The aim of this handbook is to answer the many questions you may have about the different aspects of studying for a degree at the University Strathclyde. The handbook contains practical information about the University, the Department and your course of study including course regulations, class syllabi and departmental procedures. It is an important reference document which will help you to ensure that your time here is organised efficiently and to maximum benefit.

The University of Strathclyde was formed from the Royal College of Science and Technology and the Scottish College of Commerce, and received its Royal Charter in 1964, both former institutions having had long traditions of involvement in higher education. In the case of the Royal College this dates back as far as 1796. Since receiving its Charter, the University has thrived on the John Anderson Campus in the city centre, with four faculties having developed, viz. the Faculties of Science, Engineering, Humanities & Social Sciences and the Business School.

*We believe the information provided in this Handbook is correct at date of publishing but may be subject to revision*
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Session 2014/15 - Dates to Note

Semester 1 – 26 September 2014 – 23 January 2015

Semester 2 – 26 January 2015 – 5 June 2015

Please note that the University is closed on the following dates:

29 September 2014
24 December 2014 to 2 January 2015 inclusive
3, 6 April 2015
4, 25 May 2015
17, 20 July 2015

Graduation Ceremonies (provisional dates)
Monday 29 June to Thursday 16 July 2015

NOTE: Students should register for graduation well in advance of graduation day (usually around three months beforehand) and should check the Key Dates page at http://www.strath.ac.uk/student/ or notice boards in the McCance Building for specific dates.

Deadline for June/July graduation is 8 May 2015.

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Section 1

The Department of Mechanical & Aerospace Engineering
Welcome

From the Head of Department

I am very pleased to welcome new students to the Department of Mechanical & Aerospace Engineering (MAE), and welcome back established students returning after what, I hope, was an enjoyable summer break.

New students will find themselves in a very different learning environment from school or college, and sometimes this change can be daunting. Continuing students may also find that moving on a year will require some changes to personal time management and study methods. However, if you approach your studies with diligence, commitment and intelligence, you will build an excellent platform on which to graduate from Strathclyde University and launch a successful and fulfilling career.

This handbook gives contact information for all the people in the Department, and details the requirements and regulations for the Department’s degree courses. Your Personal Development Adviser and Year Adviser of Studies can help clarify the regulations and requirements and deal with any specific problems you may encounter. You can also get help and advice on specific classes from individual lecturers and class registrars. Please let your Student Representatives know about any persistent issues, and they will convey these to us through regular meetings of the Staff/Student Committee. If you wish to talk to me about any issues, please email Donna Fairley (donna.fairley@strath.ac.uk) to arrange a suitable time for us to meet.

I hope you find the coming academic year challenging, enjoyable and rewarding and I look forward to working with you.

Prof Donald Mackenzie
Hi everyone,

On behalf of the MAESA committee, welcome to the Department of Mechanical & Aerospace Engineering! We’re looking forward to meeting all the new students and making your fresher’s year the best it can possibly be. For everyone else, welcome back for another year of fun and games!

MAESA is the Mechanical & Aerospace Engineering Students Association. It is run by students, for students who are undertaking courses in the Department of Mechanical & Aerospace Engineering. We are comprised of undergraduate students across all 5 years and we are always looking for more volunteers to help run the committee and organise our events. So if you’re looking for a way to be part of the Mechanical and Aerospace community outside of your studies, then get involved with the committee! Being part of MAESA allows you to build on existing skills, develop new ones, gain new experiences, meet new people, and above all have fun. Something that potential employers are very interested in.

If you’re not up for getting involved directly, you can always support us in other ways. Being a student group, we rely on your involvement to allow us to continue to host great events. So come along to our social events and have some beer and banter with students from all year groups. We’d love to hear suggestions for new events as well, so if you want to see something happen, let us know!

Not only are our events going to be better than ever before but there will be even more of them, as we plan on joining up with the Institution of Mechanical Engineers Glasgow Young Member’s Panel. Don’t worry; we’ll still have our 5-a-side football league, pub quizzes, and our legendary common room parties! But we’ll also be promoting some industrial visits with the help of the IMechE GYM. Not only will these provide insight into the engineering industry, but it will give you an opportunity to meet other mechanical and aerospace engineering students from across the whole of Glasgow!

Since our department is so large, communication can sometimes be a problem. So be sure to join the MAESA Facebook page and check your university email account for regular updates about upcoming events!

If you have any other suggestions or new ideas, get in touch at maesa.strath@gmail.com or visit the MAESA Strathclyde Facebook page.

On behalf of the MAESA committee, have a great year and enjoy yourselves. We look forward to seeing you at our events!

Callum Harrower & Anton Zhyzhyn

MAESA Presidents 2014/2015

e-mail: maesa.strath@gmail.com
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Student Support Services

Where to find help

There are numerous support services within the University and these are detailed in the University Student Handbook which is issued to all new students and can be found at http://www.strath.ac.uk/media/ps/sees/informationandadviceteam/student_handbook.pdf. In this section of the Departmental Handbook we show you where you can find support within the Department.

Course Director and Year Advisers

In addition to the Course Director, there is an Adviser of Study for each year of your course. The aim of the Adviser is to counsel you on particular aspects of your current year and to assist you in choosing optional subjects to study.

<table>
<thead>
<tr>
<th>Course Director (all UG courses)</th>
<th>Dr Ian J Taylor</th>
<th>Ext 3753</th>
</tr>
</thead>
<tbody>
<tr>
<td>Course Adviser (Aero-Mechanical Eng)</td>
<td>Dr Matthew T Stickland</td>
<td>Ext 2842</td>
</tr>
<tr>
<td>First Year Adviser</td>
<td>Prof James T Boyle</td>
<td>Ext 2311</td>
</tr>
<tr>
<td>Second Year Adviser</td>
<td>Dr Robert Hamilton</td>
<td>Ext 2046</td>
</tr>
<tr>
<td>Third Year Adviser</td>
<td>Dr Paul Tuohy</td>
<td>Ext 2083</td>
</tr>
<tr>
<td>Fourth Year Adviser</td>
<td>Dr Marcus Wheel</td>
<td>Ext 3307</td>
</tr>
<tr>
<td>Fifth Year Adviser</td>
<td>Dr Ian J Taylor</td>
<td>Ext 3753</td>
</tr>
</tbody>
</table>

Personal Development Scheme

The success of the Personal Development Scheme depends on the participation of both staff and students. You are required to see your Personal Development Adviser at least once every semester, even if only to confirm that all is well. Those who find they cannot speak freely to the member of staff assigned to them are invited to approach Prof Boyle, the Coordinator of the Personal Development Scheme. If this is impractical, students should approach the Faculty Manager, Dr Gayle Wilson, (Room 525, Royal College Building, Ext 2364).

Staff-Student Committee

A Staff-Student Committee, which normally meets twice per year, provides a forum where academic problems may be raised by student representatives who have been selected from each year of the course. Students are encouraged to consider the benefits of becoming a Student Rep, further information on which can be found at www.strathstudents.com.

When selected, the names of reps will be notified via email. The student reps are encouraged to run the Staff-Student Committee which normally comprises two student reps from each year of each course, the Director of Education, Year Advisers of Study, senior members of staff and others as appropriate. If there is an issue which is important to a large number of students and you believe should be discussed at this Committee, you should inform your student representative so that it can be placed on the agenda for the next meeting. Before the issue is brought to the meeting, however, it is IMPORTANT that it has first gone through the proper channels which are
shown below. Only once there has been no satisfactory resolution of a problem should it be brought before the Staff-Student Committee.

**Problems? - Where to go**

- **First port-of-call**
  - Year Adviser
  - Class Teacher
  - Your PDA
  - Director of Education or Course Adviser

- **start-of-year choices**
  - if not resolved quickly

- **immediate problems with classwork**
  - if other students have the same problem

- **longer-term academic problems**
  - if other students have the same problem

- **course options**

- **study in Europe**

- **non-academic social, health etc**

- **Your PDA**
  - Year Adviser
  - Student Year rep

- **...if unhappy with response**
  - Director of Education or Course Adviser

- **ERASMUS Coordinator**
  - Director of Education or Course Adviser

- **Your PDA**
  - Student Advisory Student Health Services

- **Head of Department**
  - ..and if all else fails

---

**Disability Service**

For information on this service please refer to the University Student Handbook, [http://www.strath.ac.uk/media/ps/sees/informationandadviceteam/student_handbook.pdf](http://www.strath.ac.uk/media/ps/sees/informationandadviceteam/student_handbook.pdf)

Prof James Boyle is the Departmental Coordinator for students with disabilities. Donna Fairley is the Department’s Examinations Coordinator.

If you believe that you qualify for special examination arrangements, then please ensure you visit the Disability Service (see [http://www.strath.ac.uk/disabilityservice/informationforstudents/](http://www.strath.ac.uk/disabilityservice/informationforstudents/)).

**NOTE:** It is important that arrangements are put in place several weeks prior to the start of the examinations.
Educational Policy

Course Aims and the Learning Experience

Your aim in choosing your degree course is undoubtedly to graduate and qualify as a competent professional engineer. Our aim is to assist you in the best ways we can to achieve that goal. There are various elements of knowledge, skills, experience and understanding which are to be found in competent engineers and your course will give you the opportunity to acquire and develop these. By the end of your course, we expect that you will:

- have a good working knowledge of the fundamentals of systems and processes which are generally recognised to be in the domain of mechanical engineering and its related subjects
- be able to understand, model and predict the behaviour of engineering artefacts through the application of scientific and technological principles
- have had a great deal of practice in creating new solutions, adapting old ones, and in using your acquired knowledge in materials, energy systems, manufacture and computer-aided design techniques.

We also expect you to develop many new capabilities which are not simply concerned with engineering technology; in fact we will be disappointed if your outlook does not change radically during your course. In particular, we expect that you will:

- continue to develop the capacity you already have to learn about many things - a good engineer can do anything
- increase your skills in communicating and working effectively with others - engineers work in teams and lead teams
- grow to understand your place as an engineer in a complex and fascinating professional community - the world is your oyster.

Student Charter

Departmental staff aim to:

- be responsible and responsive in all matters related to students
- respect individual students as partners in the learning process
- maximise learning opportunities
- minimise bureaucracy and ensure the transparency of procedures
- maintain a friendly and caring environment
- operate an efficient information system
- identify clearly the responsibilities of staff and students
- facilitate innovative developments where appropriate
- ensure equality of opportunity for all
Assessment and Feedback

The Department fully subscribes to the approach to assessment and feedback stated by the University, [http://www.strath.ac.uk/learnteach/informationforstudents/students/assessfeedback/] and elucidated in the 12 principles of good assessment and feedback, [http://www.strath.ac.uk/learnteach/informationforstaff/staff/assessfeedback/12principles/].

Accordingly, assessment and feedback methods used by each class are explicitly stated in the associated Module Descriptor Form – these can be found at [http://www.strath.ac.uk/mae/currentstudents/]. The Department also recognises that, in addition to constituting a formal response to assessment, feedback also incorporates informal communication between staff and students (either individually or collectively) that provides information on progress and performance. This implies a more bilateral process in which students are encouraged to seek feedback by actively engaging with staff as appropriate.

Engineering Profession

All courses in the Department are designed to lead to Chartered Engineer (CEng) status, in that they are accredited by one or more of the professional institutions in the Council of Engineering Institutions. It is your responsibility to exploit this benefit, although staff here will be pleased to help you with advice, form-filling and so on.

