

ACADEMIC POLICY & QUALITY OFFICE

PROGRAMME SPECIFICATION

for the award of

MSc Racing Engine Systems

Managed by the Faculty of Technology, Design and Environment

delivered by School of Engineering, Computing and Mathematics

| | |
|---|----------------|
| Date approved: | January 2014 |
| Applies to students commencing study in: | September 2020 |

RECORD OF UPDATES

| Date amended* | Nature of amendment** | Reason for amendment** |
|----------------------|--|--|
| 06/11/2019 | Addition of new module | To enhance relevancy of programme and to reflect industry focus on electric power systems |
| 06/11/2019 | Removal of acceptable modules | To enhance programme identity and to facilitate addition of new module |
| 05/02/2018 | Modification of programme title | To reflect accurately the evolution of the programme focus from design to systems |
| 05/02/2018 | Reduction of number of optional modules | To enhance the identity of the programme |
| 05/02/2018 | Introduction of independent study module | To provide flexibility required in case an optional module is failed |
| 05/02/2018 | Revision of award achievement for PGDip and PGCert | Simplification |

SECTION 1: GENERAL INFORMATION

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|--|---|
| Awarding body: | Oxford Brookes University |
| Teaching institution and location: | Oxford Brookes University Wheatley Campus, Wheatley, Oxon, OX33 1HX |
| Language of study: | English |
| Final award/s: | MSc (180 CATS credits) |
| Programme title: | Racing Engine Systems |
| Interim exit awards and award titles available: | PG Diploma Racing Engine Systems (PGDip) (Exit award only) (120 CATS credits) PG Racing Engine Systems (PGCert) (Exit award only) (60 CATS credits) |
| Brookes course code: | MSC-REY / EG86 |
| UCAS code: | P032922 |
| JACS code: | H330 |
| HECoS code: | 100205 |
| Mode of delivery: (Mode of Study given in brackets) | Face to face/on-campus (full-time) Face to face/on-campus (part-time) |
| Duration of study: | Give normal expected, and maximum possible, duration for each mode of study*. Full-time: one, five Part-time: two, five |
| Subject benchmark statement/s which apply to the programme: | UKSPEC |
| Professional accreditation attached to the programme: | IMechE https://www.imeche.org/ IET http://www.theiet.org/ Full academic requirements for CEng status |
| Apprenticeship Standard: | NA |
| University Regulations: | The programme conforms to the University Regulations for the year of entry as published/archived at: http://www.brookes.ac.uk/regulations/ |

SECTION 2: WHY STUDY THIS PROGRAMME?

The UK is a world leader in motorsport and associated high - performance engines industry - many of the world's most advanced high-performance engines are designed here. This is the only programme of its kind in the world and has been developed with the needs and requirements of the race engine manufacturers in mind. In addition to the strong theory-based modules, graduates gain a comprehensive understanding of how winning engines are created. The department's unrivalled access to industry informs and directs development and delivery of the programme. The programme is design to produce highly-skilled graduates who are ready to undertake advanced design roles with major engine manufacturers and their supply chain.

