



SWANSEA METROPOLITAN UNIVERSITY

PRIFYSGOL FETROPOLITAN ABERTAWE

Faculty of Applied Design and Engineering
Cyfadrn Dylunio Cymwysiedig a Pheirianeg
School of Automotive Engineering
Ysgol Peirianeg Fodurol

Program Handbook

BSc (Hons) Motorsport Engineering
BSc (Ord) Motorsport Engineering
BSc (Hons) Automotive Engineering
BSc (Ord) Automotive Engineering
BSc (Hons) Motorcycle Engineering
BSc (Ord) Motorcycle Engineering
HND Motorsport Engineering
HND Automotive Engineering
HND Motorcycle Engineering
HNC Automotive Engineering

September 2012
Medi 2012

1. INTRODUCTION

This document presents the case for re-validating the HND Motorsport and HND/C Automotive Engineering Portfolio of Programmes offered by the School of Automotive Engineering, and the BSc (Hons/Ord) Motorsport Engineering re-titling from the BSc Motorsport Technology to bring all programmes and events into alignment and to adapt and rename the BSc profile. It also proposes the pathways for the new BSc (Hons/Ord) Automotive Engineering, BSc (Hons/Ord) Motorcycle Engineering and the HND Motorcycle Engineering programmes which will broaden the portfolio to encompass the growing automotive and motorcycle engineering developments within the school.

The present HND Automotive Engineering course has been running at the University since 1984 and was the subject of re-validations in 1987, 1992, 1997 2002 and 2006. During this period, through consultation with industrial representation, new centre devised modules were introduced and other amendments carried out to meet the changing needs of students and employers. Therefore, the purpose of this document is to describe in detail the proposed new programme structure that will incorporate three HND's and BSc's pathways allowing for an integrated award structure over a three year period and to offer these programmes on both a full time and part time basis.

The HNC Automotive Engineering portfolio was introduced in 1981. This was then transformed into one of the first HNDs offered by this Institution in 1983 before the Faculty of Applied Design & Engineering was created. The HND Motorsport Engineering was first delivered by the School of Automotive Engineering in 2001. Therefore there is considerable experience within the School of Automotive Engineering with delivering a dual HND Pathway within an Automotive Portfolio. The first student intake for the BSc portfolio was introduced in September 2009.

Swansea Metropolitan University changed its name in January 2008 from Swansea Institute of Higher Education (it was also formerly called West Glamorgan Institute of Higher Education). The Institute was established in 1976 by the merger of three long-established colleges in the City of Swansea: the College of Art, the College of Education and the College of Technology, with the remit to offer a wide range of vocational and academic courses. The 1988 Education Act and subsequent Government legislation resulted in the decision by the Secretary of State to incorporate the Institute from 1 April 1992. The Welsh Office issued a statutory declaration on 1st October 1991 establishing the Higher Education Corporation of Swansea and altered the name to Swansea Institute of Higher Education (SIHE). The University's new title was confirmed by the Privy Council in January 2008 following two years of rigorous inspections by the QAA.

The academic organisation of the University is divided into four faculties, namely:

- Applied Design and Engineering
- Art and Design
- Humanities
- Business and Management

The School of Automotive Engineering resides within the Faculty of Applied Design and Engineering which has 60 academic staff, 14 technicians/instructors and 6 secretaries /administration staff. Within this portfolio 3 Programme Directors take direct responsibility for the daily operations of the BSc Motorsport Technology, HND Motorsport and Automotive Engineering and the HNC Automotive Engineering. Currently there are 7 schools within the Faculty and these are:

- School of Automotive Engineering
- School of Applied Computing
- School of Digital Media
- School of Industrial Design
- School of Logistics and Manufacturing Engineering
- School of Built and Natural Environment
- Welsh School of Architectural Glass

The School of Automotive Engineering currently has 9 permanent academic staff and 3 technician/instructors and 1 technician. There are approximately 270 full time equivalent students following programmes within the School.

On all academic matters the Faculty is responsible to the Academic Board of the University. Each Portfolio Board reports via its Faculty Board to the relevant committees of Academic Board.

The program pathways consist of:

- HND Motorsport Engineering
- HND Automotive Engineering
- HNC Automotive Engineering
- HND Motorcycle Engineering
- BSc(Hons/Ord) Motorsport Engineering
- BSc(Hons/Ord) Automotive Engineering
- BSc(Hons/Ord) Motorcycle Engineering

2. School of Automotive Engineering

2.1 Profile of Courses

The mission of the School of Automotive Engineering, in line with that of the University as a whole, is to provide vocationally orientated Higher Education for local and regional client groups, whilst also taking account of national and international perspectives. Throughout, the University is committed to offering its services to the widest possible student base. In line with its mission, developed from its history of providing vocational Programmes at all levels for the local community, there is a policy of open access to Programmes for all those who are judged as likely to benefit and gain the award.

The School provides a portfolio of BEng Programmes and also offers research degrees at MPhil and PhD level. All are offered on a part-time and full time basis.

Undergraduate degrees, at honours and ordinary level, currently offered in the School are:

- BEng Motorsport Engineering and Design
- BEng Automotive Engineering
- BEng Motorcycle Engineering

The School also offers:

- MPhil. and PhD programmes

2.1 Students' Employability

Students from the School have seen significant success in terms of employment. Past students from the School are currently employed with all the companies listed in the previous section. From our continued contacts with these students we are confident that the skills they developed on our courses has helped them with their employment and indeed, been a major factor in them obtaining employment in the first instance. As an example, Prodrive now has Swansea Metropolitan University as one of the few universities it regards as providing potential employees of suitable calibre to work with them in both engine and vehicle development. Other examples include Jaguar- Engine management systems, Aston Martin - Engine management systems, Brawn F1- Electronics and aerodynamics, TRW - Electronic Power steering engineering, Mahle Powertrain – Engine analysis and both Triumph and Norton Motorcycles – Design, Pi Research – Professional Systems business management and product support roles.

It was expressed by the Regional Technology Plan for Wales (RTP) - and is still true today - that an identified a number of factors exist that are essential to the improvement of the Welsh economy, and concludes that

“Innovation, Technology Education and Training are vital for the Welsh Economy”.

Andrew Davies (Former Minister for Economic Development and Transportation on the Wales Motorsport Initiative) stated that, *‘Wales has real expertise in automotive manufacturing, engineering and world class centres of expertise in research and development.’* He also expressed that through new opportunities and agreements it would, *‘boost this sector and develop world class motorsport facilities and technology.’*

The team believes the proposed portfolio addresses the RTP factors, and will alleviate the demand by employers for BSc and HN-qualified personnel with motorsport, motorcycle and automotive skills in the widest sense of the term and welcome the new proposed opportunities.

3. Programme Themes

HND Motorsport Engineering

The Motorsport Engineering Programme will develop the skills and knowledge for technical and innovative application, within the business organisations of the motorsport engineering Industry. The successful utilisation of the latest technology will require a broad understanding of issues associated with today's competitive motorsport industry. It is anticipated that students following this programme will also develop engineering skills at a high level of competence in the non motorsport competitive application.

HND Automotive Engineering

The Automotive Engineering Programme will develop the knowledge and skills, both engineering related and business orientated, necessary in a rapidly changing environment of technologies and techniques that are applied within the automotive engineering industry. The successful utilisation of the latest technology will require a broad understanding of issues associated with today's automotive industry. It is anticipated that students following this programme will also develop engineering skills at a high level of competence which can be applied to the competitive application of the industry.

HND Motorcycle Engineering

The Motorcycle Engineering Programme will develop the knowledge and skills, both engineering related and business orientated, necessary in a rapidly changing environment of technologies and techniques that are applied within the motorcycle industry. The successful utilisation of the latest technology will require a broad understanding of issues associated with today's motorcycle production and motorcycle sport industries. It is anticipated that students following this programme will also develop engineering skills at a high level of competence that can be applied to the wider industries of production, manufacture and development.

HNC Automotive Engineering

The HNC Automotive Engineering Programme will be delivered on a part-time basis and it incorporates nine of the HND Automotive Engineering modules and it would run in parallel to the HND. It will develop the knowledge and skills, both engineering related and business orientated, necessary in a rapidly changing environment of technologies and techniques that are applied to the world of 'The Automotive Industry'. The successful utilisation of the latest technology will require a broad understanding of issues associated with today's automotive industry. It is anticipated that students following this programme will also develop engineering skills at a high level of competence which can be applied to the competitive application of the industry.

BSc (Hons/Ord) Motorsport Engineering

BSc (Hons/Ord) Automotive Engineering

BSc (Hons/Ord) Motorcycle Engineering

The BSc's specifically stand alone as a three year programme. However, its first two years incorporate one of the HND Programme pathways and applicants are registered with BTEC and on completion of the Level 4 and Level 5 modules of the BSc they will be awarded with a Higher

National Diploma. Once completing Level 6, the student will be awarded with a BSc (Hons) Degree Award. Students pursuing an Ordinary Degree would not study the 40 credit Research Methods and Project module plus one other 20 credit module. This would be agreed on entry to the final year.

The first two years of the BSc's consists of three pathways which are:

- HND Motorsport Engineering
- HND Automotive Engineering
- HND Motorcycle Engineering

There are five themes that have been identified within the BSc Programme and they offer graduates a range of career choices in the Motorsport, Automotive and Motorcycle Industries. One of these themes is that of electronic control, diagnostics and instrumentation. Feedback from the Programme Team's many industrial contacts has stressed the importance of this in modern Motorsport, Automotive and Motorcycle Engineering and the Team believes the potential employability of a graduate of the programme will be enhanced with this work.

A second theme is aimed at developing students' awareness of business organisation and project management within their chosen industry. A third theme covers vehicle technologies and performance analysis. The forth theme that was identified is one that underpins all engineering activity and is that of engineering analysis. The final theme is CAD; competence in this area has proved to be invaluable for our graduates in a wide range of careers.

The final year of the BSc has attracted applicants who wish to enter the vehicle engineering industry in a development engineering or technical support role or even in technical or commercial management.

4. PROGRAMME AIMS AND OUTCOMES

The aim of each programme is to provide a full and satisfying academic experience appropriate to a Degree level whilst developing the student's ability to understand and apply academic knowledge, develop the student's skills for evaluating issues involved in the study of current Motorsport, Automotive and Motorcycle applications and stimulate creativity in the design and development of workable solutions.

There are a set of generic aims that are applicable to the portfolio, and within this set each programme will have its own specialist aims.

4.1 Specific Pathway Aims and Outcomes:

Additionally, the proposed Higher National Automotive Portfolio has specific aims and associated learning outcomes for each pathway described below.

4.2 Motorsport Engineering Pathway Level 4 & 5

The Motorsport Engineering pathway will provide for the promotion of skills and the acquisition of knowledge for development, in the motorsport industry utilising the latest systems and technology. A student following this pathway may be required to implement and manage appropriate information systems within the business context. Thus, a study of systems analysis and design and motorsport issues will be allied to the development of practical skills and the study of the engineering needs.

Aims:

1. To develop a broad knowledge base of race vehicle and machine shop engineering practice
2. To give the student a period of industrial experience within the motorsport industry
3. To develop an advanced level of knowledge and understanding of competition vehicle powertrain and chassis systems
4. To provide the student with the fundamental analytical knowledge and techniques needed in engineering
5. To develop expertise in a range of scientific and mechanical principles which underpin the design and operation of engineering systems
6. To enable the student to develop an advanced level of vehicle fault diagnosis, reasoning ability and practical skills, appropriate to the needs of motorsport
7. To provide students with knowledge and understanding of the properties, selection processing and use of materials
8. To give students proficiency in the practical application and management of appropriate engineering solutions within the motorsport environment.

9. To enable the student to learn about the importance of working as a team member to solve engineering problems by undertaking a group project involving one or more of the major topic areas of the programme
10. To enable students to select, apply and manage appropriate engineering solutions within the business environment.

Learning Outcomes:

Upon completion of this pathway the student will be able to:

- MS1. Understand and use safe working practices to undertake basic vehicle maintenance procedures and demonstrate basic manufacturing processes
- MS2. Understand in detail the technology, and the ability to analyse and predict the performance of vehicle powertrain and chassis systems
- MS3. Operate effectively in the working environment
- MS4. Analyse and model engineering situations and solve problems using algebraic and trigonometric methods, calculus, statistics and probability
- MS5. Investigate the behaviour of static and dynamic systems, complex loading systems, power transmissions systems and the control and transfer of energy in thermal and fluid systems
- MS6. Undertake analysis and evaluation using the principles of mechanical, scientific and materials at an analytical level appropriate to the programme
- MS7. Apply relevant fault diagnosis processes, interpret symptoms and undertake appropriate diagnostic work
- MS8. Select suitable materials, identify relationships between manufacturing processes and materials' behaviour and diagnose causes and modes of failure in materials
- MS9. Plan, implement and document an engineering project, as part of a team, and present, orally and by report, the design and development concepts, implementation stages and achievements of that project to meet the motorsport needs
- MS10. Utilise and implement systems for control, data acquisition and monitoring of mechanical and electronic motorsport systems
- MS11. Evaluate the relationship between a motorsport organisation and its industrial, socio-economic and environmental context, apply appropriate accounting planning, costing and monitoring processes and be cognisant of team dynamics and workforce motivation techniques.

It should be noted in the following Tables 1a, 1b, 1c that the Learning Outcomes 1,2,3,4 and 1.1, 1.2, 1.3 are specific to level 6 modules and will be discussed at reference 5.1

4.3 Automotive Engineering Pathway Level 4 & 5

The Automotive Engineering pathway will provide for the promotion of skills and the acquisition of knowledge for development within the automotive industry utilising the latest system and technology. A student following this pathway may be required to implement and manage appropriate information systems within the business context. Thus, a study of systems analysis, design and automotive issues will be allied to the development of practical skills and the study of the engineering needs.

Aims:

1. To develop a broad knowledge base of road vehicles and machine shop engineering practice
2. To give the student a period of industrial experience within the industry
3. To develop an advanced level of knowledge and understanding of road vehicle powertrain and chassis systems
4. To provide the student with the fundamental analytical knowledge and techniques required in engineering
5. To develop expertise in a range of scientific and mechanical principles which underpin the design and operation of engineering systems
6. To enable the student to develop an advanced level of vehicle fault diagnosis, reasoning ability and practical skills, appropriate to the needs of the industry
7. To provide students with knowledge and understanding of the properties, selection processing and use of materials
8. To give students proficiency in the practical application and management of appropriate engineering solutions within the automotive environment.
9. To enable the student to learn about the importance of working as a team member to solve engineering problems by undertaking a group project involving one or more of the major topic areas of the programme
10. To give students the technical and practical skills necessary for the development of quality within the chosen pathway.