The paths to CEng registration are given in an Engineering Council publication – UK SPEC which defines the initial education required and the subsequent stages of education, training and experience needed to achieve full membership. For those students who entered courses in 2000 or later, the MEng courses provide the only direct route to Chartered Engineer status, without further academic study. BEng (Hons) courses fulfil the CEng requirements in part, but graduates of these courses will require, under current Engineering Council rules, to complete a so-called ‘Matching Section’ of further study - equivalent to one year of full-time study, approximately.

In any event, you are strongly recommended to begin your own developing association with the professional body you choose by joining up now. It costs little (Student Membership is sometimes free for students on accredited courses). You will keep abreast of changes in UK SPEC and your time as a student will be credited to you when you eventually apply for full membership.
Useful Administrative and Other Information

Central Services/Reception

All general enquiries should be directed in the first instance to Central Services/Reception on Level 8 of the James Weir Building. Student opening hours, which may be subject to change, are:

Monday – Friday: 1000 - 1600

Class lecturers should indicate submission dates for coursework. Where possible coursework will be submitted electronically but failing that it should be submitted to Central Services/Reception during opening hours. The lecturer for each class will provide students with a front page for submitting their coursework. If you do not receive this front page please download one from http://classes.myplace.strath.ac.uk - coursework cannot be handed in without it.

Marked paper coursework submissions can be picked up from student boxes located near JW801.

Access to Buildings out-with Normal Hours

If you wish to have access to University premises out-with normal hours (0800 – 1800) it is important that you read Appendix 2 of this Handbook. For access to computer rooms it will be necessary for you to have a red card signed by a member of staff in Central Services.

Thereafter the card must be taken for counter-signature to the Information Technology Services (ITS) Helpdesk, level 3 of the University Library.

Normally, we can guarantee your obtaining a card if your request is made within Central Services opening hours but you should be aware that possible staff absences may prevent this so you should think ahead and try not to leave things until the last minute.

Students wishing access to laboratories out-with normal hours must complete the form contained in Appendix 2 of this Handbook (also available on the MAE Current Students webpage).

Email Accounts

You should check your ‘@strath’ email account on a regular basis to ensure that you do not miss important announcements. It is also a good idea to clear out your emails on a regular basis as emails cannot be delivered when your account has reached capacity.

References

Frequently companies will ask for referees who can comment on your academic progress as well as your general conduct. We suggest that you ask your Personal Development Adviser or Year Adviser to act as a referee; final year students should contact their project supervisor.

The Sir William Arrol Bursary

The above bursary is available to first year students in the Mechanical & Aerospace Engineering Department. The recipient of the bursary will receive £1000 per year for the 4/5 years of their course. All first year students are invited to apply for the bursary via an application form obtainable from Central Services. Completed applications must be lodged with Central Services by the end of November each year.
Use of Computing Facilities and Resources

The University will not permit the use of its computer facilities and resources for access to, or transmission of, information which is considered by the University to be unacceptable; illegal; in breach of university policies, such as those on Equal Opportunities and Harassment; wasteful of resources or not commensurate with the provision of facilities for legitimate educational purposes.

Examples of such unacceptable use may include:

- accessing or displaying pornographic material;
- stating defamatory opinions or views concerning individuals or organisations;
- accessing or displaying discriminatory material or material which encourages discrimination;
- engaging in games or chain E-mail;
- publishing information which is intended to misinform and thereby causes anxiety or inconvenience to another;
- unauthorised use of University logos, titles etc;
- spamming;
- corrupting or destroying another user’s data;
- violating the privacy of other users;
- disrupting the work of others;
- using JANET in a way that denies service to others;
- misuse of networked resources such as the introduction of viruses.

The University actively monitors usage of the University computer facilities and resources which includes monitoring the access to, publication or receipt of, any Internet materials by any user.
Study Abroad

General

The entry below should be read in conjunction with the Overseas Study entry in Section 2 of this Handbook.

The Department encourages all suitably qualified students to consider the benefits which foreign study brings to the learning experience. Students who wish to participate in an ERASMUS+ (or similar) exchange are ambassadors for the Department and the University, and should note that it is IMPERATIVE that prior permission, in principle, to pursue study overseas is obtained from both the Year Adviser for the year when they will be overseas (usually the Third Year Adviser) and Dr Andrew McLaren.

Normally this will be covered by their signature on the Learning Agreement which has to be completed by all students wishing to study overseas. Only once results are known will this permission be ratified as explained at (c) below.

Those students enrolled on courses which require foreign study as part of the requirements for the award, should be aware that such study can only proceed where the student has reached an appropriate standard and has a reasonable expectation of benefiting from the experience; if this poses a difficulty it is possible to change to another, related, course where foreign study is not obligatory.

For those participating in an exchange programme, attention is drawn especially to the following:

(a) FEES: Do not forget to apply for your fees for the subsequent academic year. You should make a point of writing to Student Experience in March asking them to send you an application form.

(b) EXAMINATIONS OUTWITH THE UNIVERSITY: Please read page 23.

(c) While the Department encourages students to participate in overseas exchange studies in their third year (and additionally in fifth year), it is important in the case of second year students that, prior to embarking on an exchange programme, certain objectives have been met, viz:

- all first year classes have been passed
- all second year compulsory classes have been passed

This is especially important in the case of non-European exchange studies, not simply from an academic point of view, but also from a practical viewpoint. The large time difference involved in international exchanges makes it difficult (or sometimes impossible) for students to take a resit examination overseas.

While agreement to participate in an exchange programme may be given, in principle, before the end of the academic year, it is imperative that the student concerned has this agreement ratified in writing, by Dr McLaren, as soon as their examination results are known. Without this ratification no student from the Department of Mechanical & Aerospace Engineering will be considered to have the necessary permission to embark on an exchange programme. In exceptional circumstances students may appeal to the Head of Department. In the event of a successful appeal, outstanding resits will be deferred until the student’s return.
ERASMUS+ - A Student's Guide

What is it?
ERASMUS is the name given to the European Community Action Scheme for the Mobility of Students. It forms a major part of the efforts of the European Union to ensure that graduates within its member countries should be able to function on a Union-wide basis within the single European market.

What is Strathclyde's involvement in it?
The University of Strathclyde (and in particular the Department of Mechanical & Aerospace Engineering) has entered into the scheme in a comprehensive way because it believes firmly in its overall aims.

What does the scheme involve?
The scheme provides a wonderful opportunity for students to spend part of their degree course at a university in another country within the European Union. This study elsewhere counts as a normal part of the degree curriculum. The various schemes have therefore been designed to ensure complementarity with studies which the student would otherwise have taken if he or she had remained at Strathclyde. Where language permits, students can attend lectures in their European university. Alternatively, for students whose language skills are less well-developed, project work may be undertaken in the host University in collaboration with a supervisor who speaks English.

Credits are awarded for overseas study just as they would be at Strathclyde and are normally awarded at the September Examination Board once transcripts have been received from the partner institution. Since performance in earlier years of the course contributes to the class of honours, for this purpose, each student will be awarded an overall grade for their period of foreign study which will be agreed between the ERASMUS Exchange Coordinator and the Adviser of Studies.

The minimum length of an exchange is three months and the maximum is a full academic year.

Is language not a difficulty?
The Faculty has recognised that proficiency in another European language is highly desirable for the success of any student exchange. Arrangements have therefore been made with the Language Learning Centre to offer specially designed classes in French. These classes are pitched at different levels to take account of previous knowledge (ranging from nil to passes in Highers). They are normally taught in small groups and aim to teach spoken and written language in an enjoyable and relevant way. These classes are recognised by all courses in the Faculty as "approved elective classes". Classes in other European languages may also be available. During the period of the exchange itself, language tuition is normally provided by the host university. This may include basic classes in languages such as Danish and Swedish. If you think you may be interested in participating in a European exchange programme you should ask your Year Adviser about the elective classes on offer from the Language Learning Centre.

What are the benefits for me?
While the exchanges usually mean hard work when you are there, they can also be enormous fun. Strathclyde students studying in Europe have taken the opportunity to travel, to spend time with students from their European university and sometimes to obtain relevant vacation employment in Europe.

How much does it cost me?
A supplementary grant is provided by the ERASMUS+ Scheme to help towards travel and higher living costs. It should be stressed that this grant is a supplement and not a substitute for your normal funding arrangements. Even although you are studying overseas, it is important to ensure
that you have applied for fees through your normal funding body for the academic year in which you will be spending time overseas, and that you are properly registered, otherwise you will not be eligible for a student loan.

**When can I go?**

Students at present in second year may opt to spend all or part of their third year abroad; exceptionally it may be possible to spend part of the fifth year overseas. What you do abroad is normally agreed beforehand, and may be a combination of lectures, labs and project work, depending upon the courses on offer and your facility with languages. All MEng students are expected to consider going abroad at some stage during their course. This is an essential element in their personal development.

There is much to be said for starting your time abroad in semester 1, if possible, since you can go early enough to check out the social scene, lecture schedules, etc, before classes start. If you want to pursue classes in Germany, you may need to go in semester 2 - project work can be carried out in either semester. Studying abroad for the whole year is by far the most beneficial and is an absolute must for France.

**How do I find out more?**

Almost all you need to know can be found at [http://www.strath.ac.uk/rio/exchangestudyabroad/goingabroad/erasmus](http://www.strath.ac.uk/rio/exchangestudyabroad/goingabroad/erasmus) This gives links to our partner institutions. Student Grant Contract forms and the Learning Agreement mentioned above may be obtained from Central Services. The deadline for completion of both of these forms is **30 April**.

Further information on European exchange arrangements is available from the Department’s ERASMUS+ Coordinator: Dr Andrew McLaren, [andrew.mclaren@strath.ac.uk](mailto:andrew.mclaren@strath.ac.uk)
The Course

Core Curriculum

The courses in the Department of Mechanical & Aerospace Engineering are organised through a number of principal themes depending on which course is undertaken e.g. Materials/Engineering Manufacture and Design, Mathematics and Computer-Aided Engineering, Engineering Science and Applications, Professional Management Studies.

For example, fundamental topics which underpin the practice of mechanical engineering develop through the themes of Mechanical Engineering Science and Applications. Mathematics and Computer-Aided Engineering studies provide competence in the use of modern, analytical IT tools; appreciation of Materials, Manufacture and Design complements the base of fundamentals. More specialised topics relating to the degree in Aero-Mechanical Engineering have an increasing presence after the second year. The individual topics are progressively integrated over the duration of the courses, Engineering Design being the unifying theme in the third year. In the fourth year, the skills, knowledge and understanding developed earlier are brought to bear on a practical project. Specialised studies, in particular Engineering subjects and a Computer-Aided Engineering class based on industrial software, round off the final years of the course.

Engineering is pursued within a Business climate and the theme of Professional and Management Studies is an essential ingredient of preparing to operate as a competent engineer.

4/5 Year Course Structure

The MEng provides the opportunity for students of above-average ability to enhance their studies in alternative ways. For example there are Masters level classes in a wide variety of Engineering topics but it may also be possible to take classes from the extensive portfolio offered by the Strathclyde Business School. Popular Business classes include Accounting and Financial Management.

