

Programme Specification

MSc Racing Engine Design

Valid from: September 2015

**Faculty of Technology, Design &
Environment**

SECTION 1: GENERAL INFORMATION

Awarding body:	Oxford Brookes University
Teaching institution and location:	Oxford Brookes University Wheatley Campus, Wheatley, Oxon, OX33 1HX
Final award:	MSc (180 CATS credits)
Programme title:	Racing Engine Design
Interim exit awards and award titles:	PG Diploma Racing Engine Design (PGDip) (Exit award only) (120 CATS credits) PG Certificate Racing Engine Design (PGCert) (Exit award only) (60 CATS credits)
Brookes course code:	EG89
UCAS/UKPASS code:	P032922
JACS code:	H330
Mode of delivery:	Face to Face
Mode/s of study:	Full time or Part time
Language of study:	English
Relevant QAA subject benchmark statement/s:	Engineering (2010)
External accreditation/recognition: <i>(applicable to programmes with professional body approval)</i>	Institution of Mechanical Engineers
Faculty managing the programme:	Technology, Design & Environment
Date of production	January 2015

SECTION 2: OVERVIEW AND PROGRAMME AIMS

2.1 Rationale for/distinctiveness of the programme

The Department of Mechanical Engineering and Mathematical Sciences has long been associated with academic provision for students wanting to enter the motorsport industry, with our first undergraduate course having started in 1996. Since that time the provision has expanded rapidly in response to its success. This has led to new courses not just in motorsport but also in performance automotive engineering. A group of our staff also have internationally recognised expertise in racing engine design and it was a logical extension of the provision in the area to offer a very specialised MSc for students wanting to work in this specialised but essential element of the industry.

This programme provides a unique preparation for work in the performance engine design industry. In the years that it has operated, employment statistics have been extremely good, applications are good including many overseas students, with a small cohort of very motivated students applying each year. The academic health of the course is clear. Some staff teaching on the programme have considerable racing engine design expertise whilst other have a wider Motorsport and Performance road car background. Staffing provision was specifically commended during our last accreditation visit from the Institution of Mechanical Engineers (IMechE). Students studying the programme make use of the Department's extensive facilities such as the engine test laboratory with four engine test-cells, the automotive laboratory and our own four post test rig. Oxford Brookes is the premier institution for motorsport education, including racing engine design. This is a discipline that demands the highest levels of achievement and it is entirely appropriate that it should offer a programme at the Masters level. Finally, Motorsport is sometimes seen as a rather glamorous and recreational activity far removed from mainstream business or engineering. Nothing could be further from the truth. Motorsport is a massive industry for the UK. It is a unique blend of business, engineering, entertainment and hard work. Naturally, without engines, there wouldn't be any racing and so graduates of the programme will always be in demand. The engineers who work in the field must be the best of all, educated well beyond the norm. For these reasons, this fully accredited, practice based analytical Masters programme on offer is like no other. Only Oxford Brookes can offer this programme.

2.2 Aim/s of the programme

The principle aim is to provide an extended and enhanced course of study at MSc level in Racing Engine Design that meets the educational requirements as described in the UK-SPEC Specific Learning Outcomes for a "period of further study" that qualifies the student for exemption from the Engineering Council Exams parts one and two. The course is designed for the most able students wishing to achieve both high academic and practical standards whilst having the potential to rise to senior levels of responsibility in industry. Additionally the course provides a broad, integrated course of study in the discipline of Racing Engine Design, which allows students to deepen their knowledge in some areas, and to take part in multi-disciplinary project-based work. A fundamental aim of the program is to prepare students for the design development and actual racing of a formula racing car and so all students are encouraged to participate in our very successful Formula Student team which provides first hand experience of putting theory into practice and attending international racing competitions. The aim is to prepare the graduates of the course for a demanding career in Racing Engine Design and furnish them with the ability to enter the industry directly upon

graduation without the need to work in any other engineering discipline or gain any further employment first. The programme offers some flexibility and choice of what subjects are studied but no matter what combination is taken, all students meet this aim.

SECTION 3: PROGRAMME LEARNING OUTCOMES

Knowledge, understanding and skills:

3.1 Academic literacy

- a) Ability to apply modern computing techniques, using innovative and creative approaches, to a wide range of complex Racing Engine Design 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 up-to-date in their knowledge by study 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 Racing Engine Design problems.
- b) Ability to articulate and explain complex Racing Engine Design 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.
- e) Ability to self-manage and self-organise both at a personal level and as a project manager.