Learning Outcomes:

Upon completion of this pathway the student will be able to:

- A1. Understand and use safe working practices to undertake basic vehicle maintenance procedures and demonstrate basic manufacturing processes
- A2. Understand in detail the technology, and the ability to analyse and predict the performance of vehicle powertrain and chassis systems

- A3. Operate effectively in the working environment
- A4. Analyse and model engineering situations and solve problems using algebraic and trigonometric methods, calculus, statistics and probability
- A5. Investigate the behaviour of static and dynamic systems, complex loading systems, power transmissions systems and the control and transfer of energy in thermal and fluid systems
- A6. Undertake analysis and evaluation using the principles of mechanical, scientific and materials at an analytical level appropriate to the programme
- A7. Apply relevant fault diagnosis processes, interpret symptoms and undertake appropriate diagnostic work
- A8. Select suitable materials, identify relationships between manufacturing processes and materials' behaviour and diagnose causes and modes of failure in materials
- A9. Plan, implement and document an engineering project, as part of a team, and present, verbally and by report, the design and development concepts, implementation stages and achievements of that project to meet the automotive needs
- A10. Utilise and implement systems for control, data acquisition and monitoring of mechanical and electronic automotive systems
- A11. Evaluate the relationship between an automotive organisation and its industrial, socio-economic and environmental context, apply appropriate accounting planning, costing and monitoring processes and be cognisant of team dynamics and workforce motivation techniques.

4.4 HNC AIMS AND OUTCOMES

The Programme aim is to provide a full and satisfying vocational experience appropriate to Higher National level, which will develop the student's ability to understand and apply academic knowledge, develop the student's skills for evaluating issues involved in the study of current Motorsport/Automotive applications, and stimulate creativity in the design and development of workable solutions.

There are a set of generic aims that are applicable to the portfolio, and within this set each programme will have its own specialist aims.

4.5 HNC Awards

The generic aims of these awards are:

1. To develop the student's competence in the principles and applications of Automotive Engineering Systems.
2. To develop a range of vocational and personal skills to assist in securing and/or enhancing employment opportunities.

3. To provide a learning base for possible further areas of study.

In order to achieve these, the generic learning outcomes will allow the student to demonstrate the ability to:

1. To gain an understanding of the principles governing the behaviour of Automotive Engineering Systems.
2. To understand and investigate ways in which Engineering Systems are applied to automotive applications.
3. To utilise good engineering practice in the maintenance, commissioning and testing of such systems.
4. To undertake adaptation and development of such systems.
5. To appreciate Business and Commercial aspects of engineering practice.
6. To develop a range of personal skills.

4.6 Motorcycle Engineering Pathway Level 4 & 5

The Motorcycle Engineering pathway will provide the promotion of skills and the acquisition of knowledge for development, within the motorcycle industry, utilising the latest systems and technology. A student following this pathway may be required to implement and manage appropriate information systems within the business context. Thus, a study of systems analysis and design and motorcycle engineering issues will be allied to the development of practical skills and the study of the engineering needs.

Aims:

1. To develop a broad knowledge of the motorcycle and machine shop engineering practice
2. To give the student a period of industrial experience within the motorcycle industry
3. To develop an advanced level of knowledge and understanding of road and competition motorcycle, its powertrain and chassis systems
4. To provide the student with the fundamental analytical knowledge and techniques required in engineering
5. To develop expertise in a range of scientific and mechanical principles which underpin the design and operation of engineering systems
6. To enable the student to develop an advanced level of vehicle fault diagnosis, reasoning ability and practical skills, appropriate to the needs of the industry.
7. To provide students with knowledge and understanding of the properties, selection, processing and use of materials
8. To enable the student to learn about the importance of working as a team member to solve engineering problems by undertaking a group project involving one or more of the major topic areas of the programme
9. To enable students to select, apply and manage appropriate engineering solutions within the business environment.

Learning Outcomes:

Upon completion of this pathway the student will be able to:

- MC1. Understand and use safe working practices to undertake basic vehicle maintenance procedures and demonstrate basic manufacturing processes
- MC2. Understand in detail the technology, and the ability to analyse and predict the performance of motorcycle vehicle powertrain and chassis systems
- MC3. Operate effectively in the working environment
- MC4. Analyse and model engineering situations and solve problems using algebraic and trigonometric methods, calculus, statistics and probability

- MC5. Investigate the behaviour of static and dynamic systems, complex loading systems, power transmissions systems and the control and transfer of energy in thermal and fluid systems
- MC6. Undertake analysis and evaluation of materials using mechanical and scientific principles at an analytical level appropriate to the programme
- MC7. Apply relevant fault diagnosis processes, interpret symptoms and undertake appropriate diagnostic work
- MC8. Select suitable materials, identify relationships between manufacturing processes and materials' behaviour and diagnose causes and modes of failure in materials
- MC9. Plan, implement and document an engineering project, as part of a team, and present, verbally and by report, the design and development concepts, implementation stages and achievements of that project to meet the motorcycle business needs
- MC10. Utilise and implement systems for control, data acquisition and monitoring of mechanical and electronic motorcycle and competition systems
- MC11. Evaluate the relationship between a motorcycle organisation and its industrial, socio-economic and environmental context, apply appropriate accounting planning, costing and monitoring processes and be cognisant of team dynamics and workforce motivation techniques

By completing the programme at Level 4 a student will have achieved the equivalent of Certificate level as defined in the QAA Framework for Higher Education Qualifications (FHEQ). The FHEQ expects that such a student will have a sound knowledge of the basic concepts of their subject, and will have learned how to take different approaches to solving problems. He or she will be able to communicate accurately, and will have the qualities needed for employment requiring the exercise of some personal responsibility.

By completing Level 5 you will have achieved the equivalent of Intermediate level as defined in the FHEQ. When you hold a qualification at this level you will have developed a sound understanding of the principles in this field of study, and will have learned to apply those principles more widely. Through this, you will have learned to evaluate the appropriateness of different approaches to solving problems. Your studies will have had a vocational orientation, enabling you to perform effectively in your chosen field.

You will have the qualities necessary for employment in situations requiring the exercise of personal responsibility and decision-making.

5.0 Programme Aims: Level 6

The aims of the programme proposed are to:

1. Develop the students expertise in the use of computers in management processes and in engineering applications using modelling techniques to solve engineering problems by simulation, to develop advanced skills in 3D solid modelling and CAD drafting
2. Allow the student to examine the environment and sustainability issues raised by motorsport/automotive/motorcycle industries and the technical and legislative response available to governing bodies, teams and manufacturers
3. Develop the student's ability to specify and install vehicle data acquisition systems and to collect, analyse and collate the data
4. Develop the student's ability to critically analyse the control and monitoring systems required for electrical and electronic systems in conventional powertrains and electric and hybrid propulsion systems
5. To stimulate and enhance a graduate's enquiring, analytical, innovative and creative approach, thereby encouraging initiative, independent and critical self-judgement

To achieve Honours level the additional educational aims of the Research Methods and Project module are reflected as:

6. To give the student the opportunity to show creativity and originality to successfully undertake individual research and engineering project work

5.1 Programme Learning Outcomes Level 6

Students who have successfully completed the proposed BSc Degree's would be expected to demonstrate the ability to:

1. Simulate a real world engineering situation, produce results and critically interpret them. Design and produce a fully dimensioned and tolerance drawing of a 3D part, in line with industrial practice
2. Evaluate the impact of current and possible future legislation and public opinion on the operation of motorsport/automotive/motorcycle events and the operational and technical solutions available to increase sustainability and reduce the environmental impact
3. Design, specify and install a modern vehicle data logging system and to collate and analyse the data collected to accurately characterise a vehicle's handling behavior
4. Analyse the operation of sensors, actuators and displays and critically analyse and evaluate the control and monitoring systems required for electric and hybrid propulsion and energy recovery systems

In addition, by having successfully completed the Research Methods and Project module, an Honours graduate would be expected to:

- 1.1 Apply appropriate methodologies in the execution of an engineering project

1.2 Use the appropriate techniques in their own research or scholarship together with the critical evaluation of current research

1.3 Use self-direction and originality in solving problems, and independently planning and implementing tasks at an appropriate level

On completing Level 6 you will have reached Honours Level as defined in the FHEQ: You will have developed an understanding of a complex body of knowledge, some of it at the current boundaries of an academic discipline. Through this, you will have developed analytical techniques and problem-solving skills that can be applied in many types of employment. You will be able to evaluate evidence, arguments and assumptions, to reach sound judgments, and to communicate effectively.

An Honours graduate should have the qualities needed for employment in situations requiring the exercise of personal responsibility, and decision-making in complex and unpredictable circumstances.

6. PROGRAMME STRUCTURE

The proposed BSc programme is 3 years duration and will normally be delivered as a full time programme. Provision is also made for students to attend part time on an in-fill basis. Unless significant demand for part-time attendance develops no special timetable provision will be made for these students and so this mode will generally be used for students repeating part of the year rather than for someone aiming to follow the whole programme part-time.

The proposed structures allow the applicants' after two years of study to reflect on their academic performance by considering various options namely, upon successfully completing the intermediate stage a HND Award is given which allows the student to go and seek employment. Alternatively, they could continue their studies and move onto Level 6 of the BSc, as illustrated below, for this validation or Level 5 of the BEng Programme providing they satisfy the entry requirements of both Degree awards.

A student who chooses to follow this programme in preference to the BEng equivalent will be intending to enter the engineering profession at Incorporated Engineer level rather than at Chartered Level. The IMechE recognises that industry needs both types of engineer and that their roles are complementary. The programme focuses, therefore, on the formation of an engineering graduate who *'will possess an ability to act as an exponent of today's technology through creativity and innovation; who will maintain and manage applications of current and developing technologies and may become engaged in technical and commercial management'*

The BEng programmes will continue to provide a significantly different route to Chartered status with its greater emphasis on the formation of the engineer who will develop appropriate solutions for engineering problems, using new and existing technologies design and apply new technologies, promoting advanced designs and design methods and pioneering new engineering services and management methods.

The intention will be to accredit the proposed programme for IEng status with the IMechE Specific Learning Outcomes Appendix 5 whilst utilising the validated Programme statements and QAA Benchmarking.

The School of Automotive Engineering, in common with the rest of the university, is committed to ensuring that all its programmes deal with environmental issues. The School is a partner of the government supported Energy Efficient Motor Sport (EEMS) campaign and this programme focuses on a number of relevant issues.

Five modules; Engine Control Systems, Emission Control and Diagnosis, Sustainability Through Technology, Engineering Team Management and Electric and Hybrid propulsion Systems directly address the issues but, an awareness of the importance of sustainability and the potential environmental impact of the motor vehicle and how to deal with it, underpins the whole programme.

Furthermore, in developing the structure for each programme, Honours and Intermediate the team reflected initially upon both the QAA framework for Higher Education Qualifications, the QAA subject benchmarks for Engineering and IMechE general learning outcomes. The qualifications framework identifies several levels as illustrated below, initially with the descriptors for a qualification at Honours (H) level: Bachelors degree with Honours

followed by the descriptors for the Higher National Diploma identified as at Intermediate level.

Honours degrees are awarded to students who have demonstrated:

- i a systematic understanding of key aspects of their field of study, including acquisition of coherent and detailed knowledge, at least some of which is at or informed by, the forefront of defined aspects of a discipline;
- ii an ability to deploy accurately established techniques of analysis and enquiry within a discipline;
- iii conceptual understanding that enables the student:
 - to devise and sustain arguments, and/or to solve problems, using ideas and techniques, some of which are at the forefront of a discipline; and
 - to describe and comment upon particular aspects of current research, or equivalent advanced scholarship, in the discipline;
- iv an appreciation of the uncertainty, ambiguity and limits of knowledge;
- v the ability to manage their own learning, and to make use of scholarly reviews and primary sources (eg refereed research articles and/or original materials appropriate to the discipline).

Typically, holders of the qualification will be able to:

- a apply the methods and techniques that they have learned to review, consolidate, extend and apply their knowledge and understanding, and to initiate and carry out projects;
- b critically evaluate arguments, assumptions, abstract concepts and data (that may be incomplete), to make judgements, and to frame appropriate questions to achieve a solution - or identify a range of solutions - to a problem;
- c communicate information, ideas, problems, and solutions to both specialist and non-specialist audiences;

and will have:

- d qualities and transferable skills necessary for employment requiring:
 - the exercise of initiative and personal responsibility;
 - decision-making in complex and unpredictable contexts; and
 - the learning ability needed to undertake appropriate further training of a professional or equivalent nature.

An Ordinary programme associated with the Honours programme is also being proposed. This option will allow students who will find difficulty in completing the Honours programme an opportunity to gain a degree in their chosen subject area. Students who choose to follow the Ordinary pathway should inform the university at the start of their final year of study. In practice, students following the Ordinary path will not study the Research Methods and Project module and one further Level 6 module.

6.1 HND/C PROGRAMME STRUCTURE

Upon completion of Level 5 of the BSc programme the student may choose to leave Swansea Metropolitan University and seek employment. The awarding body of the HN intermediate stage is BTEC (Edexcel). Swansea Metropolitan University was granted an Edexcel licence in 2000, and this has permitted a greater degree of independence in course design and award titles than applied previously.

The Programme Team has developed the pathway structure after taking into consideration the operation of the current scheme, employer views and the views of current students. The Quinquennial Review document reflects the performance and status of the present programme. There are three pathways within the HND Portfolio, and both HND pathways may be considered in the first instance as consisting of 14 compulsory modules all worth 15 credits each and one module worth 30 credits delivered over a 2 year period fulltime. The HNC utilise nine modules from the HND Automotive portfolio, eight modules worth 15 credits each and one worth 30 credits. The programme is delivered over a 2 to 5 year period part-time. All 3 Programmes are recognised as being at the intermediate level as defined from the QAA Benchmark Statements.

Descriptor for a qualification at Intermediate (I) level

- i) knowledge and critical understanding of the well-established principles of their area(s) of study, and of the way in which those principles have developed;*
- ii) ability to apply underlying concepts and principles outside the context in which they were first studied, including, where appropriate, the application of those principles in an employment context;*
- iii) knowledge of the main methods of enquiry in their subject(s), and ability to evaluate critically the appropriateness of different approaches to solving problems in the field of study;*
- iv) an understanding of the limits of their knowledge, and how this influences analysis and interpretations based on that knowledge.*

Typically, holders of the qualification will be able to:

- a) use a range of established techniques to initiate and undertake critical analysis of information, and to propose solutions to problems arising from that analysis;*
- b) effectively communicate information, arguments, and analysis, in a variety of forms, to specialist and non-specialist audiences, and deploy key techniques of the discipline effectively;*
- c) undertake further training, develop existing skills, and acquire new competences that will enable them to assume significant responsibility within organisations;*

and will have:

- d) qualities and transferable skills necessary for employment requiring the exercise of personal responsibility and decision-making.*

Each programme also takes into account the additional transferable skills for this level that may be developed in the context of Motorsport /Automotive/Motorcycle but which are of a general nature and applicable in many other contexts.