The main reason for most students to pursue the 5 year MEng option is to complete the educational requirements for Chartered Engineer status before graduating and therefore to avoid the need to return for further study at a later stage. The option to graduate after four years with a BEng Honours award is open to all students and many employers traditionally take on such graduates with a view to further in-house training which may also provide a route to Chartered status. However, current experience is that such employers look for a good class of degree and evidence of a well-rounded portfolio of achievement.

Transfer between Courses

The Department operates a policy which allows students to delay final degree choices until their career aspirations have been determined. Normally such transfers can be delayed until the start of the third year of the course.

It is normally possible to transfer from the BEng course to the more demanding MEng stream. To transfer to (and remain on) the MEng stream, students must achieve a credit weighted average (CWA) of 60% or above for their curriculum in an academic year. Any student who may wish to consider such a transfer should seek advice from their Year Adviser.

Such students should note that in addition to meeting the progress Regulations, transfers require the approval of the Director of Education. This approval will readily be granted provided that a student has achieved the necessary 60% or above CWA for the academic year. Conversely, students registered on the MEng courses may be required to transfer to the BEng stream if their performance is not at the required standard (i.e those with a CWA of lower than 60%). Further advice on all such transfers may be sought from the Course Director.
Note that it is also possible to change courses between the major discipline areas such as Mechanical, Aero-Mechanical and Mechanical Engineering with International Study. Such major changes are usually only possible in the earlier years of the courses. Changes at the end of first year usually present few problems (although are conditional on satisfactory progress). Major changes of direction become progressively less viable if delayed. If in doubt, take advice from the Director of Education.

Course Regulations - Guidance Notes

You are encouraged to consult the Regulations governing your course on a regular basis. The Regulations set out the framework for your studies and specify the criteria for your progression through the course. The language is carefully chosen to cover all eventualities and may need some interpretation or clarification. The following notes do not stand in place of the Regulations but are merely intended to explain the terms used or the thinking behind the text.

There are two main streams; MEng and BEng Honours. The MEng course is intended for high achievers and can be expected to be challenging. It is a five year course. The curriculum is mainly common with BEng in the early years but different progression and award criteria may apply. You should make yourself familiar with all of these.

Registration/Curriculum Choice

Please note that it is your responsibility to ensure that you are registered correctly. If you take a class but have not registered officially for that class you will not be awarded the credits. Conversely, if you register for a class, then do not take it, you will be recorded as having failed unless you delete the class from your record before the curriculum change deadline.

Coursework

Try hard to keep up with your coursework - it is important. If you miss the deadlines without satisfactory reasons, you may find that your assessment for that class is heavily compromised. Only you can judge if you can afford to lose marks which might affect either your progress on the course or your final assessment. It should be noted that penalties may be incurred for late coursework. In any event, all coursework should be submitted not less than 3 weeks prior to the relevant Examination Board.

Progress

Progress on the different streams is based on the accumulation of credits for which the pass mark is normally 40% (NB: level 5 subjects require a pass mark of 50%). This is the minimum acceptable for credit accumulation; however, it is important to note that students on Honours and Masters courses are expected to perform at a substantially higher level.

To progress to the next year of the MEng Degree course, a credit-weighted average (CWA) of 60% minimum is required. If a student’s CWA drops below 60%, they will be moved by the Examination Board to an appropriate BEng Degree programme, provided all other progress requirements have been satisfied. It is important to understand that, at the end of fourth year, if appropriate, failure to maintain this standard can result in the requirement to transfer from MEng to BEng and graduate immediately.
Award of the degrees

It is important to understand that your performance in the earlier years of your course can have a bearing on your final award. This means that continued high performance will be rewarded but with emphasis on the later stages of the course. You should also be aware that, in line with recommendations of the accrediting institutions, the performance to be taken into account is based on first diet assessment. The mechanism for calculating your final marks is given below.

Mechanical Engineering

BEng

Composition of final mark:
- 15% of Year 2 mark
- 25% of Year 3 mark
- 60% of Year 4 mark

Year 2:
Credit Weighted Average of first attempt at compulsory credits.

Year 3:
Credit Weighted Average of first attempt at compulsory credits.
External study has been assigned a mark.

Year 4:
120 credit curriculum:
Honours mark composed of 25% of ME409 plus 75% of credit weighted average of remaining compulsory credits.

120 + credit curriculum:
Honours mark composed of 25% of ME409 plus 75% of credit weighted average of remaining compulsory and elective credits.

MEng

Composition of Final Mark:
- 15% of Year 2 mark
- 25% of Year 3 mark
- 60% of Year 4/5 mark

Years 2 and 3:
As BEng

Year 4/5:
Credit Weighted Average of all credits taken over Years 4 and 5, including compulsory credits.

BEng/MEng (following direct entry to 3rd year)

Composition of Final Mark:
- 25% of Year 3 mark
- 75% of Year 4/5 mark

Year 3:
As BEng

Year 4/5:
Credit Weighted Average of all credits taken over Years 4 and 5, including compulsory credits.
Classification of awards

The Honours bands may vary slightly from year to year at the discretion of the Final Honours Examination Board on the advice of the External Examiner. To let you know what to aim for, the bands will normally be of the order of:

- **BEng**
  - 1st: ≥ 70%
  - 2.1: 60-69%
  - 2.2: 50-59%
  - 3rd: 40-49%

- **MEng with Distinction**: ≥ 70%
- **MEng with Merit**: 60 – 69%
- **MEng**: 50 – 59%

Proctoring/Second year project elective

A scheme exists whereby second year students may choose a ten credit project elective which involves assisting final year project students. This enables the final year student to gain experience in managing and supervision while the second year student gains an insight into the final year project requirements. Students are strongly encouraged to consider this option.

Engineering Applications (EA)

Engineering Applications provides an opportunity to acquire experience of practical engineering, and completion of this credit is a requirement for chartered status. All new students to the Department will undertake EA in two phases - Level 1, comprising mainly workshop practices in the first year and Level 2 comprising mainly practical test work in the second year.

Students will be provided with dustcoats, safety glasses and protective footwear. They should bring with them an A4 ring binder with paper for notes which will later be entered in a Log Book. Female students are advised to wear jeans if possible. Students are required to attend and perform all the designated elements of EA in order to obtain a satisfactory report and a corresponding credit which is awarded at the end of second year.

Examinations (General information)

It is important to note that:

- published exam dates may change and therefore you should not make arrangements to leave the area prior to the official end of the examination period. No special arrangements will be made in such cases.

- students will normally be given two attempts to pass classes during the course of the academic year. Students who fail to complete a class at the first attempt will be given one additional assessment opportunity before the September Board of Examiners. This will either be a re-submission of coursework or a formal examination in the August diet (as detailed in the class Module Descriptor Form). For the purposes of degree classification, first diet marks will be considered.

- those who are permitted to carry over classes to subsequent years will be given the opportunity to resit them during the course of the next academic year. Students should note that failure to pass any compulsory class after four attempts may result in transfer to the BEng pass degree in Engineering Studies. NOTE: for Level 4 and 5 classes, only ONE resit attempt is allowed (two attempts in total).

Please check the Student Experience and Enhancement Services (SEES) webpage [http://www.strath.ac.uk/exams/](http://www.strath.ac.uk/exams/) for further examination information.
External Examiners

The External Examiner for the following courses has still to be confirmed:
Mechanical Engineering
Mechanical Engineering with Financial Management
Mechanical Engineering with International Study
Mechanical Engineering with Materials Engineering.

Dr Mark Lowenberg from the University of Bristol is External Examiner for the following courses:
Mechanical Engineering with Aeronautics
Aero-Mechanical Engineering

Use of calculators

It is recommended that students have a basic scientific calculator for use in examinations as, although calculators may normally be taken into the examination venue, they must not be used to store text nor formulae nor be capable of communication. Invigilators may require calculators to be reset.

Use of dictionaries

Regulation 4.2.1 states that students whose native language is not English are permitted to use paper-based English/native language dictionaries in University examinations, except as detailed in regulation 4.2.2. These dictionaries will be subject to scrutiny by the Invigilator in charge of each examination. Electronic dictionaries are not permitted in University examinations. Regulation 4.2.2 states that, unless instructions have been issued to the contrary, dictionaries shall not be used in language examinations.

Pass mark

Normally the pass mark for each class is 40% unless otherwise notified (NB: level 5 subjects require a pass mark of 50%). However there are a number of reasons why you should set your sights higher than this, not least being the fact that your marks will appear on your Academic Transcript, copies of which are often sought by prospective employers. In addition, where the classes contribute to the grading of your final degree classification, it is important for you to secure the highest possible marks. Students in their first, second and third years, and fourth year (MEng only) who perform well, will be rewarded by the award of a Dean's Certificate for meritorious performance. In addition to this, a number of other prizes are awarded each year to top students.

Examinations out-with the University

Your attention is drawn especially to the following:

All students are expected to attend for examination at the University of Strathclyde on the dates and times scheduled. Only EXCEPTIONALLY will permission be given for students to sit examinations out-with the University.

Such an exception may be:

• when a student who is participating in an exchange programme has to take a University of Strathclyde examination while at the exchange institution

Permission will NOT be granted in the following cases:

• if a student wishes to leave the University prior to the end of the examination period
• where a student has a resit examination

If you wish to take an examination at a BONA FIDE institution other than this University (normally one of our overseas exchange institutions or a British Council Office) then you should make a formal written request to the relevant Departmental Examination Co-ordinator. For all MAE
classes with codes beginning “16” and “ME” this is:

Donna Fairley, donna.fairley@strath.ac.uk

Names of Examination Co-ordinators for other Departments may be obtained from the Examination Section of Student Experience or from the relevant Department.

This request must be made no later than SIX WEEKS prior to the start of the examination diet. Once permission, in principle, has been granted you must thereafter arrange for written communication to be sent by an authorised person at the proposed examination site confirming that the institute is prepared to act for the University of Strathclyde in this matter and giving a contact name, telephone number, e-mail address and full mail address. **NB: Post box addresses are not suitable as exam papers must be transported by courier.** This written communication must reach our Departmental Examination Co-ordinator no later than FOUR WEEKS prior to the start of the examination diet. Your request and the statement from the “authorised person” mentioned above are then sent to the Director of Professional Services from whom formal approval must be obtained. **Examination papers cannot be sent abroad unless the above procedure has been followed.**

You should also note that you will be liable for all expenses incurred and fees charged (if any) by the overseas institution.
Section 2

The Faculty of Engineering
The Faculty of Engineering

The Faculty of Engineering is one of the UK’s leading centres of engineering education. It is the largest in Scotland, and among the largest in the UK, and has achieved the highest ratings in official assessments of teaching quality and research. In addition to links with the Research Councils and the professional Engineering Institutions, the Faculty is renowned for its close links with industry. Industrial contacts are a major influence on both research programmes and taught courses, helping to keep the Faculty’s academic staff at the forefront of their subjects.