- We are known as a premier institution for Motorsport education - our motorsport legacy is recognised worldwide and many of our graduates progress to work for most advanced high-performance engine manufacturers, such as Ferrari and Mercedes HPP, F1 teams and major suppliers to motorsport industry, such as Xtrac, and Hewland.
- Our programme has been developed with and delivered in collaboration with the automotive and motorsport industry: you will be taught by staff with many years of racing engine experience, from performance road cars, Rally, IRL, Kart and F3 right up to F1. We are equipped with state-of-the-art equipment, that include four engine test cells, analytical & mechanical test equipment, Internal Combustion Engine Modelling software and the latest 3D printing technology, in addition to a range of racing cars.
- Industrial aspect of delivery is enhanced by exciting visiting speakers from business and industry, providing professional perspectives, featuring in our Industrial lecture series.
- Our close industry links can also be seen through research Dissertations and consultancies that enable us to feed the latest technology and developments into our teaching. It also provides opportunities for students to undertake Dissertations with neighbouring companies, also based in the UK Motorsport Valley, whilst our well-funded research programmes in areas of current concern such as vehicle end-of-life issues, in-cylinder combustion and emissions modelling, modern composite materials and electric vehicles offer.
- Students have the opportunity to join our international Formula Student team (OBR), mentored by alumni and visiting lecturers from automotive and motorsport industry. They put theory into practice by competing with the best universities from around the world. More information about Formula Student at Brookes can be found by visiting the [Oxford Brookes Racing website](#). Students have a unique opportunity to work on our Electric Formula Student race car development and also select this as your Dissertation topic or join the team of PhD students working on electric powertrain which may lead to the possibility of furthering their studies towards a PhD research degree.
- Visits to F1 teams, Formula E teams and major suppliers to the automotive and motorsport industry provide students with opportunities to explore technical challenges and the latest technology.
- In the most recent REF, 57% of the School's research was judged to be of world leading quality or internationally excellent with 96% being internationally recognised.

SECTION 3: PROGRAMME LEARNING OUTCOMES

On successful completion of the programme, graduates will demonstrate the following Brookes Attributes:

3.1 ACADEMIC LITERACY

- a) Ability to apply modern computing techniques, using innovative and creative approaches, to a wide range of complex Powertrain Engineering problems.
- b) Ability to integrate and apply advanced levels of knowledge, in a logical and practical manner, as appropriate, in the solution of interdisciplinary engineering problems.

3.2 RESEARCH LITERACY

- a) Ability to critically evaluate the research of others and generate new contributions to professional knowledge consistent with being an expert in the field.
- b) Ability to keep abreast with new and emerging technologies within their subject area by studying as independent learners.

3.3 CRITICAL SELF-AWARENESS AND PERSONAL LITERACY

- a) Ability to critically assess the work of oneself and others in the autonomous synthesis of solutions to complex Powertrain Engineering problems.
- b) Ability to articulate and explain complex Powertrain Engineering problems in written and oral presentational forms with clarity, brevity and logic.
- c) Ability to function collaboratively, with good interpersonal skills, in diverse teams successfully solving engineering problems.
- d) Ability to deal with complex issues both systematically and creatively, make sound judgements in the absence of complete data, and communicate their conclusions clearly to specialist and non-specialist audiences.
- c) Ability to keep abreast with new and emerging technologies within their subject area by studying as independent learners.

3.4 DIGITAL AND INFORMATION LITERACY

- a) Ability to utilise a broad range of appropriate information technology skills and their application within a technical or commercial environment.
- b) Ability to organise and analyse information, and to present it in a clear, logical and concise manner.

3.5 ACTIVE CITIZENSHIP

- a) Ability to work effectively and responsibly in business and management context.
- b) Ability to act professionally, in accordance with IMechE/IET graduate membership guidance, and so be recognised internationally as able to operate at a high level of responsibility consistent with Chartered Engineer status.

SECTION 4: CURRICULUM CONTENT & STRUCTURE

4.1 PROGRAMME STRUCTURE AND REQUIREMENTS:

| Code | Module Title | Credits | Level | Status | Coursework: Exam ratio |
|----------|---|---------|-------|--------|---------------------------|
| ENGR7005 | Advanced Powertrain Engineering | 20 | 7 | C | 50:50 |
| ENGR7009 | Engineering Business Management | 20 | 7 | C | 100:0 |
| ENGR7012 | Advanced Materials and Strength of Components | 20 | 7 | C | 50:50 |
| ENGR7016 | Racing Engine Systems | 40 | 7 | C | 50:50 |
| ENGR7019 | MSc Dissertation | 60 | 7 | C | 100:0 |
| ENGR7031 | Electric Powertrain Systems | 20 | 7 | C | 100:0 |
| ENGR7026 | Independent Study | 20 | 7 | A | 100:0 |

4.2 PROGRESSION AND AWARD REQUIREMENTS

For the award of MSc Racing Engine Systems, a total of 180 credits must be passed from the above list.