These skills include ability to:

- communicate effectively with colleagues and others, using both written and oral methods;
- use IT effectively;
- manage resources and time;
- work in a multi-disciplined team;
- undertake lifelong learning, particularly for continuing professional development.

In relation to the subject, specific benchmarks for 'engineering' the team recognises that the subjects benchmarks specifically refer to honours programmes namely, the BSc and are adhered to throughout. The team also believes that the fields identified within it for the cognate area of engineering also should be reflected within Higher National awards. Similarly, the abilities and skills that are described within the benchmarks also apply to Higher National awards but may be viewed at the Intermediate level of the qualifications framework.

Intellectually, engineers need to be creative and innovative in solving problems, and in designing systems, components and processes. They must be able to apply the appropriate tools from mathematics, science and technology, coupling these with knowledge drawn from professional experience. Graduating, the student should be able to:

- solve engineering problems, often on the basis of limited and possibly contradictory information;
- analyse and interpret data and, when necessary, design experiments to gain new data;
- design a system, component or process to meet a need;
- evaluate designs, processes and products, and make improvements;
- maintain a sound theoretical approach in enabling the introduction of new and advancing technology to enhance current practice.

The development of these can be found within modules on the programmes followed by their application, thus demonstrating the student's ability to apply them in a practical manner. For example, ability to produce solutions to problems through the application of engineering, knowledge and understanding ability to undertake technical risk evaluation will be introduced in the Level 4 modules '*Vehicle Engineering Principles*' and '*Applications in Engineering*' which is then further developed throughout modules specific to the various pathways and demonstrated through the *Group Project* module at Level 5 and actively encouraged within the *Research Methods and Project* module at Level 6.

For all pathways the Level 4 module *Engineering Design* will assist in the analysis of systems, processes and components requiring engineering solutions which is further enhanced at level 5 in *Materials Engineering* allowing the student to demonstrate the ability to apply them in a practical scenario. The 'Professional Considerations' identified in the cognitive abilities and skills are addressed at both Levels 4 & 5. *Engineering Team Management*, *Industrial Placement* and *Group Project* are specifically developed to meet the requirement of employers and to assist the student in the commercial risk evaluation. Students are also

encouraged to utilise their CAD abilities to maintain and enhance their skills, which will assist them when they commence with the module *Computer Aided Design* at Level 6.

Level 4 modules, such as *Competition Chassis Technology* or *Chassis Technology*, *Industrial Placement* (awarded at level 5) and double module *Engine Control Systems* will introduce the student to the 'essential facts, concepts and principles relating to Engineering' whilst pathway specific Level 5 modules will provide opportunities for the student to both develop these further in the specific context of their chosen pathway and to apply them in practical situations, primarily through their Project areas supported by specific modules e.g. *Study Skills*, *Engineering Team Management*, *Science and Analytical Methods*.

Many of the engineering-related practical abilities identified in the subject benchmarks will be evidenced through the submission of the student's individual assignment and project work submissions. Evidence of team working may be found in the Level 4 module *Competition Chassis Technology* or *Chassis Technology*, and the *Engine Control Systems* module followed through into the Level 5 module *Group Project* and it is actively encouraged in *Motorsport Vehicle Dynamics*, *Motorcycle Dynamics* or *Vehicle Dynamics* and *Advance Engine Technology*.

Transferable skills will be developed within all modules, although information technology and the ability to select and apply appropriate computer base methods for modelling and analysis come in various formats which are introduced at Level 4 through dedicated computer packages namely, the Bosch Scope analyser, Mitchell suspension and CAD systems.

At Level 4 there is a *Study Skills* module to enhance student's report and research development and assist them in producing a computer generated document. This will be the primary focus for their delivery within the first semester and throughout the programme. This will then be developed in later modules culminating in the student undertaking the project which will showcase many of the skills and creations of new processes or products through a synthesis of ideas.

The team recognises and supports the QAA subject Benchmarks as appropriate for this level of study in the field of engineering and acknowledge that the emphasis is on the practical abilities of individuals and the evidence demonstrating these abilities. This view lends itself naturally to the more vocational stance of Higher National awards and is reflected within the programmes' learning outcomes. These new abilities and skills are also encouraged within the final year of the BSc Programmes.

The Team has taken the view that at each Level of all the Programmes should offer no actual optional modules although this term is used to separate the Ordinary BSc Degree from the Honours awarded degree at Level 6. The Programmes offer commonality on all Levels, wherever possible, across all pathways for a given study mode, with the constraint that on occasions divergence is necessary to maintain a pathway's integrity.

Thus, on Level 4 of all three Full-time programmes, the fifteen-credit module *Chassis Technology*, *Competition Chassis Technology* and *Motorcycle Chassis Technology* are presented as a common theme to all. However, their assessment outcomes are viewed differently. Furthermore, on Level 5, *Vehicle Dynamics*, *Motorcycle Dynamics* and *Motorsport Vehicle Dynamics* are also viewed in the similar fashion.

At Level 4 the Programme Team agreed that the use of an extra element of study, namely Level 3 Mathematics, be maintained to provide the student with appropriate knowledge and understanding of mathematical disciplines to enable them to progress onto Level 5.

At Level 5 a more analytical and scientific approach has been created, Difficulties in ensuring the student has a broad knowledge of the essential concepts and principles required of Motorsport/Automotive/Motorcycle Engineering and thus introducing the use of scientific principles in the modelling and analysis of engineering systems and the development of solutions throughout all Level 5 modules.

Throughout both Levels the Team has attempted to preserve commonality as a precursor of enhanced diversity, thus recognising that there is a common thread weaving through the tapestry of the Automotive Portfolio.

The programme structure diagrams on the following pages (tables 1a to 1f) list the compulsory and optional modules required for each of the awards, their credit value, and the year at which they appear. In addition to the Honours degree, the University of Wales recognises the *Ordinary Degree* (a student must be registered on this award before the end of the first term of Level Six).

It must also be noted that the *Industrial Placement* module physically takes place in Year one although it is not credited until Level 5. Insurance that this module conforms to section 9 of the QAA code of practice have been undertaken through staff training in risk assessments, student visits and completion of section 9 form in Appendix 6. Alternatively arrangements would be made if the placement fails or the student is unable to produce a contact then the student would complete their 6 weeks training within the University's workshops.

Table 1a: HND Motorsport Engineering

Level 4			
Applications in Engineering	15		
Study Skills Development with Materials	15		
Vehicle Engineering Principles	15		
Engine Control Systems	30		
Engineering Design	15		
Competition Chassis Technology	15		
Engineering Science	15		
Level 5			
Analytical Methods	15		
Group Project	15		
Engineering Team Management	15		
Emissions Control and Diagnosis	15		
Motorsport Vehicle Dynamics	15		
Advance Engine Technology	15		
Mechanical Principles	15		
Industrial placement	15		
HND Awarded	240 Credits		

Table 1b: HND Automotive Engineering

Level 4			
Applications in Engineering	15		
Study Skills Development with Materials	15		
Vehicle Engineering Principles	15		
Engine Control Systems	30		
Engineering Design	15		
Chassis Technology	15		
Engineering Science	15		
Level 5			
Analytical Methods	15		
Group Project	15		
Engineering Team Management	15		
Emissions Control and Diagnosis	15		
Vehicle Dynamics	15		
Advance Engine Technology	15		
Mechanical Principles	15		
Industrial placement	15		
HND Awarded	240 Credits		

Table 1c: HND Motorcycle Engineering

Level 4			
Applications in Engineering	15		
Study Skills Development with Materials	15		
Vehicle Engineering Principles	15		
Engine Control Systems	30		
Engineering Design	15		
Motorcycle Chassis Technology	15		
Engineering Science	15		
Level 5			
Analytical Methods	15		
Group Project	15		
Engineering Team Management	15		
Emissions Control and Diagnosis	15		
Motorcycle Vehicle Dynamics	15		
Advance Engine Technology	15		
Mechanical Principles	15		
Industrial placement	15		
HND Awarded	240 Credits		

Table 1d: *BSc(Hons) MOTORSPORT ENGINEERING*

Modules	CATS	Hons	Ord
Level 4			
Applications in Engineering	15	C	C
Study Skills Development with Materials	15	C	C
Vehicle Engineering Principles	15	C	C
Engine Control Systems	30	C	C
Engineering Design	15	C	C
Competition Chassis Technology	15	C	C
Engineering Science	15	C	C
Level 5			
Analytical Methods	15	C	C
Group Project	15	C	C
Engineering Team Management	15	C	C
Emissions Control and Diagnosis	15	C	C
Motorsport Vehicle Dynamics	15	C	C
Advance Engine Technology	15	C	C
Mechanical Principles	15	C	C
Industrial placement	15	C	C
HND Awarded	240 Credits		
Level 6			
Computer Aided Design	20	C	O
Sustainability Through Technology	20	C	O
Data Acquisition and Instrumentation	20	C	O
Electric and Hybrid Propulsion Control	20	C	O
Research Methods and Project	40	C	x
C = Compulsory O = Optional		360 credits	300 credits

Table 1e: *BSc(Hons) AUTOMOTIVE ENGINEERING*

Modules	CATS	Hons	Ord
Level 4			
Applications in Engineering	15	C	C
Study Skills Development with Materials	15	C	C
Vehicle Engineering Principles	15	C	C
Engine Control Systems	30	C	C
Engineering Design	15	C	C
Chassis Technology	15	C	C
Engineering Science	15	C	C
Level 5			
Analytical Methods	15	C	C
Group Project	15	C	C
Engineering Team Management	15	C	C
Emissions Control and Diagnosis	15	C	C
Vehicle Dynamics	15	C	C
Advance Engine Technology	15	C	C
Mechanical Principles	15	C	C
Industrial placement	15	C	C
HND Awarded	240 Credits		
Level 6			
Computer Aided Design	20	C	O
Sustainability Through Technology	20	C	O
Data Acquisition and Instrumentation	20	C	O
Electric and Hybrid Propulsion Control	20	C	O
Research Methods and Project	40	C	x
C = Compulsory		360	300

O = Optional	credits	credits
--------------	---------	---------

Table 1f: *BSc(Hons) MOTORCYCLE ENGINEERING*

Modules	CATS	Hons	Ord
Level 4			
Applications in Engineering	15	C	C
Study Skills Development with Materials	15	C	C
Vehicle Engineering Principles	15	C	C
Engine Control Systems	30	C	C
Engineering Design	15	C	C
Motorcycle Chassis Technology	15	C	C
Engineering Science	15	C	C
Level 5			
Analytical Methods	15	C	C
Group Project	15	C	C
Engineering Team Management	15	C	C
Emissions Control and Diagnosis	15	C	C
Motorcycle Vehicle Dynamics	15	C	C
Advance Engine Technology	15	C	C
Mechanical Principles	15	C	C
Industrial placement	15	C	C
HND Awarded	240 Credits		
Level 6			
Computer Aided Design	20	C	O
Sustainability Through Technology	20	C	O
Data Acquisition and Instrumentation	20	C	O
Electric and Hybrid Propulsion Control	20	C	O
Research Methods and Project	40	C	x
C = Compulsory O = Optional		360 credits	300 credits

Table 1g: *HNC AUTOMOTIVE ENGINEERING*

Modules	CATS	HNC
Year 1 / 5		
Engineering Team Management	15	C
Vehicle Engineering Principles	15	C
Engine Control Systems	30	C
Engineering Design	15	C
Chassis Technology	15	C
Analytical Methods	15	C
Engineering Science	15	C
Project for HNC	15	C
Emissions Control and Diagnosis	15	C
C = Compulsory	150 credits	

7. PROGRAMME ADMINISTRATION

7.1 Student Support

During the student induction period at the commencement of the programme students are supplied with a range of guidance documentation and advice, which includes:

- student handbook (produced by Registry);
- programme handbook (produced by school of Automotive Engineering);

It is Faculty policy to hold a staff/student meeting approximately one-week before each Portfolio Management Committee meeting. This is attended by the Portfolio Director (or Year Tutor) and student representatives. Programme delivery and assessment issues can then be reported to the PMC.

Student representatives attend the PMC, as well as other Faculty and University committees. There is an active Student Council. The normal student support processes provided by Swansea Metropolitan University are:

- personal counsellor;
- careers advice;
- student skills support (including dyslexia support);
- student accommodation;
- student's union;
- medical services.

Examples of learning support offered to current students are:

- centrally organized PC training;
- reference to student services study skills support (e.g. for report writing).
- reference to special needs tutors (e.g. dyslexic support);

The dyslexia/study skills support provided at Swansea Metropolitan University has been developing over recent years. The Learning, Teaching and Assessment Committee recommended the appointment of a Learning and Teaching Support Tutor in September 1999 and the appointment has been the focus of development since that date. In September 2001, a full-time Study Skills Support Tutor was appointed and in February 2002 a full-time Dyslexia/Study Skills Support Tutor was appointed. A permanent fractional post and part time staff previously covered these areas. The latter appointee is also responsible for all administration associated with dyslexic students. The aforementioned staff actually report to the Head of Student Services and work closely with the Students Union and the Students' Counsellor.

7.2 Learning and Teaching Strategy

A range of teaching and learning strategies will be applied, including:

- lectures;
- practical sessions (laboratories workshops);
- tutorials;
- individual project work;

Additionally, the Faculty is keen to introduce innovative methods (e.g. computer-based directed learning) to assist students in employment to complete modules who, due to work commitments, may not be able to achieve full attendance at the University. The University is active in ICT and distance learning initiatives.

The balance of hours assigned to each activity (e.g. lectures, tutorials) within a module is determined by the nature of the module. For example, some modules require a larger proportion of formal tuition and lecturer contact, whilst others require more student-centred computer laboratory/workshop/self-study activity.

Specific examples of learning support which exceed normal support during module delivery are:

- study skills support offered centrally by Student Services, e.g. for report writing, self-study techniques which will also be covered in the Study Skills module along with the newly developed Student Learning Service (SLS) centre to encourage individual development and interaction.
- Implementation of level 6 Project tutorial support on a time-tabled one-to-one basis from a nominated Lecturer with technical expertise in the Project's field of study.
- mathematics workshops will be provided by the school to support the development of numeracy skills. These will be operated on a 'drop-in' basis thus providing the student with opportunities to discuss problems with a member of the school's staff.

The principles of continuing professional development are presented in the Project Management and Professional Issues module then promoted during tutorials and the Implementation Project.

The Faculty has a well-developed strategy of extending student access to laboratories and workshops during periods of increased demand, e.g. Assignment work. This arrangement involves student requests being processed by the Portfolio Director and Dean of Faculty in order to implement satisfactory arrangements.

In order to promote a team approach to teaching and learning, and to give more support to individual lecturers, the University has introduced procedures for internal verification, peer observation and staff mentoring.