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 Global citizenship

- a) Ability to work effectively and responsibly in a global business and management context.

- b) Ability to act professionally, in accordance with IMechE 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: PROGRAMME STRUCTURE AND CURRICULUM

4.1 Programme structure and requirements:

Level 7 Modules				
Module Code	Module Title	Credits	Status: Compulsory/ Elective	Semester of delivery
P04715	Advanced Materials Strength of Components	20	Compulsory	1
P04712	Advanced Engineering Management	20	Compulsory	1
P04732	Racing Engine Design	40	Compulsory	1
P04791	MSc Project	60	Compulsory	1, 2 & 3
P04700	Computation and Modelling	20	Optional	2
P04704	Advanced Powertrain Engineering	20		2
P04760	Data Acquisition Systems	20		2
P04703	Crash Impact Modelling	20		2
P04708	Lap-time Simulation and Race Engineering	20		2
P04713	Engineering Reliability and Risk Management	20		2

For the award of MSc Racing Engine Design a total of 180 credits must be passed from the above list, including all compulsory modules.

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 Certificate in Racing Engine Design a total of any 60 credits must be passed but these must include P04732.

For the award of Postgraduate Diploma in Racing Engine Design a total of any 120 credits must be passed but these must include P04732 and P04715.

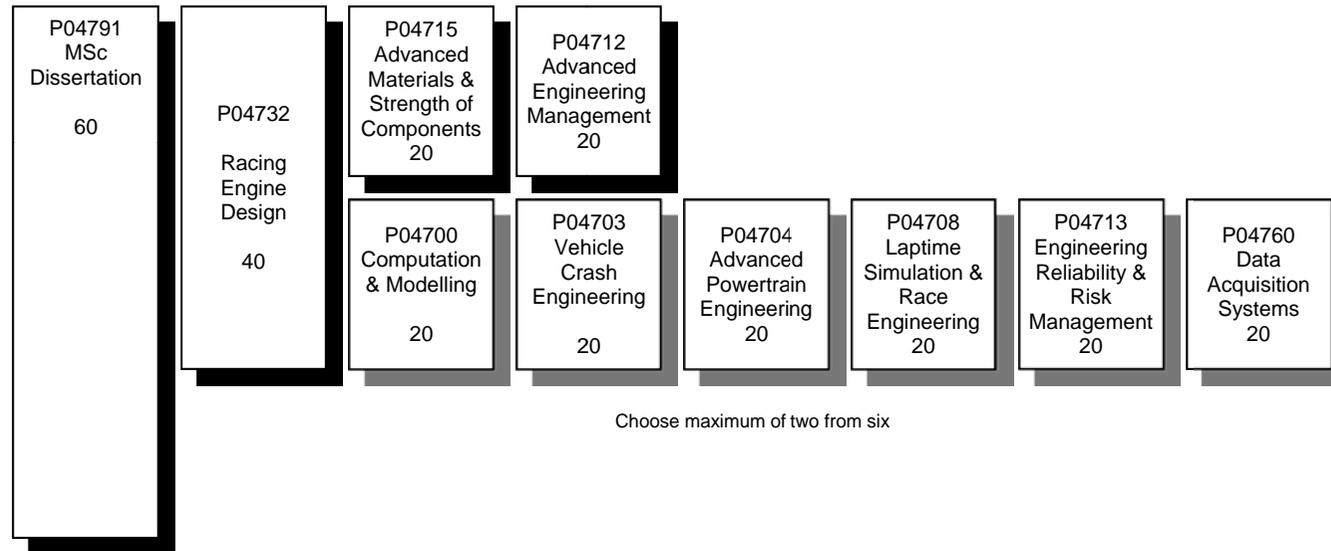
Dissertation titles are presented by staff for students to choose. There are a wide range of Racing Engine Design specific topics available reflecting the expertise of staff. Some projects are supported by external companies and racing teams and, in addition,

students are free to propose topics of their own and these again, may be with external companies or teams.

4.2 Professional requirements

The programme is accredited by the IMechE and exempts graduates from passing any further academic qualifications before becoming Chartered Engineers. (In accordance with the regulations of the IMechE, graduates will be required to complete two years of experience in a position of responsibility before being accepted as Chartered Engineers but they will not be required to pass any further exams). Admission to the IMechE is not dependent on exit classification and all graduates are eligible to become Chartered Engineers.