Provided that the required number of credits has been passed in an admissible collection of modules, then the MSc. award classification shall be a 'Pass' if the average is over 50%. This shall be superseded by a 'Merit', if the average is over 60% and the Dissertation mark is over 58% and this shall be superseded by a 'Distinction', if the average marks gained are over 70% and the Dissertation mark is over 68%.

For the award of Postgraduate Diploma in Racing Engine Systems, a total of 120 credits must be passed and these must include ENGR7016 / P04732.

For the award of Postgraduate Certificate in Racing Engine Systems, a total of 60 credits must be passed and these must include ENGR7016 / P04732.

4.3 PROFESSIONAL REQUIREMENTS

N/A

SECTION 5: TEACHING AND ASSESSMENT

The teaching, learning and assessment of the five graduate attributes are addressed in a distributed way throughout the modules on the programme. The compulsory modules provide a diet that ensures all the graduate attributes are met but this is further enhanced by the provision of the optional modules. A very important element in the teaching, learning and assessment of the graduate attributes is the Dissertation, which covers all five attributes in a single module. Students experience a variety of teaching and assessment methods on the programme, with modules typically make use of portfolio, reports, lab reports, compute- based assessments, presentations and case studies. Learning methods include formal lectures but also guided independent learning, use of the computer-based virtual learning environment 'Moodle', independent research, the preparation of computer simulations and analysis, including Finite Element Analysis (FEA), Matlab, Computational Fluid Dynamics (CFD), Engine simulation, Drive Cycle modelling and laboratory investigations.

Academic Literacy

Learning outcomes relating to modern computing techniques are taught, learnt and assessed in module such as ENGR7005 / P04704 Advanced Powertrain Engineering and ENGR7016 / P04732 Racing Engine Systems. Analysis packages taught in these modules include multi-body codes, Engine and Drive Cycle modelling, CFD, FEA simulation and languages such as Matlab amongst others. Learning methods include demonstrations, tutorials and guided learning whilst assessments feature reports based on simulations of case studies and the validation of test cases against experimental data and results. The academic literacy learning outcomes relating the application of advanced levels of knowledge to the solution of interdisciplinary knowledge are taught and learnt through a similar set of modules where the

theory behind the computer simulations is also taught. For example, in ENGR7012 / P04715 Advanced Materials and Strength of Components, advanced computer simulations are compared with and validated against theoretical predictions made using software and experimental data. This theme is common to many modules and forms an excellent learning platform for the acquisition of academic literacy.

Research Literacy

Although many modules on the programme require students to research and critically evaluate the work of others in the completion of their assessed work. One module in particular addresses this graduate attribute, this is ENGR7019 / P04791, the Dissertation where students are taught to critically evaluate the research of others and to make new contributions to the field. Experiential learning and formative assessment are employed with students undertaking literature reviews, writing critical evaluations and preparing reasoned arguments to complex problems as a preparation for the Dissertation. The Dissertation itself features more research and the synthesis of solutions to complex multidisciplinary engineering problems.

Critical self-awareness and personal literacy

This graduate attribute is addressed in a number of modules. The Dissertation module features critical assessment of one's own work and the work of others. Modules with coursework reports such as ENGR7016 / P04732 Racing Engine Systems, ENGR70XX Electric Powertrain Systems or ENGR7005 / P04704 Advanced Powertrain Engineering involve the synthesis of solutions to complex problems. The Dissertation requires students to develop the ability to articulate and explain complex problems and students are required to present their work to others as well. Some modules in management for example involve students working in groups, and students that join the Department's Formula Student team gain a very full learning experience in this area. Formal tuition in the management modules also provides teaching, learning and assessment for the ability to manage oneself in a commercial context.