OFFICE BEARERS

Executive Dean : Professor Atilla Incecik
Naval Architecture, Ocean & Marine Engineering

Vice-Dean (Academic) : Dr Andrew McLaren
Mechanical & Aerospace Engineering

Vice-Dean (Knowledge Exchange) : Professor David H Nash
Mechanical & Aerospace Engineering

Vice-Dean (International Recruitment & Development) : Dr Alex M Galloway
Mechanical & Aerospace Engineering

Vice-Dean (Research) : Professor Walter Johnstone
Electronic & Electrical Engineering

Faculty Manager : Dr Gayle Wilson

Faculty Officer (Academic) : Mrs Gabrielle Weir

The Faculty is made up of 8 academic departments, viz:

<table>
<thead>
<tr>
<th>Architecture</th>
<th>Biomedical Engineering</th>
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</thead>
<tbody>
<tr>
<td>Chemical and Process Engineering</td>
<td>Civil and Environmental Engineering</td>
</tr>
<tr>
<td>Design, Manufacture and Engineering Management</td>
<td>Electronic &amp; Electrical Engineering</td>
</tr>
<tr>
<td>Mechanical &amp; Aerospace Engineering</td>
<td>Naval Architecture, Ocean &amp; Marine Engineering</td>
</tr>
</tbody>
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General Information

General University regulations are published on the University web-site at http://www.strath.ac.uk/educationstrategy/gmpt/qualityenhancement/universityregulations/

Absence & Personal Circumstances

The following University regulations relating to absence through illness should be noted:

**Regulation 4.1.10**

Students who fail to present themselves for an examination at the time and place published will be deemed to have forfeited that opportunity to sit the examination; except that in cases of absence through illness or other sufficient cause the Board of Examiners will take into consideration documentary evidence in assessing a candidate’s position.

**Regulation 6.4.11**

Students must sit all terminal tests and examinations unless prevented by illness in which case a medical certificate must be produced.

For all absences, students should record a self-certification online via PEGASUS using the Personal Circumstances link under the services tab.

For long term absences (e.g. > 7 days) or for absences where performance in assessments (examination / coursework’s) have been affected, the student is required to submit a medical certificate (signed by a medical practitioner who is not a member of the student’s family) to Student Experience. Student Experience will inform the relevant Department and, if the absence continues for 14 days or more, the SAAS or relevant grant awarding body.

In particular for absences that affect a student’s performance in examination(s) or other assessment(s) is affected, Personal Circumstances should be notified to Student Business **within five working days** of the latest affected examination/assessment or date of submission of affected assessment. In these cases, self-certification is not sufficient and documentary evidence is required.

Students whose performance has been, or will be, affected by circumstances that are acute, severe and outside their control should inform the University **as soon as they are aware of these circumstances**, by recording them on Pegasus under ‘Personal Circumstances’ and submitting **supporting documentary evidence** as soon as such evidence is available. Students should clearly state the extent, duration and nature of their Personal Circumstances and how these circumstances affected their performance.

In considering examination results and progress requirements, the Board of Examiners is concerned to take into account medical or other circumstances which may have adversely affected a student’s performance. If a student does not submit Personal Circumstances via Pegasus, they will not be considered by the Exam Board.

In **NO** cases will a notification of Personal Circumstances be accepted after the Personal Circumstances Board has met, and students may not appeal if they fail to report circumstances prior to examination boards. Students should provide information on adverse circumstances both to their Adviser of Study and to Student Experience. They may also find it useful to arrange to see their Personal Development Adviser.

Please refer to the University policy on Personal Circumstances and Appeals to more information www.strath.ac.uk/media/ps/strategyandpolicy/PersCircs_AcademicAppeals_Aug2013_v1_1.pdf
Academic Dishonesty

to be read in conjunction with University Regulations 5.4 and 5.6

The University regards academic dishonesty as a serious matter and it can, in some cases, lead to formal proceedings being brought against a student under the University’s Student Discipline Procedure. As such, it can carry heavy penalties and it is therefore important that you are aware of what is expected (or not expected) of you as part of the academic community and about what constitutes academic dishonesty..

Examples of Academic Dishonesty

Cheating in written exams:

- Illicit copying and communicating;
- Possession of prohibited materials
- Unapproved use of electronic devices to store and retrieve information

False candidature or impersonation

- Impersonating another student in an examination or engaging someone else to take one’s place in an examination;
- Undertaking a piece of coursework for another student or engaging someone else to undertake a piece of coursework in one’s place

False declaration

- Making a false declaration in order to retrieve special consideration by an Examination Board/Committee or Appeals Committee or to obtain extensions to deadlines or exemption from work.

Fabrication or falsification of data/experimental results/statistics/references

- Presentation of data, experimental results, statistics or references in laboratory reports, essays, projects, presentations, dissertation, theses or other assessed work which have been invented or altered by the student

Plagiarism

- Using someone else’s work (ie words, ideas, results, tables or diagrams) whether taken from print, electronic or internet sources without acknowledging whether by direct copying, paraphrasing or summarizing.

Duplication

- Submitting the same piece of work for two different assignments/degree programmes – even though it is the student’s own work which is being reproduced this is a form of plagiarism and should be treated as such.

Collusion

- Agreeing with another student either to submit work produced collaboratively or to copy the other student’s work. This is a form of plagiarism in which the individual whose work is being plagiarised gives consent for this to happen. In such cases both parties are committing an offence.
Academic Appeals Procedure

Procedures for academic appeals to Faculty and Senate Appeal Committees may be found in University Regulations set down in the Calendar and Faculty guidelines - www.strath.ac.uk/media/ps/strategyandpolicy/PersCircs_AcademicAppeals_Aug2013_v1_1.pdf

The grounds for appeal are given below.

Appeals against a decision of a Board of Examiners must be made on at least one of the following grounds: (Please note: evidence should be provided for all grounds cited.)

- procedural irregularities in the assessment process (including alleged administrative error which could have led the Board of Examiners to reach a different conclusion to that which they might have reached had the error not been made);
- inadequate assessment, prejudice or bias on the part of the examiners; and/or
- You were adversely affected by illness or other relevant factors, of which you were previously unaware, or which for a good reason you were unable to disclose to the examiners in advance.

Any such appeal should be submitted in writing to the Faculty Manager by the deadline stated in the formal examination results letter. Appeals submitted after the appropriate deadline will not be considered unless there are compelling reasons for missing the deadline and these are explained in full and accompanied by the relevant evidence at the time of submission. Appeals received twelve months or more after the date of the relevant Board of Examiners will not be considered in any circumstances.

Students have the ultimate right of appeal to Senate.

Attendance and Performance

Your attention is drawn to the following regulation taken from General Regulations which can be found at: http://www.strath.ac.uk/educationstrategy/gmpt/qualityenhancement/universityregulations/

Regulation 15.1.12

Every applicant admitted to a course of study shall be required to attend regularly and to perform satisfactorily the work of each class in their curriculum.

Students have an obligation to inform the University Student Experience – Student Business at the first reasonable opportunity of any medical or other circumstances which might adversely affect their attendance, performance and/or ability to study.

A student who, in the opinion of the Head(s) of the Department(s) (or nominees(s)) offering a class, does not satisfy the requirements as to attendance and to performance and having been informed in writing, shall not be entitled to take the examination in the subject of that class. The names of such students shall be reported immediately to the relevant Board of Study.

A registered student may subsequently be permitted by the Head of Department to take the examination in the subject of the class at the next available opportunity subject to satisfactory completion of appropriate coursework.

These regulations will be applied to all Engineering classes (this includes laboratories, design classes, works visits, etc., as well as formal lectures and tutorials). Staff responsible for each class will monitor attendance as appropriate.

The regulations are emphasised for the simple reason that they are in the students’ interests. Poor attendance makes the course more difficult for you and is usually associated with poor performance. If a student has to miss classes for any good reason (medical, domestic, etc) he/she must inform their Year Adviser in writing.

We do not interpret regular attendance as necessarily meaning 100% attendance. An
occasional missed lecture, for example, is not a problem. Staff responsible for each class will make it clear if your attendance is heading towards a problem with regard to regulation 15.1.12.

Change of Address

Students are required by Regulation 6.4.9 to notify Student Experience of any change in your permanent home or term-time addresses. Student Experience sends at least four letters to each undergraduate student every year. It is therefore important that they have the correct home and term-time addresses. These letters advise students of their academic progress, provide an opportunity for students to check their undergraduate curriculum, and where applied for may assist the student to claim exemption from the Council Tax. Students can update their personal details on the University website http://pegasus.strath.ac.uk

Personal Development Scheme

A student Personal Development Scheme exists within the Faculty of Engineering, the objectives of which are to create an environment where students are able to discuss freely and in confidence any academic or personal matter. Staff can provide advice either personally or, if the student is agreeable, through another specialist member of staff. Few students encounter substantial difficulties but for those who do it is hoped that the scheme will ensure their academic welfare and encourage satisfactory progress with their studies.

The success of the scheme depends on the participation of both staff and students. Students are encouraged to see their Personal Development Adviser at least once every semester, even if only to confirm that all is well.

Equality and Diversity

The University of Strathclyde is committed to achieving and promoting equality of opportunity in the learning, teaching, research and working environments.

We value the diversity of our students and support the development of mutual respect and positive relations between people.

The University has in place an Equality Policy, Disability Policy and Equality Outcomes which meet the requirements the Equality Act 2010.

You are advised to familiarise yourself with the University approach to equality and diversity and relevant developments and information by visiting the website:

www.strath.ac.uk/equalitydiversity/equalityinformationforstudents/

It is important that you understand your rights and responsibilities. Any discriminatory practice, including cyber bullying, on your part may lead to the University initiating disciplinary action.

If you have any queries please bring these to the attention of staff or the University's Equality and Diversity office.

Email: equalopportunities@strath.ac.uk
Telephone: 0141 548 2811
www.strath.ac.uk/equalitydiversity/

Athena SWAN

The University currently holds a Bronze Athena SWAN award, recognising our commitment to advancing women's careers in science, technology, engineering, maths and medicine (STEMM) employment in academia.

The Athena SWAN Charter has been developed by the Equality Challenge Unit to encourage and recognise commitment to combating the under-representation of women in STEMM research and academia.
If you would like any additional information, please contact the Equality and Diversity office.

Students with disabilities

The University is committed to providing an inclusive learning and working environment for disabled people.

If you have, or think you have, a disability we encourage you to disclose it as soon as possible. Declaring your disability will enable you to access any additional support that you may need and help to ensure you become a successful student. The information you provide will be treated as confidential and will not be shared with other staff without your consent.

The University has a dedicated Disability Service that offers specific advice, information and assistance to disabled students, including information on the Disabled Students Allowance (DSA). Further information is available from the website: www.strath.ac.uk/disabilityservice/

In addition, each academic Department/ School (for HaSS) has at least one Departmental Disability Contact (DDC), who act as a first point of contact for disabled students. The Departmental Disability Contact list is available on the website at: www.strath.ac.uk/disabilityservice/ddc/

Please inform your course tutor, the DDC and a member of the Disability Service of your needs as soon as possible. The Disability Service will then formally communicate your needs to your Department/ School.

Email: disabilityservice@strath.ac.uk
Telephone: 0141 548 3402
www.strath.ac.uk/disabilityservice

Issues with Physical Access on campus

If you experience an issue with physical access anywhere on campus, please email: physicalaccess@strath.ac.uk where a member of Estates staff will be able to help.

Classroom Protocol

At the University we are committed to providing a safe learning environment where dignity is respected and discrimination or harassment, including cyber bullying does not occur on the basis of age, disability, gender reassignment, marriage and civil partnership, pregnancy and maternity, race, religion or belief, sex, sexual orientation and socio-economic background. No student should intentionally be made to feel threatened or excluded from class participation.