The success of the Programmes is orchestrated by an open door policy adopted by the Team. It has been recognised by the management that the University mission is to support life-long

learning, widening access and mobility. A high percentage of level 4 students will come from a vocational learning background with the minimum analytical and scientific requirements. Provision has been put into place to support the students with extra foundation mathematics and science tutorials. It has also been recognised Nationally about 5% of the student population will have a disability and of the 2010 level 4 students 18% were registered disabled of which 9% had dyslexia. Provision in the teaching and learning has to take into account the needs of all students and the use of VLE resources namely Blackboard. This has been yet another means to communicate with the student population and with the introduction of Moodle for the September 2011 cohort, this should further enhance the previous successes of such a resource.

The recognition that students need to maintain their identity within their chosen theme is maintained by individualising their assignments to the chosen pathways. Although at level 4 and 5 there are specific subjects that relate to their themes namely the chassis technologies, applications in engineering, group project and engine control systems. Industrial Placement provision is normally aimed at the area of study. In the final year the themes do become more generic although the research and application of the assignments and project are theme based to the chosen pathway.

APPENDIX 1

MODULE SYLLABI

Year 1 Modules Level 4

Module Title:	Applications of Engineering
Date Of Validation:	2011
Module Number	M1X9521
Module Value:	15 credits
Level:	4
Faculty Responsible for Delivery:	Faculty of Applied Design and Engineering
Prerequisites:	None

AIM:

This module enables students to acquire a broad knowledge base of vehicle and machine shop engineering comprehension, reasoning ability and practical skills, and to use them to complete vocational tasks successfully.

OUTCOME STATEMENTS:

Upon the successful completion of this module the student will be able to:

1. Use safe working practices and understand the reason for them.
2. Appreciate multi-disciplinary practical skills through the use of industrial equipment and processes.
3. Demonstrate the ability to produce simple components on a range of machine tools.

INDICATIVE CONTENT:

- Safe Working Practices and Understanding
- Appreciate Multi-disciplinary Practical Skills
- Produce Simple Components

TEACHING AND LEARNING IMPLEMENTATION:

	Hours
Lectures	10
Laboratory (supervised)	42
Tutorials/Seminars	0
Student private study	98
TOTAL	150

The module will be delivered by a two-hour practical machine & automotive workshop supervised for 26 weeks with introductory lectures to each area. The students will apply the theoretical concepts to practical situations.

ASSESSMENT STRATEGY:

This module will require two pieces of coursework which will be equally weighted. This coursework will consist of one machine shop-based assignment which will assess outcomes 1&3 and one automotive work shop-based assignment which will assess outcomes 1&2. The 2nd assessment would usually be required to be submitted in two stages.

Assignment	50%
Assignment	50%

READING LIST:**Essential:**

Hillier *Fundamentals of Automotive Technology 5th Edition* (Nelson Thorns 2006)

Hillier *Fundamentals of Automotive Technology 5th Edition* (Nelson Thorns 2004)

Chowanietz Eric – *Automobile Electronics* (Butterworth-Heinemann, 1995)

Heisler Heinz – *Vehicle and Engine Technology* (Edward Arnold, 1985)

Kalpakjian, Serope – *Manufacturing Engineering Technology* (Addison-Wesley, 1995)

Background:

Newton K, Steed W – *The Motor Vehicle* (Butterworth-Heinemann, 1997)

Stone Richard – *Introduction to Internal Combustion Engines* (Macmillan)

Timmings – *Manufacturing Technology: Volume 1* (Longman, 1998)

Timmings – *Manufacturing Technology: Volume 2* (Longman, 1993)

Twigg Peter – *Motor Vehicle Engineers* (Arnold, ISBN 0-340-59605-8)

Zammit S J – *Motor Vehicle Engineering Science for Technicians* (Longman, 1987)

Module Title:	Study Skills Development with Materials
Date Of Validation:	2011
Module Number	M1X9478
Module Value:	15 credits
Level:	4
Faculty Responsible for Delivery:	Faculty of Applied Design and Engineering
Prerequisites:	None

AIM:

This module aims to provide students with the underlying study strategies that can accelerate the learning process. Students will be encouraged to develop a reflective, active, positive approach to learning, and to take responsibility for their own learning. Such skills promote a deeper understanding of the topics studied throughout the programme; they support lifelong learning, and are the transferable skills desired in the employment context. As a meaningful medium for the students' exploration and development of study skills, the module will also provide students with basic background knowledge and understanding of the properties, selection, processing and use of materials.

OUTCOME STATEMENTS:

Upon successful completion of this module the student will be able to:

1. Create a personal development based on a self evaluation of skills and reflect on their application and achievement of study skills learned.
2. Select materials and processing for a specified product and identify relationships between manufacturing processes and materials' behaviour
3. Diagnose causes and remedy of failure of materials

INDICATIVE CONTENT:

- Understanding the learning process and identifying skills
- Organising study
- Structuring study and sourcing information
- Communicating and presenting information
- Developing an appropriate writing style
- Structure and properties of materials: Selection criteria of materials categorises and definition of specified material properties and test analysis of data reliability.

- Evaluation of manufacturing and material processing: An insight into the selection process whilst considering various treatments, structures limitations and functional analysis.
- Analyse and evaluate the causes of failure: should include metals, ceramics, polymers, and composites; whilst considering service life, failure investigation and preventative measures.

TEACHING AND LEARNING IMPLEMENTATION:

The conceptual, theoretical issues are suited to delivery during weekly lectures, together with practical sessions to reinforce the material learnt during lectures

	Hours
Lectures	45
Practical exercises	15
Student learning	90
Total	150

ASSESSMENT STRATEGY:

Assessment will be consist of two assessments, equally weighted. Assignment 1 will assess outcomes 1 and 2, whilst Assignment 2 will assess outcomes 1 and 3. It is envisaged that the assessments will take the form of a practical laboratory session followed by, for example, the communication of the results via a written report or a presentation in order to assess the materials-focussed outcomes alongside the study skills outcomes.

Assignment 1	50%
Assignment 2	50%

READING LIST:

Essential:

Cottrell, S.	<i>Study skills Handbook (Palgrave study guides) Palgrave Macmillian: Basingstoke 2004</i>
Callister, W.S.	<i>Materials Science and Engineering: An Introduction : Wiley 2002</i>
Benham P, Crawford RJ, Armstrong C.	<i>Mechanics of Engineering Materials: Longman 1997</i>

Background:

Cottrell, S.	<i>Skills for success: the personal development planning handbook (Palgrave study guides) Palgrave Macmillian: Basingstoke 2010</i>
--------------	---

Drew, S. & Bingham, R. Greetham, B.	<i>The student skills guide: Gower publishing 2001</i> <i>How to write better essays: (Palgrave study guides) Palgrave Macmillian: Basingstoke 2001</i>
Peck, J. & Coyle, M.	<i>The student's guide to writing: grammar punctuation and spelling (Palgrave study guides) Palgrave Macmillian: Basingstoke 1999</i>
Rowntree, D.	<i>Learn how to study: a guide for students of all ages. Time Warner paperbacks 1998</i>
Sinfield, S. & Burns, T.	<i>Essential study skills: the complete guide to success at university, Sage publications Ltd 2003</i>
Kalpakjian, S	<i>Manufacturing Processes for Engineering Materials: Addiston-Wesley 1997</i>
Higgins, RA	<i>Properties of Engineering Materials: Arnold 1994</i>
Timings, RL	<i>Engineering Materials Vol 2: Longman 1991</i>

Module Title:	Vehicle Engineering Principles
Date Of Validation:	2011
Module Number	M1X8657
Module Value:	15 credits
Level:	4
Faculty Responsible for Delivery:	Faculty of Applied Design and Engineering
Prerequisites:	None

AIM:

This module enables students to acquire an advanced level of vehicle engineering knowledge, reasoning ability, analytical and practical skills.

OUTCOME STATEMENTS:

Upon the successful completion of this module the student will be able to:

1. Analyse engine design and performance, using both practical testing and scientific calculations
2. Analyse vehicle design and performance, using applied scientific principles and practical testing

INDICATIVE CONTENT:

- Engine design analysis of combustion chambers, piston, camshaft, crankshaft design and factors affecting compression ratios.
- Calculations and technical evaluations of engine performance: torque, power, mechanical efficiency, thermal efficiency, volumetric efficiency, mean effective pressure, specific fuel consumption.
- Analysis of vehicle power-trains and transmission design selection, using the appropriate equations based on a force-balance of tractive effort and tractive resistance on a moving vehicle to predict vehicle performance and calculate appropriate gear ratios etc.
- Principles of aerodynamic drag on a vehicle (including pressure drag and skin friction), together with the relevance of Reynolds Number and the appropriate equations for aerodynamic drag.
- Understanding the principle of gradient drag, together with an approach using resolving of forces to calculate its magnitude for a given gradient
- Rolling resistance of a vehicle, together with methods for both measuring and calculating its magnitude with appropriate equations.

TEACHING AND LEARNING IMPLEMENTATION:

	Hours
Lectures	46
Laboratory (supervised)	16
Tutorials/Seminars	0
Student private study	98
TOTAL	150

The module will be delivered by a two-hour lecture each week to present key ideas. Students will apply the theoretical concepts to practical situations.

ASSESSMENT STRATEGY:

This module will require two pieces of coursework which will be equally weighted. The coursework will consist of one heat engine lab-based assignment which will assess outcomes 1 & 2 and one chassis dynamometer based assignment which will assess outcomes 3 & 4.

Assignment 1	50%
Assignment 2	50%

RESOURCES:

Suitable engine test facilities are required.

MTB01 Martyn Jenkins Laboratory
MTG06 Engine Test Laboratory

READING LIST:**Essential:**

Stone R - *Introduction to Internal Combustion Engines*, 3rd Edition (Palgrave, 1999)

Heywood, J. - *Internal Combustion Engine Fundamentals* (McGraw Hill, 1988)

Heisler H – *Vehicle and Engine Technology* (Edward Arnold, 1999)

Martyr A J, Plint M A, *Engine Testing: theory and practice* (Butterworth-Heinemann, 2007)

Background:

Heisler H – *Advanced Engine Technology*, (Edward Arnold, 1995)

Bosch – *Bosch Automotive Handbook*, 7th Edition (Wiley, 2007)

Kett P W – *Motor Vehicle Science* (Chapman & Hall, ISBN 0-412-22100-4)

Twigg P – *Motor Vehicle Engineers* (Arnold, ISBN 0-340-59605-8)

Newton K, Steed W – *The Motor Vehicle* (Butterworth-Heinemann, 1997)

Module Title:	Engine Control Systems
Date Of Validation:	2011
Module Number	M1X9475
Module Value:	30 credits
Level:	4
Faculty Responsible for Delivery:	Faculty of Applied Design and Engineering
Prerequisites:	None

AIM:

This module provides students with background knowledge and understanding of vehicle electrical and electronic systems, circuits and components. It also develops their ability to test and find faults in these systems whilst using computers as an aid for solving problems.

OUTCOME STATEMENTS:

Upon the successful completion of this module the student will be able to:

1. Investigate technical applications and solutions for engine electrical and electronic circuits
2. Analyse the solutions and operations of sensors, actuators and displays with the aid of computers

INDICATIVE CONTENT:

- Vehicle electrical and electronic circuits
- Sensors, actuators and displays analysis and technical evaluation
- Electromagnetic interference and operation of suppression devices
- Technical applications of engine control systems
- Dedicated computer and scope functions and analysis

TEACHING AND LEARNING IMPLEMENTATION:

	Hours
Lectures	60
Laboratory (supervised)	60
Tutorials/Seminars	0
Student private study	180

TOTAL	300
--------------	------------

The module will be delivered by weekly lectures to present key ideas. Students will apply the theoretical concepts to practical situations.

ASSESSMENT STRATEGY:

100% coursework consisting of one lab-based assignment, which will assess all learning outcomes.

Assignment	100%
------------	------

READING LIST:

Essential:

Bosch, Bosch Automotive Handbook 7th Edition (Bosch 2007)

John Bird Electrical and Electronic Principles and Technology (Newnes, 2007)

Bosch, *Automotive Electrics and electronics-3rd Edition* (Bosch 2005)

Heinz H Advanced engine technology (Edward Arnold 1995)

Denton T Advanced Automotive Fault Diagnosis 2nd Ed (Elsevier Ltd 2006)

Background:

Automotive Electrics and electronics-3rd Edition (Robert Bosch, 2005)

Hiillier V – *Fundamentals of Automotive Electronics* – 2nd Edition (Stanley Thornes, 1996)

Stackpoole L, Morrison M and Gregory A – *Electronics for Motor Mechanics* (Longman, 1992)

Tranter A – *Automobile Electrical & Electronic systems* (Haynes, 1992)

Module Title:	Engineering Design
Date Of Validation:	2011
Module Number	M1X8653
Module Value:	15 credits
Level:	4
Faculty Responsible for Delivery:	Faculty of Applied Design and Engineering
Prerequisites:	None

AIM:

The aim of this module is to give students an opportunity to experience the process of carrying out a design project. It will enable them to appreciate that design involves synthesising parameters which will affect the design solution.

OUTCOME STATEMENTS:

Upon the successful completion of this module the student will be able to:

1. Prepare a design specification
2. Prepare a design report
3. Use computer technology in the design process.

INDICATIVE CONTENT:

- Design specification in relation to customer requirements, design parameters and information and evaluating aesthetics, function, performance against relevant standards
- Design report including *analysis of possible design solutions*, *evaluation of costs*, future development potential, sustainability considerations, engineering concepts and compliance.
- Computer technology: 3D modelling, standards, 2D drafting standards, parts and material storage and retrieval, engineering calculations & functional requirements

TEACHING AND LEARNING IMPLEMENTATION:

	Hours
Lectures	10
Laboratory (supervised)	42
Tutorials/Seminars	0
Student private study	98
TOTAL	150

The module will be delivered by a two-hour computer laboratory each week to present key ideas. Students will apply the theoretical concepts to practical situations. The module will be implemented using some lectures together with supervised laboratory sessions.

ASSESSMENT STRATEGY:

There are two assignments one consisting of 60% which will assess outcomes 1 & 2 through MX. The 2nd assessment 40% will assess outcome 3 as a practical application on the computer using NX.

Assignment 1	60%
Assignment 2	40%

READING LIST:

Essential:

Pugh, S. Total Design: Integrated Methods for Successful Product Engineering (Prentice Hall 1990)

Simmons, C. Maquire, D. Manual of Engineering Drawing to British and International Standards. (Newnes 2003)

Pahl, G. Beitz, W. Feldhusen, J. Grote, K.H. Engineering Design: A Systematic Approach (Springer 2006)

Ullman, D.G. The Mechanical Design Process (McGraw-Hill Higher Education 2002)

Background:

UGS NX Development Team UGS NX software information / help files (updated annually)

Andreas *et al* – *Product Design for Assembly* (IFS, 1989)

Shigley – *Mechanical Engineering Design* (2001)

Beitz, Paul – *Engineering Design and Systematic Approach* (Longman, 1991)

Birsch A – *Product Design* (Design Council, 1985)

Module Title:	Chassis Technology
Date Of Validation:	2011
Module Number	M1X9487
Module Value:	15 credits
Level:	4
Faculty Responsible for Delivery:	Faculty of Applied Design and Engineering
Prerequisites:	None

AIM:

The aim of this module is to develop an understanding of the design and application of vehicle suspension systems.