Digital information literacy

Graduates of the programme necessarily have very well developed computer based analytical skills because of the large amount of computer software used in the design and analysis of Powertrain systems and components. However, the graduate attribute, 'Digital information literacy' extends beyond this to include the use of computers for more general skills such as presentations, literature reviews, preparation of design reports etc. Modules such as ENGR7016 / P04732 Racing Engine Systems, ENGR70XX Electric Powertrain Systems and ENGR7019/ P04791 Dissertation, amongst other, all provide opportunities for students to learn and be assessed on these abilities. The Dissertation in particular requires the presentation of complex engineering issues in a clear and logical manner so that other people new to the subject can quickly understand the analysis presented and its worth.

Active Citizenship

This graduate attribute relates to how well the graduates of the programme are prepared for work in the international and business context. In some considerable measure the learning outcomes for this graduate attribute are met through the professional accreditation of the programme. The Institution of Mechanical Engineers is recognised worldwide as providing a high quality, regulated framework that ensures new graduates are well rounded and conversant with the influences shaping the current climate for practice. Modules that address these learning outcomes particularly well include ENGR7009 / P04712 Engineering Business Management and ENGR7019 / P04791 Dissertation.

In general, the assessment regime selected is appropriate for the material covered resulting in a good proportion of the modules being assessed with a mixture of 50% coursework and 50% exam weighting (alternative Exam: Coursework weightings may be used), whilst the others are assessed by coursework only. Each specific graduate attribute is considered below and the way in which the programme enables students to meet the learning outcomes associated with each graduate attribute is examined. The final Dissertation is assessed nominally as coursework and includes written reports and a progress viva. Students are expected to spend an average of 200 hours for a 20 credit module, typically split as 36 hours of contact with a balance being independent study.

SECTION 6: ADMISSION TO THE PROGRAMME

6.1 ENTRY REQUIREMENTS

Students entering the course will normally be at least 21 years of age and hold one of the following qualifications:

- An Engineering Council-accredited Mechanical, Automotive or Motorsport Engineering Degree with a minimum level of lower second-class Honours.
- An alternative Engineering subject or suitable science degree with a minimum level of upper second-class Honours.
- A qualification equivalent in standard to these qualifications.

In the Mission Statement the University has highlighted the need to widen access to higher education from those traditionally under-represented among students. With respect to this requirement the School provision to enable this strategy is to enable the MSc to be taken in full or part time study mode and to give individual consideration to applicants from industry without the specifically named entry qualifications in above.

Applicants with a proven track record in the Powertrain Engineering sector are welcome to apply and start the course or can raise their entry status to an acceptable level by taking appropriate undergraduate modules as associate students.

Where appropriate, suitable English as a Foreign Language qualifications will be required.

6.2 DBS AND OTHER PRE-COURSE CHECKS REQUIRED

N/A

6.3 JOB ROLE/EMPLOYER PROFILE (DEGREE AND HIGHER APPRENTICESHIPS)

N/A

SECTION 7: PREPARATION FOR EMPLOYMENT

Graduate employability of the programme is excellent, with more than 90% of graduates going on to work in relevant industry or taking a higher degree. Brookes alumni are working for F1 engine makers and developers, such as Mercedes HPP, Ferrari, Delphi, Cosworth and MAHLE, F1 teams and automotive manufacturers such as Jaguar Land-Rover, Ford and TATA, for example. They are our best ambassadors - our graduates are very sought after and Formula One teams regularly recruit on campus. We have longstanding relationships with many automotive, motorsport and powertrain manufacturing companies and vacancies are often filled directly from Brookes. For many years our students have been recruited as design engineers as well as data, race, and materials engineers as well as in production control, quality, procurement, testing and management roles. The kind of programme that raises students to this level of preparation is demanding and students work long and hard to realise this potential. However, our students are of very high calibre, very motivated and competitive thus our completion rates are very high year on year.

We have a very strong employability support with dedicated Careers adviser not only providing CV workshops and interview training but also supports on campus employment fairs. Brookes is regularly contacted by engineering companies seeking our graduates and our Placements Officer provides a very strong and active link between the employers and students. There is also specialist help for students preparing their CV from their dedicated Academic Adviser and the University Careers team.