You are reminded of your responsibility to show respect to fellow classmates and staff by remembering the following protocol for the duration of your studies:

- Attend all scheduled lectures/ seminars and/ or practical sessions such as labs, including any additional learning and teaching sessions.
- Arrive on time and remain in class until the end of the session. If you need to leave early for any reason, please notify the tutor at the beginning or prior to the class.
- Do not disrupt the class by habitually coming in late or coming and going from the classroom during the session. Students arriving late, without justified reasons, may be refused entry.
- Refrain from consistently interrupting another speaker and listen to the ideas of others with respect. Do not be rude or make personal attacks on individuals during group discussions.
- Inform and establish consent of the tutor if you wish to record the lecture. The recording must be used only for personal study.
Do not bring food into the classroom, other than for medical reasons, e.g. diabetes. Beverages may be permissible at the tutor’s discretion if the room utilisation rules allow.

Inform tutors of specific requirements for example the need to perform prayers for practising students of diverse faiths.

Seek consent of students and staff before taking any photos, audio or visual recordings in the classroom. These must not be shared on any social network sites without permission.

At any course related external visit you are acting as ambassadors of the University and are reminded to act as such.

Refrain from smoking on premises as this is prohibited in all University buildings.

Follow emergency instructions and health and safety procedures.

Should you have any concerns please bring them to the attention of your tutor and/or appropriate University staff.

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### Examination Information

#### Examination Boards

There are two types of Examination Board: the Final Year ‘Honours’ Board and the General Board.

The Final Year (or ‘Honours’) Board of Examiners meets in June to review the performance of all final year students. A decision is made at the Board on the class of degree to be awarded to each student. Subsequent to the meeting of the Final Year Board results are made available to individual students via PEGASUS.

The MEng may be awarded ‘with Distinction’ or ‘with Merit’.

Students can graduate from the BEng degree with one of five classifications of degrees:
- First Class Honours
- Second Class Honours (Upper Division)
- Second Class Honours (Lower Division)
- Third Class Honours
- Pass

The General Board of Examiners considers the performance of all students other than those in the final year. The General Board meets first in late June, and analyses students’ performance in all degree examinations (whether taken in the First or Second Semester). The Board makes one of the following decisions:

**A Clear Pass**  The student has no re-sits and should proceed to the next year of study.

**May Proceed**  The student may proceed to the next year of the course, but should take re-sits in those classes which (s)he has failed.

**Withdraw**  The student will be instructed to withdraw from the course.

**Re-sit** (June Board only). The student should take re-sit examinations in August, after which a decision will be made on possible progress to the next year of study.

**Do Not Proceed** (September Board only). The student has not satisfied the requirements for progress to the next year of his/her course and will be required to enter academic suspension. (S)he may take re-sit examinations in the coming Session.
Re-attend The student has not satisfied the requirements for progress to the next year of his/her course. (S)he is required to re-attend the current year (for which the standard tuition fee will be charged) before a further decision will be made by the Board regarding progress.

Overseas Semester(s) (June Board only): the student has taken part in an overseas exchange and some or all of his/her marks are not yet available.

Unusual circumstances dictate that the student should receive a Special Letter, outlining his/her academic position as determined by the Examiners.

Transfer - The student will be transferred to another course. This can be qualified by a decision of:

Transfer + Suspend or Transfer and Resit.

An MEng or BEng Honours student may be transferred from an MEng to BEng Hons stream or from a BEng Hons to BEng Pass stream if the student is not performing at a high enough level.

In addition to making one of the decisions above, the Board may decide:

Either
i to caution a student whose performance has been poor. In this case, the Faculty Manager or other attending administrator will inform the student that this poor performance gives cause for concern, and advise him/her to consult his/her Personal Development Adviser.

or
ii to warn a student that (s)he has almost exhausted their attempts at a class and that (s)he will have just one further opportunity to obtain a pass.

Examinations and Resit Attempts
If a student does not pass a particular examination then it is essential to resit outstanding examinations at the next examination diet or at the next available opportunity (or complete supplementary work to a satisfactory standard) so that eventually the total credits required for the final degree can be accumulated.

Note that although Examination Boards normally allow undergraduates two attempts to gain a particular credit (or submit supplementary work), such attempts must be at two consecutive offerings of the examination. It should also be noted that the marks used to determine the final honours or MEng grading are based on those obtained at the first examination attempt.

Use of Calculators in Examinations
The introduction into the examination room and the use of calculators, computers and similar items is permissible only if they are used in a way compatible with Regulations 4.3.1 and 4.3.4 (see below). Candidates are not permitted to share the use of such items.

Regulation 4.3.1. “Communication between candidates, or between a candidate and anyone other than an examiner or invigilator, is forbidden during an examination”.

Regulation 4.3.4 “Candidates are permitted to introduce into the examination room only the following items of a learning or reference nature:

i) dictionaries as permitted by Regulation 4.2:

ii) material identified on the relevant question paper as necessary or permissible:

iii) material certified as permissible to meet a special academic or physical need”.

Examinations Outwith the University

It is a University Regulation (4.1.3) that “All examinations shall take place at the University, or in the case of a class taught elsewhere, at the appropriate learning centre. In exceptional circumstances and at the request of the Head of Department responsible for the candidate’s course of study, the Director of Corporate Services may authorise arrangements for examinations to be held elsewhere, subject to the payment by the candidate of any necessary costs.”

All students are expected to attend for examination at the University of Strathclyde on the dates and times posted. Only exceptionally will permission be given for students to sit examinations outwith the University. Please also see the entry in Section 1 regarding this issue.

Faculty Compensation Scheme

The Faculty operates a Compensation Scheme which is designed to assist Boards of Examiners to take decisions about student progress at the end of each of the first, second and third years of undergraduate study and the first four years of an integrated Masters degree. Fail marks in the range 30–39% may be eligible for compensation under the scheme and converted to a pass provided the weighted credit average across the students prescribed curriculum is 45% or higher. Up to 20 credits may be compensated in this way. The scheme can be applied only to the student’s first attempts and, therefore, is normally used only at the June meetings of the Boards of Examiners when the results from the January and May/June degree examinations are considered. Marks of N + a mark (i.e. where there is an exam result but missing coursework) are not eligible for compensation.

Faculty Office

The Faculty Office for Engineering is located on Level 5 of the Royal College. The Faculty Manager can be consulted for advice on submitting letters of appeal.

<table>
<thead>
<tr>
<th>Role</th>
<th>Name</th>
<th>Phone</th>
<th>Email</th>
</tr>
</thead>
<tbody>
<tr>
<td>Faculty Manager</td>
<td>Gayle Wilson</td>
<td>548 2364</td>
<td><a href="mailto:gayle.wilson@strath.ac.uk">gayle.wilson@strath.ac.uk</a></td>
</tr>
<tr>
<td>Faculty Officer (Academic)</td>
<td>Gabrielle Weir</td>
<td>548 4158</td>
<td><a href="mailto:gabrielle.weir@strath.ac.uk">gabrielle.weir@strath.ac.uk</a></td>
</tr>
<tr>
<td>Faculty Admin Assistant</td>
<td>Andrea Roy</td>
<td>548 2749</td>
<td><a href="mailto:andrea.roy@strath.ac.uk">andrea.roy@strath.ac.uk</a></td>
</tr>
</tbody>
</table>

Faculty Policy of Teaching and Learning

The Faculty of Engineering adheres to all the University policies, procedures and guidelines on undergraduate and postgraduate teaching and learning that can be found at http://www.strath.ac.uk/educationstrategy/gmpt/qualityenhancement/universityregulations/

In addition the Faculty has an excellent reputation for innovation in teaching and learning and examples of this can be found in all Departments. In 2004 the Faculty had extensive consultations with students drawn from the majority of Departments and this has resulted in the following Faculty policies being endorsed by the Board of Study for implementation in academic year 2006-07 onwards.

1. Departments should ensure coursework is returned to students within the semester and ideally within 2 weeks from the submission date.

2. Worked examples to past examination papers should be provided.

3. Learn Online should continue to be developed and staff should be encouraged to undertake training and move to wider usage.

4. Industrial lectures should be quality checked and only included where the material is clearly related to course content.

5. Industrial visits should be focused on application, clearly structured with explicit expectations and outcomes, and subject to evaluation.
Fee Payments and Grants

UK students applying for support from the Student Awards Agency for Scotland (SAAS) or a Local Education Authority (LEA) are expected to submit applications to the relevant award agency at the earliest opportunity.

Students from the European Union registered for an undergraduate degree course can also apply to the SAAS for fee support, but are not able to apply for UK student loans.

Graduation

Award Ceremonies (or Congregations) are held in June/July and October/November each year. All students hoping to graduate or be presented must enroll to graduate by completing a form and paying the appropriate fee. Details of the ceremonies and enrolment forms are usually available from Student Experience in March each year.

Student Experience

Student Experience is based on Level 1 of the McCance Building. All changes to classes/courses must be notified to Student Experience. Student Experience hours of opening are:

Monday-Friday: 1000 to 1600 hours

Out-with these times, information and forms are available on a stand outside Student Experience and much of the information/forms you may require are available on the Student Experience website at:

http://www.strath.ac.uk/sees/

Sponsorship

Student sponsorship is reasonably common within the Departments in the Engineering Faculty - http://www.strath.ac.uk/engineering/scholarships/. The advantage of sponsorship is that a company will usually supplement a student’s income and offer employment in the summer vacation; there may also be the possibility of graduate employment on completion of his/her studies. Students in 1st, 2nd or 3rd year may find it worthwhile to spend some time identifying companies willing to offer sponsorship. Look out for companies advertising that they operate a sponsorship scheme – check the notices in the Departments, the Careers Library or newspapers. If you are unsure whether a particular company operates a sponsorship scheme, write to their Human Resources Manager, requesting information.

Student Complaints

Please refer to the website for the new complaints procedure.

http://www.strath.ac.uk/staff/policies/academic
Overseas Study

Please also refer to Study Abroad in Section 1 of this handbook.

Erasmus
Strathclyde is a leading participant in the ERASMUS programme. Under this programme the student can apply to spend a minimum of 3 months or up to a maximum of a full academic year of his/her course as an exchange student at a partner university in Europe. Approximately 50 Strathclyde students participate in Erasmus exchange each year, mostly during their third year.

If students are interested in this opportunity they should contact their department to find out if it participates in the programme and what options are open to them.

International Student Exchange Programme
Strathclyde students have the opportunity to spend a year of their degree as exchange students at universities in the USA or Canada. This can be as part of an individual exchange agreement between Strathclyde and a North American University.

Please contact Allison Handley in the Recruitment & International Office for further details.

Singapore Exchange Programme
The University of Strathclyde has an exchange agreement with Nanyang Technological University (NTU) in Singapore which allows students from the Faculty of Engineering and Strathclyde Business School to apply for a year or a semester at NTU. Any student wishing to apply should contact Dr Siew, Department of Electronic and Electrical Engineering.

Study in Australia
To find out more about an exchange at Queensland University of Technology, Brisbane, Australia please contact Allison Handley in the Recruitment & International Office.
Section 3

Educational Aims & Course Regulations
The educational aims communicated to students via course literature indicate that the course is designed to graduate qualified professional engineers and that a student will:

Develop the capacity to learn independently and to master new ideas and technologies.

Increase skills in communicating and working effectively with others – individually and in teams.

Develop a sound working knowledge of the fundamentals of systems and processes, which are generally recognised to be in the domain of mechanical engineering and related subjects.

Develop the ability to understand, model and predict the behaviour of engineering artefacts through the application of mathematical, scientific and technological principles.