OUTCOME STATEMENTS:

Upon the successful completion of this module the student will be able to:

1. Examine chassis, suspension and steering geometry.
2. Analyse chassis and suspension systems.
3. Determine chassis and suspension specification.

INDICATIVE CONTENT:

- Analysis of forces into the chassis structure: Use of CAE for analysis of geometry characteristics. Prediction of influence of the measured variables on vehicle handling. Interaction of suspension geometry with torque induced suspension and steering behaviour.
- Suspension frequency analysis: critical damping coefficient and damping force, critical/under/over damping, mechanisms of friction, air and viscous suspension system.
- Tyre characteristics and evaluation: Natural resonant frequency of suspension, shock isolation versus maintenance of wheel contact.. Analysis of suspension geometry. Measurement of sprung and un-sprung masses.
- Calculation of force paths from the tyre contact patch to suspension mounting points
- Calculation of spring – mass systems and suspension natural frequency
- Calculation of linear and torsional spring characteristics

TEACHING AND LEARNING IMPLEMENTATION:

	Hours
Lectures	52
Laboratory (supervised)	20
Tutorials/Seminars	0
Student private study	78
TOTAL	150

The module will be delivered by weekly lectures each week to present key ideas. Students will apply the theoretical concepts to practical situations. The module will be implemented via lectures together with supervised laboratory sessions.

ASSESSMENT STRATEGY:

Assignments equally divided in two stages consisting of work shop and computer applications which will cover all 3 learning outcomes.

Assignment 1	50%
Assignment 2	50%

READING LIST:**Essential:**

Rowley, W An Introduction to Race Car Engineering 3rd Edition (Rowley Race Dynamics, 2005)

Dixon J Tires, Suspension and Handling 2nd Ed (Society of Automotive Engineering 1996)

Bastow, D, Howard, G and Whitehead, J Car Suspension and Handling, 4th ed. (Society of Automotive Engineering 2004)

Background:

Mavrig Mike – Brake Systems & Technology (HP Books 1998)

T. Gillespie - Fundamentals of vehicle dynamics (SAE 1992)

J. Y. Wong Theory of Ground Vehicles 4th ed (John Wiley and Sons 2008)

Module Title:	Competition Chassis Technology
Date Of Validation:	2011
Module Number	M1X9487
Module Value:	15 credits
Level:	4
Faculty Responsible for Delivery:	Faculty of Applied Design and Engineering
Prerequisites:	None

AIM:

The aim of this module is to develop an understanding of the design and application of motorsport vehicle suspension systems.

OUTCOME STATEMENTS:

Upon the successful completion of this module the student will be able to:

1. Examine motorsport chassis, suspension and steering geometry.
2. Analyse chassis and suspension systems.
3. Determine chassis and suspension specification.

In each outcome the emphasis is on the special requirements of motorsport applications.

INDICATIVE CONTENT:

- Analysis of forces into the chassis structure: Use of CAE for analysis of geometry characteristics. Prediction of influence of the measured variables on vehicle handling. Interaction of suspension geometry with torque induced suspension and steering behaviour.
- Suspension frequency analysis: critical damping coefficient and damping force, critical/under/over damping, mechanisms of friction, air and viscous suspension system.
- Tyre characteristics and evaluation: Natural resonant frequency of suspension, shock isolation versus maintenance of wheel contact. Analysis of suspension geometry. Measurement of sprung and un-sprung masses.
- Calculation of force paths from the tyre contact patch to suspension mounting points
- Calculation of spring – mass systems and suspension natural frequency
- Calculation of linear and torsional spring characteristics

TEACHING AND LEARNING IMPLEMENTATION:

	Hours
Lectures	52
Laboratory (supervised)	20
Tutorials/Seminars	0
Student private study	78
TOTAL	150

The module will be delivered by weekly lectures to present key ideas. Students will apply the theoretical concepts to practical situations. The module will be implemented using lectures together with supervised laboratory sessions.

ASSESSMENT STRATEGY:

Assignments equally divided in two stages consisting of work shop and computer applications which will cover all 3 learning outcomes.

Assignment 1	50%
Assignment 2	50%

READING LIST:**Essential:**

Rowley, W An Introduction to Race Car Engineering 3rd Edition (Rowley Race Dynamics, 2005)

Dixon J Tires, Suspension and Handling 2nd Ed (Society of Automotive Engineering 1996)

Bastow, D, Howard, G and Whitehead, J Car Suspension and Handling, 4th ed. (Society of Automotive Engineering 2004)

Background:

Mavrig Mike – Brake Systems & Technology (HP Books 1998)

T. Gillespie - Fundamentals of vehicle dynamics (SAE 1992)

J. Y. Wong Theory of Ground Vehicles 4th ed (John Wiley and Sons 2008)

Module Title:	Motorcycle Chassis Technology
Date Of Validation:	2011
Module Number	M1X
Module Value:	15 credits
Level:	4
Faculty Responsible for Delivery:	Faculty of Applied Design and Engineering
Prerequisites:	None

AIM:

The aim of this module is to develop an understanding of the design and functionality of the kinematical system of the motorcycle and the requirements and operational design requirements of motorcycle suspension systems.

OUTCOME STATEMENTS:

Upon the successful completion of this module the student will be able to:

1. Examine motorcycle kinematics and geometry.
2. Analyse chassis and suspension systems.
3. Determine chassis and suspension specification.

In each outcome the emphasis is on the special requirements of motorcycle applications.

INDICATIVE CONTENT:

- Measurement and analysis of the motorcycle kinematics and its relation to the dynamics handling characteristics of the vehicle.
- Analysis of the forces and moments acting on the chassis structure
- Suspension natural frequency and its relation to spring stiffness and damper characteristics and requirements.
- Tyre characteristics, stiffness and friction characteristics.

This work combines the practical and analytical approach to the understanding of the motorcycle system and its ancillaries. The motorcycle is studied practically and as both a free-body system resolved trigonometrically and as a CAD based model. This approach allows the derivation of forces and moments to be conducted on the vehicle with the aim of deriving from first principles the relationships and interdependencies of the motorcycle system. The stiffness, damping, compliance and kinematics of the system are mathematically analysed and related to the real motorcycle and real motorcycle data for validation and testing of the validity of the derived equations.

TEACHING AND LEARNING IMPLEMENTATION:

	Hours
Lectures	39
Laboratory (supervised)	39
Tutorials/Seminars	0
Student private study	72
TOTAL	150

The module will be delivered by weekly lectures to present key ideas. Students will apply the theoretical concepts to practical situations. The module will be implemented using lectures together with supervised laboratory sessions.

ASSESSMENT STRATEGY:

Assignments equally divided in two stages consisting of work shop and computer applications which will cover all 3 learning outcomes.

Assignment 1	50%
Assignment 2	50%

READING LIST:**Essential:**

John Bradley	<i>The Racing Motorcycle: A Technical Guide for Constructors (Volume 1 & 2)</i> (Broadband Leisure Publications, 2003)
John Robinson	<i>Motorcycle Tuning: Four Stroke</i> (Butterworth-Heinemann, 1993)

Background:

Tony Foale	<i>Motorcycle Handling and Chassis Design.</i> (Tony Foale, 2002)
Gaetano Cocco	<i>Motorcycle Design and Technology</i> (Giorgio NADA Editore, Dec 2005)

Module Title:	Engineering Science
Date Of Validation:	2011
Module Number	M1X9522
Module Value:	15 credits
Level:	4
Faculty Responsible for Delivery:	Faculty of Applied Design and Engineering
Prerequisites:	None

AIM:

The aim of this module is to investigate a number of major scientific principles which underpin the design and operation of engineering systems. It is a broad-based module, covering mechanical principles. Its intention is to give an overview which will provide the basis for further study in specialist areas of engineering.

OUTCOME STATEMENTS:

Upon the successful completion of this module the student will be able to:

1. Investigate static and dynamic engineering systems
2. Investigate energy transfer in thermal and fluid systems

INDICATIVE CONTENT:

- Static and dynamic: A calculative and analytical considerations of the bending equation, $\frac{M}{I} = \frac{\sigma}{y} = \frac{E}{R}$ and torsion equation, $\frac{T}{J} = \frac{\tau}{r} = \frac{G\theta}{l}$, moments, uniform linear and rotary motion, simple energy systems and mechanical oscillations.

- Analysis of thermal heat transfer through conduction, $Q = \frac{-kA(T_2 - T_1)}{x}$, convection,

$$Q = hA(T_2 - T_1) \text{ and radiation, } Q = 56.7\epsilon A \left[\left(\frac{T_2}{1000} \right)^4 - \left(\frac{T_1}{1000} \right)^4 \right]. \text{ Analysis of the}$$

fundamentals of gas laws including, Boyle's Law, Charles' Law, the combined/universal gas

law, $\frac{P_1V_1}{T_1} = \frac{P_2V_2}{T_2}$ and the ideal gas law.

TEACHING AND LEARNING IMPLEMENTATION:

	Hours
Lectures	52
Laboratory (supervised)	0
Tutorials/Seminars	20
Student private study	68
TOTAL	150

The module will be delivered on weekly basis and will be implemented through formal lectures.

ASSESSMENT STRATEGY:

There are two phase test that cover both outcomes

Phase Test 1	50%
Phase Test 2	50%

READING LIST:**Essential:**

W. Bolton- *Engineering Science* (Newnes, 2006)

Tooly M, Dingle L – *Higher National Engineering* (Butterworth-Heinemann, 2004)

Watson K, - *Foundation Science for Engineers* (McMillon, 1998)

Background:

Bolton W – *Mechanical Science* (Blackwell Scientific, 2006)

Hannah J, Hillier M – *Mechanical engineering science* (Longman, 1999)

Happian – Smith J, - *An Introduction to Modern Vehicle Design* (Butterworth Heineman, 2002)

Year 2 Modules Level 5

Module Title:	Analytical Methods
Date Of Validation:	2011
Module Number	M2X8663
Module Value:	15 credits
Level:	5
Faculty Responsible for Delivery:	Faculty of Applied Design and Engineering
Prerequisites:	None

AIM:

The primary aim of this module is to provide the fundamental analytical knowledge and techniques needed to successfully complete the core modules of Higher National Engineering programme. This module has been designed to enable students to use fundamental algebra, trigonometry, calculus, statistics and probability, for the analysis, modelling and solution of realistic engineering problems.

OUTCOME STATEMENTS:

Upon the successful completion of this module the student will be able to:

1. Analyse and model engineering situations and solve problems using algebraic, trigonometric, and differential calculus methods
2. Analyse and model engineering situations and solve problems using integrative calculus, statistics and probability.

INDICATIVE CONTENT:

- Algebraic methods
- Review trigonometric methods
- Introduction to calculus
- Statistics and probability

TEACHING AND LEARNING IMPLEMENTATION:

	Hours
Lectures	60
Laboratory (supervised)	0
Tutorials/Seminars	10
Student private study	80
TOTAL	150

The module will be delivered by weekly lecture/tutorial to present key ideas. Students will apply the theoretical concepts to practical situations. The module will be implemented using some lectures together with supervised laboratory sessions

ASSESSMENT STRATEGY:

The module is assessed by examination with two tests each worth 50% Test 1 covers outcome 1 and Test 2 covers outcome 2

Phase Test 1	50%
Phase Test 2	50%

READING LIST:**Essential:**

Stroud, K.A.-*Engineering Mathematics* (Palgrave Macmillan 2007)

Bird – *Higher Engineering Mathematics* (Butterworth-Heinemann, 1996)

Clifford, M. et al - *An introduction to Mechanical Engineering* (Hodder 2009)

Croft, Davis, Hargreaves – *Introduction to Engineering Mathematics* (Addison-Wesley, 1995)

Lee, S – *An introduction to mathematics for engineers* (Hodder 2008)

Background:

Rouvel J-*Automotive Mathematics* (Pearson/Prentice Hall 2005)

Singh K-*Engineering Mathematics through applications* (Palgrave 2003)

James, Glyn – *Modern Engineering Mathematics* (Addison-Wesley, 1996)

Mustoe L R – *Engineering Mathematics* (Longman, 1997)

Tooly M, Dingle L – *Higher National Engineering* (Butterworth-Heinemann, 1998)

Module Title:	Group Project
Date Of Validation:	2011
Module Number	M2X8661
Module Value:	15 credits
Level:	5
Faculty Responsible for Delivery:	Faculty of Applied Design and Engineering
Prerequisites:	None

AIM:

1. The module aims to study the principles of effective design and development and leads to a group project involving one or more of the major topic areas of the programme.
2. The application of Engineering principles and skills to the cost effective solution of technical problems with due regard to specification, design, cost and methods of production.
3. The importance of working in teams is introduced and the development of effective team skills is integral to the module.

OUTCOME STATEMENTS:

Upon successful completion of this module, the student will be able to:

1. Plan a project, as part of a team, and to verbally present the design and development concepts and implementation stages.
2. Document a design and development programme from initial concept to final realisation, including references to the project specification, research, implementation and achievements etc.
3. Implement the design and development, as part of a team, and demonstrate its operation and also demonstrate an ability to produce the design on time and within budget.

INDICATIVE CONTENT:

- Systematic design and development procedures.
- Objective design and development selection.
- Project Planning.
- Cost prediction, manufacturing.
- Quality and reliability.
- Technical report writing.
- Group working and management.
- Communication skills

TEACHING AND LEARNING IMPLEMENTATION:

	Hours
Lectures:	5
Laboratory	45
Student private study:	100
TOTAL	150

A series of lectures (5 hours) will be given to cover project planning, research and group working skills at the start of the first term.

Group Project

The remainder of the module will be allocated to a group project. The project requires the student to apply the knowledge and skills acquired from the lectures plus relevant knowledge gained from other programme modules. This knowledge will be applied to solve a technical design and development problem, with each member of the team having clearly defined roles to satisfy his/her contribution to the design solution.

The design and development project will commence after the first 6 hours of lectures. For the remaining part of the first term the students will primarily concentrate on research, the production of a project plan and tentative designs whilst getting the project underway. For the second and third terms students will concentrate on the implementation of the plan and achieving the project aims.

The students will work in groups of 3 – 10. The project teams will be required to hold weekly meetings with recorded minutes, chaired by the elected student and attended by supervising staff as appropriate. The project plan will be updated as necessary to complete the project successfully.