4.3 Structure Diagram



SECTION 5: PROGRAMME DELIVERY

5.1 Teaching, Learning 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 elective 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. Some modules feature reports, lab reports, computer based assessments, presentations and case studies. Learning methods include formal lectures but also guided independent learning, use of the computer based learning environment 'Moodle', independent research, the preparation of computer analyses, experiments and the like. All assessment is guided by the Brookes assessment compact; details of which may be found at:

<http://www.brookes.ac.uk/aske/documents/BrookesAssessmentCompact09.pdf>

A minority of modules are assessed entirely by exam and these relate only to some of the business options. Several modules are assessed entirely by coursework, P04701 CAD/CAM and P04791, the dissertation, being examples. Others are by a mixture of 30% coursework and 70% exam, for example, P04710 Advanced Strength of Components. Others still are assessed with a 50/50 mix of coursework and exam, for example, P04732 Racing Engine. In general, the assessment regime selected is appropriate for the material covered. In the same way that design work is not assessed by exam, maths is not assessed by group project work! 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.

Academic Literacy

Learning outcomes relating to modern computing techniques are taught, learnt and assessed in module such as P04700 Computation and Modelling, P04701 CAD/CAM, P04704 Advanced Powertrain Engineering and P04732 Racing Engine Design. Analysis packages taught in these modules include multi-body codes, computation fluid dynamics, advanced FEA and languages such as Matlab amongst others. Learning methods include demonstrations, tutorials and guided learning, and assessment features reports based on simulations of case studies and the validation of situations against real data and results from other codes. 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 P04710 Advanced Strength of Components or P04700 Computation and Modelling. Advanced computer simulations for racing engine performance are prepared which are compared with and validated against test data using programming languages such as Matlab. This theme is common to a number of 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 P04791, the dissertation. In this module 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 P04732 Racing Engine Design or 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 Motorsport artefacts. 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. Several modules, such as P04760 Data Acquisition Systems, P04700 Computing and Modelling and P04791, the dissertation, amongst others, all provide opportunities for students to learn and be assessed on these abilities. The project 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.

Global Citizenship

This graduate attribute relates to how well the graduates of the programme are prepared for work in the international and global 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 P04712 Advanced Engineering Management and P04791, the dissertation.

5.2 Assessment regulations

The programme conforms to the University Postgraduate Taught Regulations. Details can be found at: <http://www.brookes.ac.uk/uniregulations/current>

SECTION 6: ADMISSIONS

6.1 Entry criteria

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 its 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 Department's 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 above.

Applicants with a proven track record in the Motorsport 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 (see: <http://www.brookes.ac.uk/international/apply/english/>).

6.2 CRB checks

Not Applicable

SECTION 7: STUDENT SUPPORT AND GUIDANCE

The University prides itself on the provision of good support facilities for students. This starts upon arrival; there is a comprehensive induction process that introduces students to the University and the programme itself. Members of teaching staff explain their subject areas to new students. There are sessions to familiarise students with the University Academic Computer Management System where students enter the modules they wish to study etc. There are Library tours, introductions to senior staff in the Department, and a 'freshers' fair' where all the clubs and societies have stands introducing themselves.

The programme has a handbook containing all the important information about how the programme runs and what must be done and these are explained to new students. Provision of central support such as language teaching for foreign students, Upgrade sessions for maths support etc. are all detailed.

In keeping with University practice, the Department has Student Support Coordinators who can help with problems and offer guidance for students needing help from other University offices. Help can extend to guidance on what to do if illness or circumstances beyond the student's control affect their studies, support for dyslexia, even problems with Landlords or problems with other students.

Each student will be allocated an academic adviser to assist students on academic issues such as module selection. Often the academic adviser will provide a reference when the student is applying for jobs.

Individual groups of students also have support available because of their specific needs, for example disabled students or international students.

The dissertation forms a major part of the programme and particular support is offered for this. During Semester 1, students are given presentations about the completion of the dissertation and the selection of titles. The dissertation involves a lot of work and often the student will get to know the supervisor well and choose him or her to act as referee for job applications etc.