Be provided with extensive practice in creating new engineering solutions, adapting old ones, and in using acquired knowledge in materials, energy systems, manufacture and computer-aided design techniques.

Practice formulating, monitoring and adjusting project plans in the light of changing circumstances.

Develop an understanding of financial, organisational and strategic aspects of engineering businesses.

Have as many opportunities as practicable to follow special interests and activities during the programme.

Have the opportunity to develop foreign language capabilities.

Grow to understand his/her place as a professional engineer within engineering and the wider community.

Meet the Educational Base requirements for eventual registration as a Chartered Engineer.
11.47 Department of Mechanical & Aerospace Engineering

Mechanical Engineering

BEng with Honours in Aero-Mechanical Engineering
BEng with Honours in Mechanical Engineering
BEng with Honours in Mechanical Engineering with International Study
BEng in Mechanical Engineering
Diploma of Higher Education in Mechanical Engineering
Certificate of Higher Education in Mechanical Engineering

Course Regulations [These regulations are to be read in conjunction with Regulation 11.1]

Status of the Courses
11.47.1 All students are normally admitted in the first instance as potential Honours students. Transfer between these courses is possible prior to the third year of study. Transfer to the MEng degree courses in Mechanical Engineering, Mechanical Engineering with International Study and Aero-Mechanical Engineering is possible prior to the fourth year of study subject to satisfying the appropriate progress requirements.

Mode of Study
11.47.2 The courses are available by full-time study only.

Place of Study
11.47.3 The BEng course in Mechanical Engineering with International Study requires study at an approved institution abroad. Such study will normally extend over a minimum period of 30 weeks.

Curriculum
First Year
11.47.4 All students shall undertake classes amounting to 120 credits as follows:

<table>
<thead>
<tr>
<th>Compulsory Classes</th>
<th>Level</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>16 132 Engineering Mechanics 1</td>
<td>1</td>
<td>20</td>
</tr>
<tr>
<td>16 165 Engineering Analysis 1</td>
<td>1</td>
<td>10</td>
</tr>
<tr>
<td>EE 108 Electrical Circuits</td>
<td>1</td>
<td>10</td>
</tr>
<tr>
<td>ME 101 Heat and Flow 1</td>
<td>1</td>
<td>10</td>
</tr>
<tr>
<td>ME 105 Mechanical Engineering Design</td>
<td>1</td>
<td>20</td>
</tr>
<tr>
<td>ME 107 Experimental and Laboratory Skills</td>
<td>1</td>
<td>10</td>
</tr>
<tr>
<td>MM 117 Mathematics 1M</td>
<td>1</td>
<td>20</td>
</tr>
</tbody>
</table>

Elective Class(es) 20

Second Year
11.47.5 All students shall undertake classes amounting to 120 credits as follows:

<table>
<thead>
<tr>
<th>Compulsory Classes</th>
<th>Level</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>16 232 Engineering Mechanics 2</td>
<td>2</td>
<td>20</td>
</tr>
<tr>
<td>16 288 Professional Studies</td>
<td>2</td>
<td>10</td>
</tr>
<tr>
<td>19 222 Electrical Machines and Control</td>
<td>2</td>
<td>10</td>
</tr>
<tr>
<td>56 208 Design and Engineering Applications 2</td>
<td>2</td>
<td>10</td>
</tr>
<tr>
<td>ME 203 Heat and Flow 2</td>
<td>2</td>
<td>20</td>
</tr>
<tr>
<td>ME 209 Mathematical Modelling and Analysis</td>
<td>2</td>
<td>20</td>
</tr>
<tr>
<td>ME 212 Materials Engineering and Design</td>
<td>2</td>
<td>10</td>
</tr>
</tbody>
</table>

together with classes appropriate to the chosen course:

Aero-Mechanical Engineering
16 231 Flight and Spaceflight 1 2 10
ME 201  Aero Design and Flight Test  2  10

**Mechanical Engineering**

**Mechanical Engineering with International Study**

Elective Class(es)  20

Students wishing to obtain credits for participation on a Vertically Integrated Project (VIP) shall replace ME 208 Design and Engineering Applications 2 with:

- VP 201  Vertically Integrated Project 201  2  10
- or
- VP 202  Vertically Integrated Project 202  2  10

**Third Year**

11.47.6  All students shall undertake classes amounting to 120 credits as follows:

<table>
<thead>
<tr>
<th>Compulsory Classes</th>
<th>Level</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>16 327  Structural Mechanics</td>
<td>3</td>
<td>10</td>
</tr>
<tr>
<td>16 361  Dynamics and Control</td>
<td>3</td>
<td>20</td>
</tr>
<tr>
<td>16 363  Engineering Analysis 3</td>
<td>3</td>
<td>20</td>
</tr>
<tr>
<td>ME 301  Heat and Flow 3</td>
<td>3</td>
<td>20</td>
</tr>
<tr>
<td>ME 415  Strategic Analysis of Engineering Business Case Studies</td>
<td>4</td>
<td>10</td>
</tr>
<tr>
<td>ME 416  Engineering Ethics</td>
<td>4</td>
<td>10</td>
</tr>
</tbody>
</table>

together with classes appropriate to the chosen course:

**Aero-Mechanical Engineering**

- 16 351  Flight and Spaceflight 2  3  10
- 16 309  Aero-Design 2  3  20

**Mechanical Engineering**

**Mechanical Engineering with International Study**

- ME 312  Mechanical Design 3A  3  10
- ME 313  Mechanical Design 3B  3  20

**Mechanical Engineering with International Study**

All students are normally required to undertake study abroad at an approved institution and shall follow an approved curriculum reflecting that undertaken by students taking the Mechanical Engineering course. Such study will normally extend over a minimum period of 30 weeks.

Students wishing to obtain credits for participation on a Vertically Integrated Project (VIP) shall replace ME 415 Strategic Analysis of Engineering Business Case Studies with:

- VP 301  Vertically Integrated Project 301  3  10
- or
- VP 302  Vertically Integrated Project 302  3  10

**Fourth Year**

11.47.7  All students shall undertake classes amounting to 120 credits as follows:

<table>
<thead>
<tr>
<th>Compulsory Classes</th>
<th>Level</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>16 402  Case Studies in Engineering</td>
<td>4</td>
<td>10</td>
</tr>
<tr>
<td>16 429  Computer Aided Engineering Design</td>
<td>4</td>
<td>20</td>
</tr>
<tr>
<td>ME 403  Engineering Materials Selection</td>
<td>4</td>
<td>10</td>
</tr>
<tr>
<td>ME 405  Heat and Flow 4</td>
<td>4</td>
<td>10</td>
</tr>
</tbody>
</table>
ME 409 Individual Project*  
ME 414 Advanced Mechanics and Dynamics  

Together with classes appropriate to the chosen course:

**Aero-Mechanical Engineering**

ME 410 Aerodynamic Performance  

**Mechanical Engineering**

**Mechanical Engineering with International Study**

ME 404 Energy Systems Modelling  

* For students registered for Aero-Mechanical Engineering, class ME 409 Individual Project shall be on an Aero-related topic.

ME409 Individual Project can be used to contribute towards a Vertically Integrated Project (VIP).

**Progress**

11.47.8 Progress to a period of study abroad is dependent on passing all compulsory classes. A student registered for the Mechanical Engineering with International Study course who does not meet this requirement at this stage will be required to transfer to another course.

11.47.9 In order to progress to the second year of the course, a student must have accumulated at least 100 credits from the course curriculum.

11.47.10 In order to progress to the third year of the course, a student must have accumulated at least 220 credits from the course curriculum.

11.47.11 In order to progress to the fourth year of the chosen course, a student must have accumulated at least 360 credits from the course curriculum.

**Final Assessment and Honours Classification**

The final Honours classification will normally be based on the first assessed attempt at compulsory and specified optional classes taken in the second, third and fourth years.

**Award**

11.47.13 **BEng with Honours:** In order to qualify for the award of the degree of BEng with Honours in the chosen course, a candidate must have accumulated no fewer than 480 credits from the course curriculum including those for the classes 16402 Case Studies in Engineering and ME 409 Individual Project, which in the case of the BEng with Honours in Aero-Mechanical Engineering must normally be on an aero-related topic.

11.47.14 In order to qualify for the award of BEng with Honours in Mechanical Engineering with International Study, in addition to satisfying the provisions of Regulation 11.47.14, a student must normally have spent no fewer than 30 weeks of approved study abroad.

11.47.15 **BEng:** In order to qualify for the award of the degree of BEng in Mechanical Engineering, a candidate must have accumulated no fewer than 360 credits from the course curriculum.

11.47.16 **Diploma of Higher Education:** In order to qualify for the award of a Diploma of Higher Education in Mechanical Engineering a candidate must have accumulated no fewer than 240 credits from the course curriculum.

11.47.17 **Certificate of Higher Education:** In order to qualify for the award of a Certificate of Higher Education in Mechanical Engineering, a candidate must have accumulated no fewer than 120 credits from the course curriculum.

**Transfer**

11.47.18 A candidate who fails to satisfy the progress or award requirements for the BEng in Mechanical Engineering or BEng in Aero-Mechanical Engineering may be transferred to the degree of BEng in Engineering Studies.
12.47 Department of Mechanical Engineering

Mechanical Engineering

MEng in Aero-Mechanical Engineering
MEng in Mechanical Engineering
MEng in Mechanical Engineering with Aeronautics
MEng in Mechanical Engineering with Automotive Engineering
MEng in Mechanical Engineering with Financial Management
MEng in Mechanical Engineering with Materials Engineering
MEng in Mechanical Engineering with International Study

Note: The MEng in Mechanical Engineering with Automotive Engineering is available only to students registered prior to session 2010/11

Course Regulations [These regulations are to be read in conjunction with Regulation 12.1]

Status of the Courses
12.47.1 The courses are at Integrated Masters level. Transfer to the BEng degree in Mechanical Engineering or to the BEng with Honours degrees in Aero-Mechanical Engineering, Mechanical Engineering or Mechanical Engineering with International Study is possible at any time subject to satisfying the appropriate progress requirements. Transfer between the MEng degrees may be possible at any time prior to the fourth year of study.

Mode of Study
12.47.2 The courses are available by full-time study only.

Place of Study
12.47.3 The MEng in Mechanical Engineering with International Study requires study at an approved institution abroad. Such study will normally extend over a minimum period of 30 weeks.