Students will be expected to make a full contribution to the work of the group. If an individual member of the group is failing to make a satisfactory contribution to the group or is jeopardising the success of the project he or she will be counselled by the supervisor in the first instance.

If the problem persists, the student concerned will be allocated a specific element of the particular project being undertaken which will be identified by the supervisor through a detailed analysis of the project brief. This element will still be a constituent part of the original group project brief but will be such that no other group member will be reliant upon the outcomes of it for their particular section of the project. Thus the student will maintain the opportunity provided to be part of a group, thereby being involved as a team member, but at the same time not preventing the remaining group members from successfully fulfilling their own roles/responsibilities.

This element will contribute to the overall project submission of the group. The student will still be required to submit their work as part of the group submission and partake in group discussions and the final group presentation; thus their contribution to the team can still be assessed. This process will be monitored and controlled by the supervisor and reported to the examining board as it identifies an initial failure to engage in the group's activities and any subsequent grading should reflect this.

If a student continues failing to engage with the group then he/she shall be withdrawn from the project module with the group project being revised for the remaining students and the chair of the

examining board informed. The student withdrawn will be informed that he/she will have up to three opportunities to redeem his/her failure but only in repeat years as he/she will have to join the next set of group project teams as they come through.

Where a student has withdrawn from the project due to illness or other good cause (duly documented) he/she will be offered the opportunity to join a group project team in the following year.

At the discretion of the Examining Board a student may be offered the opportunity to give a thorough written account (defended in an oral examination) of what he/she would have done had he/she been able to participate in a group project. If this opportunity arises as a result of failure of the module then the student will not be able to gain a mark greater than 40%.

ASSESSMENT STRATEGY:

Assessment will be in two stages by means of a written initial report and Group Oral examination at the end of the first term and by a final report and final Group Oral examination at completion of the project.

Initial Report (20%) and Initial Oral examination (10%)

Final Report (50%) and Final Oral examination (20%)

Outcome 1 will be assessed by initial report and initial oral examination.

Outcome 2 will be assessed by final report.

Outcome 3 will be assessed by final oral examination.

An individual's contribution to the oral report and to the written report will be assessed at each stage. The use of a VLE such as a Blackboard Wiki for the written report is encouraged as this enables an individual's contribution to be clearly identified though traditional paper reports may also be used with the individual's work identified.

Where the Project supervisor has been required to organise the work of an individual to ensure the successful progress of a project that student's mark will reflect this intervention.

READING LIST:

Essential:

Maylar, H *Project Management.*
(Prentice Hall, 2006).

Cole, G.A. *Management Theory and Practice, 6th Edition (Thomson 2004)*

Background:

Mullins, L *Management and Organisational Behaviour, 6th Edition*
(FT Prentice Hall 2001)

Bosch *Bosch Automotive Handbook, 7th Edition*
(Bosch 2007)

Moon, J *Achieving Success through academic assertiveness; real life strategies for today's students* (Routledge 2009)

Module Title:	Project for HNC
Date Of Validation:	2011
Module Number	
Module Value:	15 credits
Level:	5
Faculty Responsible for Delivery:	Faculty of Applied Design and Engineering
Prerequisites:	None

AIM:

This module develops students' ability to apply the knowledge and skills they develop at work and on either of the vehicle-based Higher National programmes

The module aims to integrate the skills and knowledge developed in other modules of the programme within a major piece of work that reflects the work-based performance of a technician, supervisor or manager in the motor industry. The project should relate to the specialist area of the motor industry in which the student is employed or wishes to specialise. It should reflect the nature of the work in the specialist area together with the skills and related knowledge required.

The project will allow students to develop the ability to research and evaluate information in order to produce a solution or decide recommendations relating to a motor industry issue. They may work as part of a team or individually, and present their findings in a report within a defined timescale.

OUTCOME STATEMENTS:

Upon the successful completion of this module the student will be able to:

1. Select a project and agree specifications and procedures
2. Implement the project within agreed procedures and to specification
3. Evaluate the project
4. Present a project evaluation.

INDICATIVE CONTENT:

- **Select a project and agree specifications**

Project specifications: identify and record a prioritised list of requirements relevant to the chosen project type – technical (service, repair, operation, testing, performance, diagnosis, environmental issues, legislation, economics), management (financial, operational, legal, market related, customers, staff, physical resources, efficiency, developing technology)

Process of project selection: formulate a plan of action, appraise the feasibility of the project and carry out a critical analysis of the outline specification, agree roles and allocate responsibilities, (for group projects), initiate a project log book

- **Implement the project**

Select option: simple comparison and decision-making methods and techniques for generating solutions for the selection from alternatives should include the use of elements such as graphical displays, statistical data, quality and resource requirements, process capability, fitness for purpose, costs, brainstorming, mind mapping

Record: maintain log book entries

- **Evaluate the project**

Procedures: formulate a plan of action, appraise the feasibility of the project and carry out a critical analysis of the outline specification

Evaluation techniques: graphs, statistics, Gantt charts, sequencing, scheduling, critical path methods, use of computer software packages where appropriate; maintain log book entries

- **Present a project evaluation**

Present: written report, log book record of all events, an oral presentation; use of sketches, charts, graphs, drawings and associated technical reports; use of CAD, DTP, spreadsheets, WP should form a necessary part of the presentation process wherever possible; presentation to know audiences (peer groups, tutors) and unknown audience (actual or simulated customer or client).

TEACHING AND LEARNING IMPLEMENTATION:

	Hours
Lectures	10
Laboratory (supervised)	10
Tutorials/Seminars	15
Student private study	115
TOTAL	150

Lectures on the general Implementation Project documentation standards, planning standards, and stage submission requirements will be delivered to all Level 5 students. Group tutorials will be used to deliver Pathway information delineating specific Pathway needs. Individual tutorials will be on a one-to-one basis, preferably with a Pathway specialist tutor.

ASSESSMENT STRATEGY:

100% assignment coursework consisting of 3 stages which will assess all learning outcomes

Presentation 1	30%
Presentation 2	40%
Final Report	30%

READING LIST:

Due to the nature of the module, students should refer to the reading lists of other modules in the programme which relate to the specific aspect they are investigating. However, the following references may be of general use.

Essential:

Cole, G.A. *Management Theory and Practice, 6th Edition Thomson 2004*

Lock, D. *Project Management (8th Edition)Gower Press, 2003*

Maylar, H *Project Management* Prentice Hall, 2006.

Moon, J *Achieving Success through academic assertiveness; real life strategies for today's students* Routledge 2009

Smith N J – *Engineering Project Management* Blackwell Scientific, 1995

Wysocki, R. K., McGary, R. *Effective Project Management (3rd Edition)Wiley, 2003*

Module Title:	Engineering Team Management
Date Of Validation:	2011
Module Number	M29481
Module Value:	15 credits
Level:	5
Faculty Responsible for Delivery:	Faculty of Applied Design and Engineering
Prerequisites:	None

AIM:

To develop an ability to analyse the social and commercial context of the motorsport industry in terms of business environments including: management organisation and administration, regulation and legislation, financial management, marketing and sponsorship.

OUTCOME STATEMENTS:

Upon successful completion of this module the student will be able to:

1. Evaluate the relationship between a motorsport organisation and the industrial, socio-economic and environmental context in which it is found.
4. Apply accounting methods, planning, costing and monitoring projects, workforce motivation and team dynamics.

INDICATIVE CONTENT:

- Business organisations and the environment
- Regulation and Legislation
- Environmental Protection
- Management and Group Behaviour
- Financial and Management Accounting
- Income generation through a variety of sources
- Project Planning and Control

TEACHING AND LEARNING IMPLEMENTATION:

Individual topics will be introduced by a weekly lecture of two hours. Lectures will be supported by self-assessment exercises and/or directed study. Seminars, group discussions and workshops will be used to understand concepts and undertake practical applications such as case study analysis.

	Hours
Lectures	30
Practical exercises	10
Student learning	110
Total	150

ASSESSMENT STRATEGY:

Assessment will be by coursework and examination

Outcome 1 will be assessed by examination for 50% Outcome 2 will be assessed by coursework assessment for 50%

READING LIST:

Essential:

- | | |
|-----------------|---|
| Cole, G.A. | <i>Management Theory and Practice, 6th Edition</i> (Thomson 2004) |
| Dyson, J R | <i>Accounting for Non-Accounting Students, 5th Edition</i> (FT Prentice Hall 2000) |
| Kotler, P et al | <i>Principles of Marketing</i> (FT Pearson Educational 2008) |

Background:

- | | |
|-------------------------------|---|
| Brassington, F and Pettitt, S | <i>Principles of Marketing, 2nd Edition</i>
(FT Prentice Hall 2000) |
| Maylor H. | <i>Project Management 3rd Edition</i> (FT Prentice Hall 2005) |
| Guy Masterman | <i>Sponsorship – for a return on investment</i>
(Butterworth - Heinemann 2007) |
| MacIntyre, E | <i>Essentials of Business Law</i> (Longman 2007) |
| Kreitner R | <i>Principles of management, 11th Edition</i>
(South Western - Cengage learning 2009) |

Module Title:	Emission Control and Diagnosis
Date Of Validation:	2011
Module Number	M2X9480
Module Value:	15 credits
Level:	5
Faculty Responsible for Delivery:	Faculty of Applied Design and Engineering
Prerequisites:	None

AIM:

This module aims to enable the student to investigate the causes and reduction of exhaust gas pollution in vehicles and an advanced level of vehicle engineering fault diagnosis.

OUTCOME STATEMENTS:

Upon the successful completion of this module the student will be able to:

1. Select suitable criteria for fault diagnosis, interpreting symptoms and repair recommendations
2. Apply principles of test measurement and analysis to determine the performance of a vehicle emissions and combustion control systems.
3. Evaluate and present test results and produce a fault location guide for a given vehicle system.

INDICATIVE CONTENT:

- Fault diagnosis, interpreting, symptoms and repair recommendations
- Determine the performance of vehicle systems
- Present test results and produce a fault location guide
- Evaporation of emission control.

TEACHING AND LEARNING IMPLEMENTATION:

	Hours
Lectures	30
Laboratory (supervised)	23
Tutorials/Seminars	0
Student private study	97
TOTAL	150

The module will be delivered by a one and half hour lecture each week to present key ideas. Students will apply the theoretical concepts to practical situations. The module will be implemented using lectures together with supervised laboratory sessions.

ASSESSMENT STRATEGY:

Assignment 1	50%
Assignment 2	50%

READING LIST:

Essential:

James Halderman- Automotive Fuel and emissions control systems 2nd Ed (Prentice Hall 2009)

Tom Denton – *Advanced Automotive Fault Diagnosis* (Butterworth Heinemann 2006)

John Heywood – *Internal Combustion Engine Fundamentals* (McGraw Hill 1988)

A Martyr – *Engine Testing* (Butterworth Heinemann 2007)

Bosch – *Automotive Handbook* (Bentley 2007)

Background:

Robertson Stewart – *Automotive Electrical Maintenance* (Edward Arnold, 1994)

Automotive Electric and Electronic Systems (Haynes 3049)

Tom Denton – *Automobile Electrical & Electronic Systems*

Allan Bennick – *Vehicle Electronics Systems* (Allan WM Bonnick)

Automotive Fuel Injection Systems (Haynes 9755)

Automotive Engine Management and Fuel Injection Systems Manual (Haynes 344)

www.automotive.-technology.co.uk

Module Title:	Vehicle Dynamics
Date Of Validation:	2011
Module Number	M2X9485
Module Value:	15 credits
Level:	5
Faculty Responsible for Delivery:	Faculty of Applied Design and Engineering
Prerequisites:	None

AIM:

The aim of this module is to develop an understanding of the factors affecting the dynamic performance of a vehicle suspension system and so to enable the modification of a vehicle's handling characteristics to be undertaken.

OUTCOME STATEMENTS:

Upon the successful completion of this module the student will be able to:

- 1 Use a data acquisition system to measure and analyse vehicle performance
- 2 Quantify and predict the result of suspension changes on vehicle handling balance.

INDICATIVE CONTENT:

- Determination of vehicle suspension roll stiffness distribution empirically using chassis test rig and by calculation.
- Use of calculation and empirical validation to find weight transfer due to unsprung mass, sprung mass at roll centre height and sprung mass acting about roll axis, and vehicle roll angle,
- Tyre performance characteristics and force development mechanisms.
- Influence of load distribution on handling balance
- Use, calibration and operation of proprietary data acquisition systems
- Data analysis using proprietary software to generate maths channels for use in vehicle behaviour analysis .

TEACHING AND LEARNING IMPLEMENTATION:

	Hours
Lectures	45
Laboratory (supervised)	45
Tutorials/Seminars	0
Student private study	60
TOTAL	150

The module will be delivered by lectures and practical coursework. Students will apply the theoretical concepts to practical situations including workshop based testing and track testing

ASSESSMENT STRATEGY:

There are two 40% assignments / coursework consisting of assignment 1 covering outcome 2 and assignment 2 covering outcome 1. The 20% Phase test covers all 3 outcomes.

Assignment 1	40%
Assignment 2	40%
End Test	20%

READING LIST:**Essential:**

Abe, M, Manning W (2009) *Vehicle Handling Dynamics: Theory and Application* BH

Dixon, JC (1996) *Tyres, Suspension and Handling* 2nd ed. SAE, Warrendale

ISO 4138 (1982) *Road Vehicle Steady State Test Procedure*

Bastow, D, Howard, G and Whitehead, J (2004) *Car Suspension and Handling*, 4th ed. SAE, Warrendale

Background:

Segars J (2010) *Analysis Techniques for Racecar Data Acquisition* SAE

Staniforth, A (2006) *Competition Car Suspension - A Practical Handbook* 4th ed. (Haynes) Sparkville

Module Title:	Motorsport Vehicle Dynamics
Date Of Validation:	2011
Module Number	M2X9485
Module Value:	15 credits
Level:	5
Faculty Responsible for Delivery:	Faculty of Applied Design and Engineering
Prerequisites:	None

AIM:

The aim of this module is to develop an understanding of the factors affecting the dynamic performance of a competition car suspension system and so to enable the modification of its handling characteristics to be undertaken.

OUTCOME STATEMENTS:

Upon the successful completion of this module the student will be able to:

1. Use a data acquisition system to measure and analyse a competition car's dynamic performance.
2. Quantify and predict the result of suspension changes on a competition car's handling balance.

INDICATIVE CONTENT:

- Determination of vehicle suspension roll stiffness distribution empirically and by calculation.
- Use of calculation and empirical validation to find weight transfer due to unsprung mass, sprung mass at roll centre height and sprung mass acting about roll axis, and vehicle roll angle.
- Tyre performance characteristics and force development mechanisms
- Influence of load distribution on handling balance
- Use, calibration and operation of proprietary data acquisition systems
- Data analysis using proprietary software to generate maths channels for use in vehicle behaviour analysis .