The Department runs an annual 'Life after Brookes' day to which all students are invited. The day features material helpful in preparation for the time when students leave Brookes such as guest lecturers, talks from the University Alumni office, advice and guidance on CV preparation and careers etc. The day ends with entertainment and refreshments.

In general the Department is a close knit community of teachers and learners and support is available informally all the time.

SECTION 8: GRADUATE EMPLOYABILITY

The graduate employability of the programme is very good. In recent years one hundred percent of graduates have gone on to work in the industry and graduates are very sought after with some receiving several job offers.

Students have recently graduated and started work with F1 Engine makers; others have joined manufacturers for the wider Motorsport industry and others still have gone to work for performance road car engine suppliers.

We have long standing relationships with many companies now and vacancies are sometimes filled directly from Brookes without public advertisements ever being made.

Last year many students went to work in the industry as design engineers but others went as data engineers, materials engineers, sales engineers, production control and management, quality, procurement, testing, aerodynamics and management. Necessarily the kind of programme that raises students to this level of preparation is demanding and students must expect to work long and hard to realise this potential. Applicants are very motivated and completion rates are very high with only one or two students not completing the course each year.

We also have a very successful undergraduate placements scheme, cited by the Institution of Mechanical Engineers as a model of good practice. The scheme is administered by our Placements Officer who is available to offer contacts and advice to postgraduate students on the programme, significantly enhancing our graduate employability. There is help for students in preparing for interviews and the preparation of CVs both from staff individually and from University support.

SECTION 9: LINKS WITH EMPLOYERS

The Department has strong links with the industry. When originally designed, the course was shaped by the industry and organisations such as the Oxford Motorsports Forum brought together senior staff from the industry with the course development

team to ensure that the content was exactly matched to the needs of the industry. The process of enrichment continues through the Department's Industrial Advisory Board which is well populated with senior staff from the industry. In addition, many staff themselves have contacts with the industry and the Department is currently conducting research and consultancy on a range of racing engine problems often related to emissions as well as performance. Many students are successful in gaining dissertations with employers and sometimes go to work for them afterwards.

We have visiting speakers, host the Annual World Motorsports Symposium, and provide consultancy in areas such as combustion and emissions. We have active research programmes in many areas and a large body of published work from our research programmes together with an active knowledge exchange partnership where companies work together with departmental staff to develop economic solutions to complex problems.

SECTION 10: QUALITY MANAGEMENT

Indicators of quality/methods for evaluating the quality of provision

The programme is fully accredited by The Institution of Mechanical Engineers (IMechE) and at the last visit received the maximum period of accreditation of five years without any conditions being imposed at all. In addition to accreditation, the programme is routinely inspected by the University's own QA system of periodic review and again has recently been fully approved. All modules on the programme have the assessment inspected and approved by external examiners from other institutions and their reports consistently show the level to be at a high standard. Each module also has an internal moderator who ensures the assessment is reviewed by the external examiner. All modules undergo a module evaluation process in which the students fill out a standard questionnaire. The results are prepared centrally and made available to the module leader and the programme management team who can review the feedback on all modules on the programme. The academic health of the programme is further monitored by a system of annual review. This draws together information and opinions about the programme from stakeholders such as teaching staff, external examiners, administrators, student coordinators, programme leaders and proposes changes to improve the course on a continual rolling basis. A particularly important group in this process is, of course, the students themselves and student representatives are present at the Subject Committee meetings held each semester where these things are discussed. In addition to this, the Department has a student forum open to all students where any matters relating to study of the programme can be brought up. Senior staff and the Head of Department attend the meeting too. The programme also has student focus groups where small numbers of students discuss issues with the Programme Lead and Subject Coordinators. Matters raised in these ways are fed into the quality control process and the cycle of continuous improvement therefore has many contributing sources. Some improvements are academic in nature, such as the inclusion of new software or analysis techniques and these are implemented by staff. Others are more general, for example improvements in catering, or the provision of new cash machines and these are implemented by referral through the committee structure of the university. The programme is also monitored by national surveys such as the PTES and results from such surveys feed into the quality control process through consideration in the annual review process and subsequent discussion at university meetings such as the Academic Enhancement and Standards Committee.

The programme adheres to the nationally accepted benchmarks for MSc Engineering degrees via the QAA Benchmark Statement (2010) and the Engineering Council UKSPEC document. The programme also conforms to the structure and regulations of the University's Postgraduate Frameworks.