Curriculum
First Year
12.47.4 All students shall undertake classes amounting to 120 credits as follows:

<table>
<thead>
<tr>
<th>Compulsory Classes</th>
<th>Level</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>16 132 Engineering Mechanics 1</td>
<td>1</td>
<td>20</td>
</tr>
<tr>
<td>16 165 Engineering Analysis 1</td>
<td>1</td>
<td>10</td>
</tr>
<tr>
<td>EE 108 Electrical Circuits</td>
<td>1</td>
<td>10</td>
</tr>
<tr>
<td>ME 101 Heat and Flow 1</td>
<td>1</td>
<td>10</td>
</tr>
<tr>
<td>ME 105 Mechanical Engineering Design</td>
<td>1</td>
<td>20</td>
</tr>
<tr>
<td>ME 107 Experimental and Laboratory Skills</td>
<td>1</td>
<td>10</td>
</tr>
<tr>
<td>MM 117 Mathematics 1M</td>
<td>1</td>
<td>20</td>
</tr>
</tbody>
</table>

Elective Class(es)                                       |       | 20      |

Second Year
12.47.5 All students shall undertake classes amounting to 120 credits as follows:

<table>
<thead>
<tr>
<th>Compulsory Classes</th>
<th>Level</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>16 232 Engineering Mechanics 2</td>
<td>2</td>
<td>20</td>
</tr>
<tr>
<td>16 288 Professional Studies</td>
<td>2</td>
<td>10</td>
</tr>
<tr>
<td>19 222 Electrical Machines and Control</td>
<td>2</td>
<td>10</td>
</tr>
<tr>
<td>56 208 Design and Engineering Applications 2</td>
<td>2</td>
<td>10</td>
</tr>
<tr>
<td>ME 203 Heat and Flow 2</td>
<td>2</td>
<td>20</td>
</tr>
<tr>
<td>ME 209 Mathematical Modelling and Analysis</td>
<td>2</td>
<td>20</td>
</tr>
<tr>
<td>ME 212 Materials Engineering and Design</td>
<td>2</td>
<td>10</td>
</tr>
</tbody>
</table>
together with classes appropriate to the chosen course:

**Mechanical Engineering**
**Mechanical Engineering with International Study**
**Mechanical Engineering with Materials Engineering**
Elective Class(es) 20

**Aero-Mechanical Engineering**
**Mechanical Engineering with Aeronautics**
16 231  Flight and Spaceflight 1 2 10
ME 201  Aero Design and Flight Test 2 10

**Mechanical Engineering with Automotive Engineering**
16 263  Automotive Systems 1 2 10
Elective Class 10

**Mechanical Engineering with Financial Management**
AG 151  Introduction to Finance and Accounting 1 20

Students wishing to obtain credits for participation on a Vertically Integrated Project (VIP) shall replace 56 208 Design and Engineering Applications 2 with:

VP 201  Vertically Integrated Project 201 2 10
or
VP 202  Vertically Integrated Project 202 2 10

**Third Year**
12.47.6 All students shall undertake classes amounting to 120 credits as follows:

<table>
<thead>
<tr>
<th>Compulsory Classes</th>
<th>Level</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>16 327 Structural Mechanics</td>
<td>3</td>
<td>10</td>
</tr>
<tr>
<td>16 361 Dynamics and Control</td>
<td>3</td>
<td>20</td>
</tr>
<tr>
<td>16 363 Engineering Analysis 3</td>
<td>3</td>
<td>20</td>
</tr>
<tr>
<td>ME 301 Heat and Flow 3</td>
<td>3</td>
<td>20</td>
</tr>
<tr>
<td>ME 415 Strategic Analysis of Engineering Business Case Studies</td>
<td>4</td>
<td>10</td>
</tr>
<tr>
<td>ME 416 Engineering Ethics</td>
<td>4</td>
<td>10</td>
</tr>
</tbody>
</table>

together with classes appropriate to the chosen course:

**Aero-Mechanical Engineering**
**Mechanical Engineering with Aeronautics**
16 351  Flight and Spaceflight 2 3 10
16 309  Aero- Design 2 3 20

**Mechanical Engineering**
**Mechanical Engineering with Automotive Engineering**
**Mechanical Engineering with Financial Management**
**Mechanical Engineering with Materials Engineering**
**Mechanical Engineering with International Study**

ME 312  Mechanical Design 3A 3 10
ME 313  Mechanical Design 3B 3 20

**Mechanical Engineering with International Study**
Students who elect to undertake study abroad in their third year must do so at an approved institution and shall follow an approved curriculum reflecting that undertaken by students taking the Mechanical Engineering course. Such study will normally extend over a minimum period of 30 weeks.
Students wishing to obtain credits for participation on a Vertically Integrated Project (VIP) shall replace ME415 Strategic Analysis of Engineering Business Case Studies with:

VP 301 Vertically Integrated Project 301 3 10
or
VP 302 Vertically Integrated Project 302 3 10

**Fourth Year**

12.47.7 All students will undertake classes amounting to 120 credits as follows:

<table>
<thead>
<tr>
<th>Compulsory Classes</th>
<th>Level</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>16 402 Case Studies in Engineering</td>
<td>4</td>
<td>10</td>
</tr>
<tr>
<td>16 429 Computer Aided Engineering Design</td>
<td>4</td>
<td>20</td>
</tr>
<tr>
<td>ME 403 Engineering Materials Selection</td>
<td>4</td>
<td>10</td>
</tr>
<tr>
<td>ME 405 Heat and Flow 4</td>
<td>4</td>
<td>10</td>
</tr>
<tr>
<td>ME 409 Individual Project*</td>
<td>4</td>
<td>40</td>
</tr>
<tr>
<td>ME 414 Advanced Mechanics and Dynamics</td>
<td>4</td>
<td>20</td>
</tr>
</tbody>
</table>

together with classes appropriate to the chosen course:

**Aero-Mechanical Engineering**

**Mechanical Engineering with Aeronautics**

ME 410 Aerodynamic Performance 4 10

**Mechanical Engineering**

**Mechanical Engineering with Automotive Engineering**

**Mechanical Engineering with Financial Management**

**Mechanical Engineering with Materials Engineering**

**Mechanical Engineering with International Study**

ME 404 Energy Systems Modelling 4 10

* For students registered for Aero-Mechanical Engineering class ME 409 Individual Project shall be on an Aero-related topic.

ME409 Individual Project can be used to contribute towards a Vertically Integrated Project.

**Fifth Year**

12.47.8 All students, with the exception of those following the Mechanical Engineering with International Study course who elect to spend fifth year of studies abroad, shall undertake 120 level 5 credits as follows:

Students following the Mechanical Engineering with International Study course, who do not elect to spend their fifth year of studies abroad will also follow the diet of compulsory and optional classes below.

**Compulsory Class**

ME 519 Group Project* 5 40

* For students registered for Aero-Mechanical Engineering the ME 519 Group Project shall be on an Aero-related topic.

ME519 Group Project can be used to contribute towards a Vertically Integrated Project.

together with classes appropriate to the chosen course:

**Aero-Mechanical Engineering**

Compulsory Classes
ME 501  Systems Engineering 1  5  10
16 599  Aerodynamic Propulsion Systems  5  10
together with optional classes chosen from Regulation 12.47.9

**Mechanical Engineering**

**Mechanical Engineering with Aeronautics**

**Mechanical Engineering with International Study**

Compulsory Classes
ME 501  Systems Engineering 1  5  10
together with optional classes chosen from Regulation 12.47.9

**Mechanical Engineering with Automotive Engineering**

Compulsory Classes
ME 505  Machine Dynamics  5  10
ME 518  Topics in Automotive Engineering  5  10
together with optional classes chosen from Regulation 12.47.9

**Mechanical Engineering with Financial Management**

Compulsory Class
ME 515  Finance for Mechanical Engineers  5  60
together with optional classes chosen from Regulation 12.47.9

**Mechanical Engineering with International Study**

Students who elect to undertake their period of study abroad in fifth year must do so at an institution acceptable to the Head of Department and shall follow an approved curriculum, which must include the equivalent of ME 519 Group Project and the equivalent Level 5 content required for award of the degree.

**Mechanical Engineering with Materials Engineering**

No fewer than 20 credits from the classes in List A below:

16 565  Engineering Composites  5  10
ME 523  Polymer and Polymer Composites  5  10
ME 931  Industrial Metallurgy  5  10

together with optional classes chosen from Regulation 12.47.9

12.47.9 **Optional Classes**

16 565  Engineering Composites  5  10
16 587  Pressurised Systems  5  10
16 599  Aerodynamic Propulsion Systems  5  10
ME 501  Systems Engineering 1  5  10
ME 502  Systems Engineering 2  5  10
ME 505  Machine Dynamics  5  10
ME 507  Machinery Diagnosis and Condition Monitoring  5  10
ME 511  Mathematical Modelling in Engineering Science  5  10
ME 512  Spaceflight Mechanics  5  10
ME 514  Advanced Topics in Fluid Systems Engineering  5  10
ME 517  Spaceflight Systems  5  10
ME 520  Advanced Research Project A  5  10
ME 521  Advanced Research Project B  5  20
ME 523  Polymer and Polymer Composites  5  10

Exceptionally, such other level 5 classes totalling no more than 20 credits as approved by the Course Director.
12.47.10 **Class Combinations**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>ME 515</td>
<td>Finance for Mechanical Engineers</td>
<td>60</td>
</tr>
</tbody>
</table>

**Progress**

12.47.11 Progress to a period of study abroad is dependent on passing all compulsory classes. A student registered for the Mechanical Engineering with International Study course who does not meet this requirement at this stage will be required to transfer to another course.

12.47.12 In order to progress to the second year of the course, a student must have accumulated at least 100 credits from the course curriculum.

12.47.13 In order to progress to the third year of the course, a student must have accumulated at least 220 credits from the chosen course curriculum.

12.47.14 In order to progress to the fourth year of the course, a student must have accumulated at least 360 credits from the chosen course curriculum.

12.47.15 In order to progress to the fifth year of the course, a student must have accumulated at least 480 credits from the chosen course curriculum.

**Final Assessment and Classification**

12.47.16 The final classification for the degree of MEng in the chosen course will normally be based on the first assessed attempt at compulsory and specified optional classes in the second, third, fourth and fifth years.

**Award**

12.47.17 **MEng**: In order to qualify for the award of the degree of MEng in Aero-Mechanical Engineering or the MEng in Mechanical Engineering or the MEng in Mechanical Engineering with International Study, or the MEng in Mechanical Engineering in the chosen specialisation, a candidate must have accumulated no fewer than 600 credits from the appropriate course curriculum. These must include those for the classes 16402 *Case Studies in Engineering*, ME 409 *Individual Project* and ME 519 *Group Project*.

In addition, candidates for the degree of MEng in Aero-Mechanical or Mechanical Engineering with International Study must satisfy the requirements of 12.47.18 or 12.47.19 respectively.

12.47.18 In the case of candidates for the MEng in Aero-Mechanical Engineering, both ME 409 *Individual Project* and ME 519 *Group Project* must be on aero-related topics.

12.47.19 A candidate for the award of MEng in Mechanical Engineering with International Study in addition must normally have undertaken no fewer than 30 weeks of approved study abroad.

For candidates who have taken their final year abroad, a class equivalent to ME 519 *Group Project* will be accepted in lieu of ME 519 *Group Project*.

**Transfer**

12.47.20 A candidate who fails to satisfy the progress or award requirements for the degree of MEng may be transferred to the degree of BEng in the chosen course where available.
Section 4

Class Details
Class Syllabuses

(R) = Registrar in charge of class.

NB: Past exams papers (hard and electronic copies) can be found in the University Library. Module Description Forms for all classes which follow can be found on the Departmental web site at http://www.strath.ac.uk/mae/currentstudents/

These contain comprehensive (and sometimes more up-to-date) information on all classes.

First Year

Year Adviser: Prof J T Boyle

All enquiries about classes should be directed to the Class Registrar (R)

16132  Engineering Mechanics 1  -  20 credits (ECTS 10)
1st and 2nd Semester:    Prof J T Boyle (R), Dr R Hamilton

Educational Aim: A study of mechanics gives you the basic tools to understand how the world, both natural and man-made, works - if you take the time to do this carefully, then you will be well prepared for more advanced studies in mechanical engineering. A knowledge of mechanics is a fundamental tool for a mechanical engineer. Our purpose is to understand what has become known as classical mechanics. The concepts of classical mechanics you will deal with include a study of forces, motion, energy, work, momentum and heat, how these are connected, and how these ideas can be applied to engineering problems. The ideas behind classical mechanics changed the human race absolutely and forever. Most historians agree that no discovery in human thought has been more influential.