TEACHING AND LEARNING IMPLEMENTATION:

	Hours
Lectures	45
Laboratory (supervised)	45
Tutorials/Seminars	0
Student private study	60
TOTAL	150

The module will be delivered by lectures and practical coursework. Students will apply the theoretical concepts to practical situations including workshop based testing and track testing

ASSESSMENT STRATEGY:

There are two 40% assignments / coursework consisting of assignment 1 covering outcome 2 and assignment 2 covering outcome 1. The 20% Phase test covers all 3 outcomes.

Assignment 1	40%
Assignment 2	40%
End Test	20%

READING LIST:**Essential:**

Abe, M, Manning W (2009) *Vehicle Handling Dynamics: Theory and Application* BH

Dixon, JC (1996) *Tyres, Suspension and Handling* 2nd ed. SAE, Warrendale

Bastow, D, Howard, G and Whitehead, J (2004) *Car Suspension and Handling*, 4th ed. SAE, Warrendale

Background:

Bolles, B (2006) Asphalt Handling Fixes, *Circle Track Magazine*, September

Haney, P(2003) *The Racing & High Performance Tyre*,TV Motorsports, Redwood City

Milliken, WF and Milliken, DL (1995) *Race Car Vehicle Dynamics*, SAE, Warrendale

Rowley, W (2005) *An Introduction to Race Car Engineering* 3rd ed. Rowley Race Dynamics, Calgary

Staniforth, A (2006) *Competition Car Suspension - A Practical Handbook* 4th ed. (Haynes) Sparkville

Weighell, P (2006) Shortcut to Success *Racecar Engineering*, V16 No10 p56-p64

Classic Texts

Smith, C (1978) *Tune to Win* Aero Publishers, Fallbrook

Smith, C (1985) *Engineer to Win* Publishers, Fallbrook

Smith, S (2000) *Trackside Chassis Tuning Guide*, Steve Smith Autosports, Santa Ana

Module Title:	Motorcycle Dynamics
Date Of Validation:	2011
Module Number	M2X9482
Module Value:	15 credits
Level:	5
Faculty Responsible for Delivery:	Faculty of Applied Design and Engineering
Prerequisites:	None

AIM:

The aim of this module is to develop an understanding of the factors affecting the dynamic performance of a competition car suspension system and so to enable the modification of its handling characteristics to be undertaken.

OUTCOME STATEMENTS:

Upon the successful completion of this module the student will be able to:

1. Use a data acquisition system to measure and analyse the dynamic behaviour and handling effects experienced by the modern motorcycle
2. Quantify and predict the result of geometric and suspension system changes on a motorcycles handling and cornering response.

INDICATIVE CONTENT:

- Determination the wheel loads of a motorcycle under static and dynamic conditions.
- The performance of a motorcycle accelerating against resistive loads.
- The effect of transmission ratios for given engine and motorcycle application
- The determination of the longitudinal weight transfer of an accelerating motorcycle.
- The limits of both acceleration and braking.
- To analyse the effect of aerodynamic forces on the behaviour of the motorcycle.
- Fitting, calibrating and testing data acquisition systems
- Analysing real dynamic data from controlled tests and full track activities
- Developing basic motorcycle dynamics simulation model

This work builds on the analytical knowledge the students have to practically apply different mathematical and physical concept to the motorcycle. These include the suspension analysis in terms of a mass-spring-damper second order differential equation problem, the derivation and application of natural frequency and critical damping concepts to specify a suspension system and the first principles derivation of the kinematic and dynamics characteristics of a motorcycle to enable the motorcycle to be modelled as a multi-degree of freedom dynamic system.

TEACHING AND LEARNING IMPLEMENTATION:

	Hours
Lectures	45
Laboratory (supervised)	45
Tutorials/Seminars	0
Student private study	60
TOTAL	150

The module will be delivered by lectures and practical coursework. Students will apply the theoretical concepts to practical situations including workshop based testing and track testing

ASSESSMENT STRATEGY:

There are two 40% assignments / coursework consisting of assignment 1 covering outcome 2 and assignment 2 covering outcome 1. The 20% Phase test covers all 2 outcomes.

Assignment 1	40%
Assignment 2	40%
End Test	20%

READING LIST:**Essential:**

Vittore Cossalter	<i>Motorcycle Dynamics</i> (Lulu, 2008)
Tony Foale	<i>Motorcycle Handling and Chassis Design.</i> (Tony Foale, 2008)

Background:

Andy Ibbott	<i>Performance Riding Techniques</i> (J H Haynes & Co Ltd, 2006)
John Bradley	<i>The Racing Motorcycle: A Technical Guide for Constructors (Volume 1 & 2)</i> (Broadband Leisure Publications, 2003)

Module Title:	Advanced Engine Technology
Date Of Validation:	2011
Module Number	M1X9479
Module Value:	15 credits
Level:	5
Faculty Responsible for Delivery:	Faculty of Applied Design and Engineering
Prerequisites:	None

AIM:

The aim of this module is to provide the student with the opportunity to expand his/her knowledge and experience of automotive engine design and performance.

OUTCOME STATEMENTS:

Upon the successful completion of this module the student will be able to:

1. Investigate and evaluate engine design performance.
2. Investigate engine intake and exhaust systems.
3. Investigate pressure charging.

INDICATIVE CONTENT:

- A technical analysis of combustion efficiency, influenced by combustion chamber shape and valve port geometry.
- Induction and exhaust manifold design and influence on air/fuel ratio with practical flow bench tests and technical evaluation.
- Calculation of tuned inlet and exhaust manifold runner lengths, based on inertia charging, Helmholtz resonator and Organ Pipe theory calculations.
- Supercharging, Turbo-charging. Numerical methods for isentropic efficiency of compressor, charge density, charge mass flow rate. WOT graphs of charge mass flow rate.
- Calculations of charge temperatures in pressure-charged systems, including calculated density recovery when using an intercooler.

TEACHING AND LEARNING IMPLEMENTATION:

	Hours
Lectures	45
Laboratory (supervised)	15
Tutorials/Seminars	0
Student private study	90
TOTAL	150

The module will be delivered by weekly lectures to present key ideas. Students will apply the theoretical concepts to practical situations. The module will be implemented using lectures together with supervised laboratory sessions.

ASSESSMENT STRATEGY:

Two 50% assignment coursework consisting of one heat engine/motorsport based assignment which will assess outcomes 1 & 2 and one workshop-based assignment which will assess outcome 3.

Assignment 1	50%
Assignment 2	50%

READING LIST:

Essential:

Heisler H – *Vehicle and Engine Technology* (Edward Arnold, 1999)

Martyr A J, Plint M A, *Engine Testing: theory and practice* (Butterworth-Heinemann, 2007)

Bell C – *Maximum Boost* (1997)

Heisler H – *Advanced Engine Technology* (Edward Arnold, 1995)

Background:

Kett P W – *Motor Vehicle Science* (Chapman & Hall, ISBN 0-412-22100-4)

Newton K, Steed W – *The Motor Vehicle* (Butterworth-Heinemann, 1997)

Twigg P – *Motor Vehicle Engineers* (Arnold, ISBN 0-340-59605-8)

Blair GP – *Design and simulation of four stroke engines*, (SAE, 1999)

Module Title:	Mechanical Principles
Date Of Validation:	2011
Module Number	M2X8663
Module Value:	15 credits
Level:	5
Faculty Responsible for Delivery:	Faculty of Applied Design and Engineering
Prerequisites:	Engineering Science

AIM:

This unit covers an extended range of mechanical principles which underpin the design and operation of mechanical engineering systems. It includes strengths of materials and mechanics of machines. The aim of the unit is to provide a firm foundation for work in engineering design and a basis for more advanced study.

OUTCOME STATEMENTS:

Upon successful completion of this module the student will be able to:

5. Analyse complex loading systems, loaded beams and thin walled pressure vessels.
6. Analyse power transmission systems and undertake the dynamic balancing of rotating systems

INDICATIVE CONTENT:

1. Complex loading systems

Relationships: definition of Poisson's Ratio, typical values of Poisson's Ratio for common engineering materials

Two and three-dimensional loading: expressions for strain in the x, y and z-directions, calculation of changes in dimensions

Volumetric strain: expression for volumetric strain, calculation of volume change

Elastic constants: definition of Bulk Modulus, relationship between Modulus of Elasticity, Shear Modulus, Bulk Modulus and Poisson's Ratio for an elastic material

Buckling: buckling theory and application of Euler's equations for buckling

2. Loaded beams and cylinders

Relationships: Slope: $i = \frac{1}{EI} \int M dx$

Deflection $y = \frac{1}{EI} \iint M dx dx$

Loaded beams: simply supported beams and simple cantilevers carrying combined concentrated and uniformly distributed loads. Standard cases and Macaulay's method for deriving and integrating bending moment expression

Stress in thin-walled pressure vessels: circumferential hoop stress and longitudinal stress in cylindrical and spherical pressure vessels subjected to internal and external pressure (eg compressed air receivers, boiler steam drums, submarine hulls, condenser casings), factor of safety, joint efficiency

3. Power transmission

Belt drives: flat and v-section belts, limiting coefficient friction, limiting slack and tight side tensions, initial tension requirements, maximum power transmitted

Friction clutches: flat single and multi-plate clutches, conical clutches, coefficient of friction, spring force requirements, maximum power transmitted by constant wear and constant pressure theories, validity of theories

Gear trains: simple, compound and epicycle gear trains, velocity ratios, torque, speed and power relationships, efficiency, fixing torques

4. Dynamics of rotating systems

Balancing: single plane and multi-plane rotating mass systems, Dalby's method for determination of out-of-balance forces and couples and the required balancing masses

Flywheels: angular momentum, kinetic energy, coefficient of fluctuation of speed, coefficient of fluctuation of energy, calculation of flywheel mass/dimensions to give required operating conditions

TEACHING AND LEARNING IMPLEMENTATION:

The module will be delivered by a 1.5 lecture each week to present key ideas and students will apply the theoretical concepts.

	Hours
Lectures	45
Practical exercises	0

Student learning 105

Total 150

ASSESSMENT STRATEGY:

The module will be assessed by means of two phase tests. Phase test 1 will assess outcomes 1&2.
Phase test 2 will assess outcomes 3&4

Phase Test 1 50%
Phase Test 2 50%

READING LIST:

Essential:

Shigley, J E *Mechanical Engineering Design (McGraw Hill, 2011, 9th E)*

Walker, K. *Applied Mechanics for Engineering Technology (Pearson, 2007, 8th Ed)*

Background:

Bolton W *Mechanical Science (Wiley-Blackwell, 2006)*

Bird, J *Mechanical Engineering Principles (Newnes , 2002)*

Hannah J, Hillier M J *Mechanical Engineering Science (Prentice Hall, 1999)*

Hannah J, Hillier M J *Applied Mechanics (Longman, 1995, 3rd Edition)*

Module Title:	Industrial Placement
Date Of Validation:	2011
Module Number	M2X9524
Module Value:	15 credits
Level:	5
Faculty Responsible for Delivery:	Faculty of Applied Design and Engineering
Prerequisites:	None

AIM:

This module gives credit for the 6 week industrial placement that takes place in the first year of the programme.

OUTCOME STATEMENTS:

Upon the successful completion of this module the student will be able to:

1. Undertake a six week industrial placement
2. Study organisational and management/workshop techniques.
3. Carry out verbal communication.

INDICATIVE CONTENT:

- Management roles and styles within the work environment.
- Introduction to group behaviour.
- Problem solving techniques.
- Management of technology.
- Time management.

TEACHING AND LEARNING IMPLEMENTATION:

	Hours
Lectures	20
Laboratory (supervised)/visit	10
Tutorials/Seminars	30
Student private study	90
TOTAL	150

The module will be delivered by tutorials and industrial visit within the remaining six weeks of term time.

The QAA Code of Practice Section 9 provides a Work-based and Placement Learning chart with 8 guidelines that have been formally presented in Appendix 6 of this report. The Guidance Note D-3 Appendix 7 from the University Quality Hand Book is adhered to throughout.

The seven stages of placement are followed as guidance.

1. Pre-placement briefing; This is provided as 1 hour lessons over a 20 week period and a final tutorial prior to leaving for placement.
2. Student selection and screening; The student will be encouraged to make contact with their own placement and guidance of this process will be provided. If not successful a portfolio of past placements will be discussed and once confirmation of placement is given the University will contact the organisation to inform them of the procedures and to establish that the selected placement is appropriate.
3. Negotiations of objective/programmes with host company; Once the company has been selected and found to be appropriate, indemnity forms are sent for completion by the company.
4. Identification of programme of work; This is generally achieved from student statements of what the host company specialises in and the student is encouraged to find a placement within their chosen theme although providing it is engineering based then that is also acceptable.
5. Induction of student to company including Health and Safety briefing; Prior to the placement over the first two terms the students are provided with an insight into the operation of Health and Safety and in their student placement handbook it also informs them of the correct procedures and they will evaluate how they were introduced into the organisation.
6. Placement – with mentors; All placements will require the student to have sufficient support throughout their stay. Visits from the University team will also take place sometime during the 6 week period and contact via the phone within the 1st week of placement is also encouraged.
7. Re-entry to the university and dissemination of newly acquired skills and knowledge; When the student returns in the 2nd year of the programme at level 5 a written report is presented

to the academic staff and the student will also report their findings of their experiences at the placement to the new level 4 cohort.

8. Post –placement review and evaluation; From the academic visit report and student assignment an evaluation of the placement by the team can be recorded.

Acknowledgement of a successful placement is also expressed to the individual organisations by the academics during their visits.

ASSESSMENT STRATEGY:

100% assignment divided in to 3 stages consisting of undertaking the placement, presentation to 1st year students on return and written report which is submitted and assessed at the beginning of Year 2 and which will cover all 3 learning outcomes.

Industrial Placement	40%
Presentation	5%
Assignment	55%

READING LIST:

Essential:

Mullins L – *Management and Organisational Behaviour* 9th Ed Halow, 2010

Background:

Belbin R Meredith – *Management Team* (Heinemann, 1995)

Adair J - *Communications at Work* (Pitman, 1989)

Level 6 Year 3

Module Title:	Computer Aided Design
Date Of Validation:	2011
Module Number	M3X8666
Module Value:	20 credits
Level:	6
Faculty Responsible for Delivery:	Faculty of Applied Design and Engineering
Prerequisites:	None

AIM:

The aims of this module are to develop computer modelling techniques in order to simulate engineering scenarios, to develop advanced skills in 3D solid modelling and CAD drafting and to analyse tolerances in drawings based on functional requirements and manufacturing capabilities.

