UNIVERSITY of BRADFORD

Faculty of Engineering and Informatics

Programme Specification

Programme title: MSc Automotive Systems Engineering

Academic Year:	2019/20
Degree Awarding Body:	University of Bradford
Partner(s), delivery organisation or support provider (if appropriate):	N/A
Final and interim award(s):	**Master of Science** (MSc) **Automotive Systems Engineering** **Postgraduate Diploma** (PGDip) **Automotive Systems Engineering** **Postgraduate Certificate** (PGCert) **Automotive Systems Engineering** *[Framework for Higher Education Qualifications (FHEQ) level 7]*
Programme accredited by (if appropriate):	N/A
Programme duration:	1 year full time
QAA Subject benchmark statement(s):	Engineering (Master's)
Date last confirmed and/or minor modification approved by Faculty Board	June 2019

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.

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, etc. The increasing complexity and interconnectivity of vehicle sub-systems now opens up the possibility for the sub-systems to interact to meet the required function rather than the systems themselves (e.g. steering, brakes) dictating the available functions. It is a top down approach to vehicle engineering which drives innovative new methods to vehicle design. 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. Students 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.

This 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 an 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. The skills and knowledge that the students will hold will enable them to work within a truly global industry.

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 60 credit Individual Research Project focusing on key areas of research expertise within the Automotive Research Centre.

With reference to teaching and learning, 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. Postgraduates will be able to move directly into responsible roles in employment with a minimum of additional training. 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, to enable graduates to pursue programmes of further study, or to move directly into responsible employment.

Learning with and as part of a research community

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. 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 with minimal additional training, and who can provide technical, managerial and entrepreneurial leadership in specialist and interdisciplinary projects.

The Bradford graduate

Upon graduation students will be able to work within the automotive industry as: (a) Systems and Feature integration engineers; (b) Projects Engineer (b) CAE specialist (c) Design Engineer (d) Quality, Reliability and Systems Validation Engineer or (e) Research and Development Engineer (R&D). Transferrable 'systems engineering' skills will allow graduates to work in other industries e.g. 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 actions 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, etc. as 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 Faculty welcomes and celebrates the diverse cultural and national backgrounds of our students. We are committed to an educational experience that is inclusive, one where gender and ethnicity are central elements in developing engineering solutions that address the needs of a diverse society. The University currently holds Bronze Athena Swan accreditation from the Equality Challenge Unit.

Programme Aims

The programme is intended to:

- Give technical depth in the discipline of Automotive Systems Engineering
- Provide breadth through the integration of skills and knowledge from computer science.
- 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 award of Postgraduate Certificate at FHEQ level 7, students will be able to:

LO1 Evidence comprehensive understanding 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;

LO2 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;

LO3 Evidence advanced level knowledge and understanding of a wide range of engineering materials and components and their relevance and application within an automotive context;

LO4 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;

LO5 Work effectively in a team in order to meet shared objectives on projects of an automotive systems engineering nature;

LO6 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 award of Postgraduate Diploma at FHEQ level 7, students will be able to:

LO7 Evidence understanding and critical evaluation of concepts relevant to the engineering and computer science disciplines, and apply them effectively (including in engineering projects).

LO8 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.

LO9 Evidence self-direction, independent learning, and originality of thought to generate innovative designs for products, systems, components or processes to fulfil new needs.

LO10 Use software packages in the advanced analysis, design, evaluation, and optimisation of complex engineering systems.

LO11 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.

LO12 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 award of Degree of Master at FHEQ level 7, students will be able to:

LO13 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 (e.g. 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.

Curriculum

Core modules:

FHEQ Level	Module Title	Core/ Option/ Elective	Credit	Study Period	Module Code
7	Modelling and Optimisation	C	20	1	ENM7005-B
7	Big Data Systems and Analytics	C	20	1	COS7006-B
7	Team Project	C	40	1, 2	ENG7011-D
7	Automotive Tribology and Noise Vibration and Harshness	C	20	2	MAE7031-B
7	Vehicle Powertrain and Dynamics	C	20	2	MAE7030-B

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.

Degree of Master

FHEQ Level	Module Title	Core/ Option/ Elective	Credit	Study Period	Module Code
7	MSc Project	C	60	3	ENG7002-E

Students will be eligible for the award of ***Degree of Master*** if they have successfully completed at least 180 credits and achieved the award learning outcomes.

Learning and Teaching Strategy

The 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 CDIO framework. This means that our learning strategy will be to encourage students to work in teams to **C**onceive potential solutions, **D**esign new products processes or services, **I**mplement (or model) and test those designs, and **O**perate 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. The PG/Dip students will operate analytical instruments, under supervision, during the initial phase of their research project.

The University of Bradford is well known for attracting students from a wide variety of backgrounds, experiences and countries. The University's *modus operandi*, "Making Knowledge Work", is embedded in the philosophy of this programme.

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 that 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.

A main method of assessment (as is common on all professional engineering degree programmes) is by formal written examinations. 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 in to the structure of the examinations, case studies, laboratory demonstrations and project work.

Assessment Regulations

This Programme conforms to the standard University Assessment Regulations which are available at the link below

http://www.bradford.ac.uk/aqpo/ordinances-and-regulations/

Admission Requirements

The University welcomes applications from all potential students and most important in the decision to offer a place is our assessment of a candidate's potential to benefit from their studies and of their ability to succeed on this particular programme. Consideration of applications will be based on a combination of formal academic qualifications and other relevant experience.

The standard entry requirements for the programme are as follows:

We specifically require that all applicants have a second-class Honours degree or equivalent in a relevant discipline. Applications from candidates with Physics, mathematics or Computer Science degrees including relevant background in maths and physics will be considered on an individual basis. Candidates who do not fulfil the normal entry requirements but have extensive industrial experience in a related area will be considered on an individual basis.

The University of Bradford has always welcomed applications from disabled students, and these will be considered on the same academic grounds as are applied to all applicants. If applicants have some form of disability they may wish to contact the programme leader before they apply.

Applications are welcome from students with non-standard qualifications or mature students (those over 21 years of age on entry) with significant relevant experience.

Recognition of Prior Learning

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.

Minor Modification Schedule

Version Number	Brief description of Modification	Date of Approval (Faculty Board)
1		