satisfying the general admissions requirements of the University of Bradford, the typical applicant profile for this programme is to have at least an undergraduate degree classified at 2:2 honours or above in a related engineering field (for example, Mechanical, Manufacturing, Aerospace, Railway and so on), from an accredited degree awarding body. Applications from candidates with Physics, Mathematics, or Computer Science degrees including relevant background in maths and physics will be considered on an individual basis.

International students are welcome to apply and should check their country page website for details of equivalent qualifications: https://www.bradford.ac.uk/international/country/

For all students whose first language is not English, the standard postgraduate English language requirements for the University apply and these are listed at: https://www.bradford.ac.uk/international/entry-requirements/

Access and Recognition of Prior Learning

Applications are welcome from students with non-traditional qualifications, and/or significant personal/professional experience. Candidates who do not fulfil the normal entry requirements but have extensive industrial experience related to Medical/Biomedical Engineering are considered on an individual basis.

The University of Bradford has always welcomed applications from disabled students. To discuss adjustments or to find out more about support and access, you may wish to contact the Disability Service before you apply: www.bradford.ac.uk/disability/before/

Applications are particularly welcomed from women, returners to study (those aged 26+ at the start of the programme), armed forces families, carers and care leavers, estranged or orphaned learners, refugees and asylum seekers, and Romani or Traveller families.

If applicants have prior certificated learning or professional experience which may be equivalent to parts of this programme, the University has procedures to evaluate and recognise this learning in order to provide applicants with exemptions from specified modules or parts of the programme: www.bradford.ac.uk/teaching-quality/prior-learning/

Please note: The information above relates to the contemporary recruitment cycle at time of publication and therefore may now be out of date. The current entry requirements are published on the course website: https://www.bradford.ac.uk/courses/pg/automotive-systems-engineering/