OUTCOME STATEMENTS:

Upon the successful completion of this module the student will be able to

1. Design and produce a fully dimensioned and toleranced drawing of a 3D part based on analysis of tolerances required to make the part function correctly in its assembly in line with industrial practice
2. Simulate a real world engineering situation, produce results and critically interpret them

INDICATIVE CONTENT:

This module will contain some compulsory elements and some which can be chosen by the student based on their interest

- Design requirements analysis
- Tolerancing for function including manufacturing capability and GDT
- Finite element analysis
- Parametric modelling of complex assemblies

TEACHING AND LEARNING IMPLEMENTATION:

	Hours
Lectures:	30
Tutorials/examples:	30
Student Private Study	140
TOTAL	200

It is envisaged that students will follow the indicative content via an extended case study on a load bearing assembly such as an overdrive KERS gearset

ASSESSMENT STRATEGY:

Assignment	50%
Assignment	50%

Outcome 1 will be assessed by the production of a 2D drawing of a 3D part modelled in the context of an assembly for 50% Outcome 2 is assessed by production of a written report based on a simulation for 50%

READING LIST:

Kelly Bramble	Geometric Boundaries (The Engineers Edge)
Iso Standards	ISO 128-1:2003

Plus as appropriate for the case studies

Module Title:	Sustainability Through Technology
Date Of Validation:	2011
Module Number	M3X8
Module Value:	20 credits
Level:	6
Faculty Responsible for Delivery:	Faculty of Applied Design and Engineering
Prerequisites:	None

AIM:

The aims of this module are to examine the environmental issues raised by the automotive and motorsport industry and to investigate the technical and legislative response available to the governing bodies, teams and manufacturers.

OUTCOME STATEMENTS:

Upon successful completion of this module the student will be able to:

1. Evaluate the impact of current and possible future legislation and public opinion on the operation of motorsport events.
2. Analyse the operation and effectiveness of alternative fuels, electric and hybrid propulsion and energy recovery systems to reduce the environmental impact.

INDICATIVE CONTENT:

- Political and legislative pressures on the industry including Euro emissions legislations and the European drive cycle.
- Emissions legislation within motorsport.
- Fuels for IC engines – bio ethanol, bio butanol bio diesel, lpg, hydrogen.
- Comparison of engine performance improvement methods for conventional and alternative fuels, including feasibility and chemical breakdown.
- Hybrid powertrains.
- Emissions legislation for road and competition.
- CO2 emission levels.
- Carbon off setting and mechanisms.
- Exhaust after treatment.
- Electric propulsion systems.
- Noise pollution.

TEACHING AND LEARNING IMPLEMENTATION:

	Hours
Lectures:	40
Laboratory	20
Student Private Study:	140
TOTAL	200

Lectures will be supported by practical workshop and track sessions. Practical work will be based both at SMU and at 'Pembrey Vehicle Dynamics Centre' to support the theory presented.

ASSESSMENT STRATEGY:

Exam	50%
Coursework	50%

Outcome 1 will be assessed by examination and Outcome 2 by means of an assignment

READING LIST:

Essential:

D.James D Halderman and James Linder	<u><i>Automotive Fuel and Emissions Control Systems</i></u> (Prentice Hall, 28 Nov 2008)
Allen Fuhs	<u><i>Hybrid Vehicles</i></u> (CRC Press 1 Oct 2008)
SP Singal	<u><i>Noise Pollution and Control</i></u> (Narosa Publishing House, 2001)
Michael Westbrook	<u><i>The Electric Car: Development and Future of Battery, Hybrid and Fuel-cell Cars</i></u> (IEE, Power & Energy Nov 2001)

Background:

<u>Ronald M. Heck</u> , <u>Robert J. Farrauto</u> , <u>Suresh T. Gulati</u>	<i>Catalytic Air Pollution Control: Commercial Technology</i> (John Wiley and Sons, 2009)
<u>Deborah Gordon</u> and <u>Daniel Sperling</u>	<i>Two Billion Cars: Driving Toward Sustainability</i> (Oxford University Press, March 2009)

Website:

http://www.eemsonline.co.uk/	Website for Energy Efficient Motorsport
http://www.evuk.co.uk/	Website for Electric Vehicles UK
http://www.the-mia.com/	Website for the Motorsport Industry Association

Journals:

Race Car Engineering, Race Tech Magazine, Race Engine Technology, Autosport Magazine

Articles:

Ian Bamsey

Shedding light - Where is Formula One heading?
(Race Engine Technology
Publication Date: 28th November 2008)

Ian Bamsey

Diesel versus diesel & diesel versus gasoline
(Race Engine Technology
Publication Date: 11th August 2008)

EEMS

Motorsport embraces its energy efficient future
(Energy Efficient Motor Sport Publication Date:
30th January 2007)

Green Car Guide

A Hybrid Goes Rallying (Green Car Guide
Publication Date: 1st August 2006)

British Touring Car Championship

Fuel for Thought (Official programme for BTCC
event at Croft motor racing circuit Publication
Date: 16th July 2005)

Module Title:	Data Acquisition and Instrumentation
Date Of Validation:	2011
Module Number	M3X8667
Module Value:	20 credits
Level:	6
Faculty Responsible for Delivery:	Faculty of Applied Design and Engineering
Prerequisites:	None

AIM:

The aims of this module are to develop the student's ability to design, specify and install a vehicle data acquisition system and to collect, analyse and collate and present the data obtained to accurately characterise the handling behaviour of modern vehicles.

OUTCOME STATEMENTS:

Upon successful completion of this module the student will be able to:

- 1 Design, specify and install a modern vehicle data logging system.
- 2 Analyse data collected to accurately characterise a vehicle's handling behaviour.

INDICATIVE CONTENT:

- Damper dynamometer testing.
- Sensor design and utilisation
- Data logger design and specification
- Physical testing.
- Tyre testing procedures and analysis.
- Control system analysis.
- Collation of data
- Appropriate presentation of results
- Vehicle handling behaviour evaluation
- Aerodynamics including evaluation and development
- Complex math channels for analysis
- Statistical analysis of data including filters and sampling rates
- Calibration methods

TEACHING AND LEARNING IMPLEMENTATION:

	Hours
Lectures:	30
Laboratory	30
Student Private Study:	140
TOTAL	200

Lectures will be supported by practical workshop and track sessions. Practical work will be based both at SMU and at 'Pembrey Vehicle Dynamics Centre' and consist of practical test sessions that support the theory presented.

ASSESSMENT STRATEGY:

Assignment	50%
Assignment	50%

Both outcomes will involve the use of test vehicles, test and measurement systems and simulation work. Each outcome will be assessed by assignment, each of which will cover 50%

READING LIST:

Essential:

Jorge Segers	<i><u>Analysis Techniques for Racecar Data Acquisition</u></i> (SAE Mar 26, 2008)
Simon McBeath	<i>Competition Car Data Logging</i> (J H Haynes & Co Ltd; 2nd Revised edition, 11 Dec 2008)
Graham Templeman	<i>The Competition Car Data Logging Manual</i> (Veloce Publishing PLC, 28 Aug 2008)

Background:

John Park and Steve Mackay	<i>Practical Data Acquisition for Instrumentation and Control Systems.</i> (Newnes,10 Jun 2003)
Neil Spalding	<i>MotoGP Technology</i> (J H Haynes & Co Ltd, 2006)

Module Title:	Electric and Hybrid Propulsion Control
Date Of Validation:	2011
Module Number	M3X8668
Module Value:	20 credits
Level:	6
Faculty Responsible for Delivery:	Faculty of Applied Design and Engineering
Prerequisites:	None

AIM:

The aims of this module are to develop the student's ability to critically analyse the control and monitoring systems required for electric and hybrid propulsion systems and to enable the critical evaluation of powertrain design for electric and hybrid propulsion and kinetic energy recovery systems

OUTCOME STATEMENTS:

Upon successful completion of this module the students will be able to:

1. critically analyse the control and monitoring systems required for electric and hybrid propulsion systems
2. critically evaluate powertrain design for electric and hybrid propulsion and kinetic energy recovery systems

INDICATIVE CONTENT:

- Electrical Principles
- Electric propulsion systems
- Hybrid systems
- The physics of electronic sensors
- Electrical and electronic hardware calibration and testing
- Instrumentation and control software design and implementation
- Calculations of vehicle road load and duty cycle generation
- Calculations of mechanical and electrical energy storage systems

TEACHING AND LEARNING IMPLEMENTATION:

	Hours
Lectures:	30
Laboratory	30
Student Private Study:	140
TOTAL	200

Lectures will be supported by practical workshop sessions.

ASSESSMENT STRATEGY:

Coursework	50%
Exam	50%

Outcome 1 will involve the use of laboratories and will be assessed by an assignment.

Outcome 2 will be largely theoretical in nature and will be assessed by an examination.

READING LIST:

Essential:

Yimin Gao *et al.*

Modern Electronic Hybrid Electric and Fuel Cell Vehicles. 2nd edition (CRC Press Inc, 2010)

J Miller

Propulsion Systems for Hybrid Vehicles (IET 2008)

Background:

Leithman Seth

Build your own plug in hybrid vehicle. (McGraw-Hill, 10 Jul 2009)

John R. Brauer

Magnetic actuators and sensors. (Wiley Blackwell, 17 Mar 2006)

A Hughes

Electric Motors and Drives 3rd Edition (Newnes 2006)

Module Title:	Research Methods and Project
Date Of Validation:	2011
Module Number	M3X8671
Module Value:	40 credits
Level:	6
Faculty Responsible for Delivery:	Faculty of Applied Design and Engineering
Prerequisites:	None

AIM:

The aim of this module is to develop the student's ability to show individual creativity and originality; to apply where appropriate and go beyond where necessary, the knowledge and skills taught throughout the degree programme, to enhance investigative, problem-solving and other transferable skills, and to apply all this to a successful project.

OUTCOME STATEMENTS:

Upon the successful completion of this module the student will be able to:

1. Prepare and present to specialist and non-specialist audiences an academic seminar paper that reviews critically the current research literature pertinent to an area of motorsport/automotive/motorcycle engineering and proposes a suitable title for the project.
2. Undertakes the project proposed applying appropriate methodologies for the achievement of the objectives of the study.

INDICATIVE CONTENT:

- Research principles and approaches (e.g. the research process, purpose, sources of data including primary/secondary research, quantitative/qualitative data, objective/hypothesis formation, reliability, validity)
- Research design strategies, (e.g. action research, experiments, surveys, case studies), their advantages and limitations, and their suitability to a variety of research contexts.
- Data collection & sampling methods (e.g. interviews, questionnaires, observation), and their advantages and limitations in a variety of contexts.
- Data analysis techniques.
- Ethical and professional considerations
- Referencing conventions (e.g. the Harvard system, numeric system).
- Critical, analytical thinking and writing
- Academic writing convention (e.g. the structure and format of a seminar paper, and a project report).

- Presentation techniques/skills appropriate to a professional engineer.

LEARNING AND TEACHING IMPLEMENTATION:

The student is initially required to select a topic relevant to motorsport, automotive or motorcycle engineering suitable for the project element of this module. He or she must then prepare and present to an audience of staff and fellow students an academic seminar paper that critically reviews the current research literature pertinent to the topic selected and proposes the project title. With a project plan that identifies how the objectives proposed will be achieved. He or she must then undertake the project and produce a project report. This module, therefore, requires that the student demonstrate a high level of self-direction and initiative, and takes responsibility for the direction of his or her own learning. This is reflected in the teaching and learning strategy implemented at the start of the module. Lectures will introduce conceptual, theoretical issues and key ideas and will allow students to engage in discussion on the application of the theoretical concepts to practical situations. However, for the exploration of these topics and their application to practical, pathway-specific situations and case studies, tutorials are the most appropriate strategy. During tutorials, a flexible, student-led approach will be taken; students will discuss and develop their individual project ideas, and will be given the opportunity to consult with topic specialists amongst the teaching team. During academic seminars, student will disseminate to their peers the findings of their research and respond to peer questioning; such activity further enhances their transferable skills of presentation techniques.

The table below provides a suggested allocation of teaching hours to deliver the module:

	Hours
Lectures	20
Tutorials/Seminars	20
Supervised laboratory	0
Student private study	360
TOTAL HOURS	400

ASSESSMENT STRATEGY:

To achieve outcome 1, the student will be required to prepare a written seminar paper of approximately 2,000 words based on secondary research and present the paper to his/her peers (30% weighting). Outcome 2 requires that the student undertakes a project on the subject proposed (70% weighting), which is further broken down to oral examination 10%, written report 55% and exhibition 5%.

Assessment Timetable

Stage	Date	Topic	Mode of Assessment	Mark (%)
1	December	Seminar Presentation	Seminar	30
2	May	Project	Oral examination Written Report Exhibition	10 55 5

Assessment Distribution**Seminar paper 30%**

Characteristic	Weighting
Develop and structure appropriately a seminar paper making effective use of an appropriate referencing system	0.3
Demonstrate in-depth knowledge of the underlying concepts and principles associated with the topic under research.	0.3
Propose and justify valid project objectives and strategies to achieve them	0.2
Quality of visual presentation and verbal communication.	0.2

Oral examination - 10%

Characteristic	Weighting
Response to technical questioning and demonstration of engineering competence.	0.4
Ability to demonstrate understanding of relevance and implications of project conclusions	0.2
Quality of visual presentation and verbal communication.	0.2
Overall achievement and ownership of project	0.2

Written Report - 55 %

Characteristic	Weighting
Technical and analytical content	0.2

Methodology	0.2
Achievement of the defined objectives	0.2
Evaluation	0.2
Presentation, structure and referencing of report	0.2

Exhibition/Summary Paper - 5%

Characteristic	Weighting
Technical Content	0.3
Quality of Presentation	0.3
Ability of paper to summarise the range of work undertaken	0.4

Assessment Criteria

Criterion	Percentage
Exceptional – could the student be expected to achieve more?	>90%
First class achievement – outstanding in all aspects	70-90%
Technically correct and solid – but lacking some detail and/or intellectual flair of first class and above	60-70%
Generally sound but with some areas of inadequacy	50-60%
Whilst some areas are correct – many areas are inadequate and flawed	40-50%
Generally of a poor standard with little understanding or commitment	<40%

PHYSICAL RESOURCES:

Computer/projector
Internet access
Library
Workshop /laboratory facilities

ROOM REQUIREMENTS:

Lecture Theatre
Tutorial room

READING LIST:

Essential Text:

Bell, J

Doing Your Research Project (Open University Press, , 2005)

Background Reading:

Cottrell, S.

Critical Thinking Skills: Developing Effective Analysis and Argument, Palgrave Study Guides, Palgrave Macmillan: Basingstoke(2005)

Dawson, C.W.

Projects in Computing and Information Systems: a Student's Guide, (Addison Wesley: Harlow, 2005)

Quinn, M. J.

Ethics for the Information Age: International Edition,
3rd Ed., (Pearson: NY, 2009)

Journals

Journal of Automotive Engineering, IMechE, MIRA Papers, SAE Electronic Database