Students come to engineering mechanics with an elementary understanding of the basic principles of mechanics acquired from introductory school physics together with their application to problem solving. This class places more emphasis on the basic skills (see Specific Outcomes below) required to start to apply these concepts and principles to real engineering problem solving. The class focuses on the practice of these skills, rather than factual content. In this class doing required background reading, coming to class and doing homework are like practising for a football team (or musical group, using a simple analogy). The tutor/lecturer is less a source of information and more of a coach (or conductor) who structures practice and sets standards. Students’ progress not by absorbing (and regurgitating) information but rather by practising their skills individually and learning to work effectively with others. The exams are like league games (or concerts) where students test their skills in a situation where performance counts.

Syllabus: Statistics; frameworks; friction; velocity and acceleration; inertia and change of motion; motion in a circle; balancing; periodic motion; dynamics of rotation; work, energy and power; impulse and momentum; aircraft mechanics.

Assessment:    Please refer to the Module Description Form

16165  Engineering Analysis 1  -  10 credits (ECTS 5)
1st and 2nd Semester:    Dr J Wood (Semester 1), Dr H Chen (Semester 2), Prof Jim Boyle, Dr Zhangming Wu

Educational Aim: This module aims to give an introduction to the use of engineering modelling and communication using the PTC Creo three dimensional modelling system and to introduce
engineering tolerances and their relation to manufacturing processes. Basic numerical methods will also be introduced using MathCAD and Matlab maths & engineering software.

Syllabus: The module will teach the following:

**Software and IT applications:** Introduction to PTC Creo and introduction to MathCAD and Matlab.

**Engineering modelling and communication:** The role of modelling in a modern engineering environment, review of geometric modelling, introduction to features-based modelling, design intent, tolerances, part and assembly models and drawings.

**Numerical methods:** Introduction to matrix algebra, roots of equations, linear regression analysis of experimental data.

Assessment: Please refer to the Module Description Form

**ME101 Heat and Flow 1 - 10 credits (ECTS 5)**

1st and 2nd Semester: Dr W M Dempster (R)

Educational Aim: Knowledge of Thermodynamics, Heat and Fluid Flow are important for the understanding and design of thermal and hydraulic systems involving energy conversion and transmission, such as engines and turbines, pumps and compressors, and associated pipework. The aim of the class is to introduce the basic concepts of Thermodynamics and Fluid Mechanics, and the applications thereof, as a foundation for further studies.

Syllabus: An introduction to energy conversion processes and systems involving work and heat transfer. Conversion of energy from one form to another. The First Law of Thermodynamics. Non flow processes involving perfect gases. The properties of systems such as pressure, temperature and energy. The Continuity Equation, Bernoulli’s Equation, Applications to flow in pipes, nozzles, siphons

Assessment: Please refer to the Module Description Form

**ME105 Mechanical Engineering Design - 20 credits (ECTS 10)**

1st and 2nd Semester: Dr A J McLaren (R), Dr B Keating, Mr F Gaddis (DMEM)

Educational Aim: The aim of this class is to place the essential elements of design at the heart of courses for Mechanical Engineering students. It shows how the disparate elements of engineering science may be brought together and used to create a safe, durable and cost-effective solution to a perceived engineering need.

Syllabus: The module will teach the following:

a) Mechanical dissection of an engineering artefact is used to illustrate and understand the fundamental elements of the design process.

b) An introduction to formal design methods, sketching and drawing.

c) Integration of engineering science elements within a framework of design; build and test projects.

Assessment: Please refer to the Module Description Form

**ME107 Experimental and Laboratory Skills - 10 credits (ECTS 5)**

1st and 2nd Semester: Dr A J McLaren (R), Dr Patricia Munoz-Escalona
Educational Aim: The aim of the class is to introduce students to a range of experimental and laboratory related skills, appropriate to Mechanical and Aerospace Engineering. This will include elements of laboratory and workshop safety including risk assessment procedures. Students will gain familiarity with a range of hand tools and welding/joining procedures and develop an understanding of how to conduct experiments, record data, evaluate errors and write a technical report.

Syllabus: The module will teach the following:

a) Each student will attend two afternoons of hand/power tools training, and one afternoon of welding and joining. A short online individual reflective report will be submitted for each activity.

b) Each student group will complete a risk assessment as part of the Mechanical Dissection element of class ME105 Mechanical Engineering Design. Following this lab, each student will submit an individual online version of this risk assessment, including a personal reflection on lab safety.

c) Each student will attend two experimental sessions to conduct experiments related to core classes in the first year Mechanical Engineering curriculum. Each lab session will be preceded by an online pre-lab giving background information to each task. Students will submit a formal lab report which will be formatted in a standard style to introduce report writing skills including error analysis and referencing.

Each student will participate individually and as student group in online discussion forums.

Assessment: Please refer to the Module Description Form

EE108   Electrical Circuits - 10 credits (ECTS 5)
1st and 2nd Semester:       Dr P Niewczas (R), Dr R O’Leary

Educational Aim: To introduce students to the fundamental concepts of electricity and the analysis and design of analogue and digital circuits and systems used for measurement and control within engineering applications.

Syllabus: The module will teach the following:

• Basic electrical theory and definitions: electrons; charge; current; voltage; power; sources.
• Basic DC circuits: resistance and Ohm's Law; calculation of total resistance, current and voltage.
• Kirchhoff's Law, Thevenin and Norton equivalent circuits.
• Basic principles of sensors: temperature, strain, acceleration, liquid level, position, etc.
• Basic models of amplifiers and operational amplifiers.
• Basic digital electronics: Boolean logic; logic gates; counters.
• Basic AC circuits: concept of phase; frequency; capacitors; inductors; impedance; use of j operator.
• Data acquisition systems and applications.
• Case studies of complete engineering systems, covering:
  • Signal processing
  • Analogue to digital conversion
  • Digital to analogue conversion
  • Interfacing
  • Control systems
  • Other applications in engineering, medicine, aerospace, etc

Assessment: Please refer to the Module Description Form
MM117 Mathematics 1M - 20 credits (ECTS 10)
1st and 2nd Semester: Dr D Pritchard (R), Dr E Dombi

Educational Aim: To give a basic understanding of the concepts and applications of mathematical functions, complex numbers, vectors, matrices, differentiation and integration.

Syllabus:

**Algebra and Geometry**
- Basic algebra: mathematical notation and operations; manipulating formulae and solving equations (linear, quadratic, polynomial; simultaneous equations in 2 unknowns); set and interval notation; the binomial expansion.
- Functions: basic concepts (graph, domain and range); continuity and limits; composition of functions; one-to-one functions and inverses; linear, quadratic and polynomial functions; exponentials and logarithms; rational functions; the modulus function; odd and even functions.
- Trigonometry: sin, cos and tan; radian measure; graphs, periodicity; sec, cosec and cot; trigonometric identities; the wave function; trigonometric equations.
- Vectors: magnitude and direction; vectors as directed line segments; vector algebra; orthogonal unit vectors; representation of vectors as number triples; scalar and vector products.
- Complex numbers: motivation and definition; roots of quadratic equations; real and imaginary parts; the arithmetic and algebra of complex numbers. The Argand diagram; modulus and argument; polar form (trigonometric and exponential); products and quotients in polar form; hyperbolic functions; De Moivre's theorem and its consequences.
- Matrices: definition, terminology and properties; scalar multiplication and addition of matrices; matrix multiplication (pre- and post-multiplication; non-commutativity; associativity). Systems of linear equations - matrix representation; the inverse of a square matrix; singular and non-singular matrices; solution of a system of linear equations using the inverse matrix; elementary row operations; Gaussian elimination.

**Calculus**
- Motivation and definitions: velocity (average and instantaneous); definition of a derivative; simple examples from first principles; notations (dy/dx, f'(x), df(x)/dx); graphical interpretation in terms of tangent to a graph; stationary points; higher derivatives.
- Standard derivatives: derivatives of x^a, sin (x), cos(x); the exponential and natural log functions and their derivatives; the inverse trigonometric functions sin^-1(x) and tan^-1(x) and their derivatives.
- Rules of differentiation: linearity; the chain rule; the product rule; the quotient rule.
- Implicit differentiation: first derivatives; simple cases of second derivatives.
- Parametric differentiation: first derivatives; simple cases of second derivatives; related rates of change.
- Applications: graph sketching; optimisation problems; linear approximation and error analysis.
- Indefinite integration: antiderivatives; standard integrals.
- Definite integration: the area under a curve; definition as a limit of a Riemann sum; the Fundamental Theorem of Calculus; infinite limits.
- Methods of integration: linearity; substitution; integration by parts; integration of simple rational functions; integrals of some trigonometric functions.
- Applications: area between two curves; volumes of revolution; arc length of a plane curve.

Assessment: Please refer to the Module Description Form
**Second Year**

**Year Adviser: Dr R Hamilton**

All enquiries about classes should be directed to the Class Registrar (R)

16231 Flight and Spaceflight - 10 credits (ECTS 5)

1st and 2nd Semester: Dr M T Stickland (R), Prof R Brown

Educational Aim: This module aims to give a theoretical and historical background to the development of modern aircraft and spacecraft design.

Syllabus: The module will teach the following:

1. History of flight.
2. Theoretical aerodynamics: aircraft layout and nomenclature, lift and drag coefficients, Bernoulli’s equation.
7. Generation of thrust: propeller theory, history of turbojet development, gas turbines, inlets, compressors, combustion chambers, turbines and afterburners.
8. Spaceflight: history of rocket development, rocket engines, multistaging, escape velocity.

Assessment: Please refer to the Module Description Form

16232 Engineering Mechanics 2 - 20 credits (ECTS 10)

1st and 2nd Semester: Dr R Hamilton (R), Dr L Yang

Educational Aim:

1st Semester
The module aims to provide students with the basic skills to analyse dynamics problems, associated with bodies and simple mechanisms, from first principles.

2nd Semester
To develop skills, knowledge and understanding in the areas of structural analysis and elementary stress analysis. The work is divided into 4 parts i) statics revision including shear force and bending moment diagrams ii) beams in bending iii) shear and torsion iv) 2D stress and strain.

Syllabus:

1st Semester
Rectilinear and angular motion where acceleration is a function of time, displacement and velocity. Centre of mass and moment of inertia of a composite object. Dynamic equivalence and connected systems. Free vibration analysis of an undamped single degree of freedom system – Simple Harmonic Motion.

2nd Semester
Tensile test – uniaxial systems, temperature and pre-load effects. Engineers’ theory of bending. Direct and bending effects. Shear stress due to torsion and bending. Two dimensional stress and strain including Mohrs circle for stress and Von Mises and Tresca yield criterion.

Assessment: Please refer to the Module Description Form
16263  Automotive Systems 1 - 10 credits (ECTS 5)

1st and 2nd Semester:   Prof D Mackenzie (R), Dr B Keating, Dr C Johnstone

Educational Aim: This module aims to impart an understanding of the influences which have shaped automotive engineering design in the past, and to explore possible future scenarios.

Also, to convey the fundamental engineering principles involved in the design and manufacture of the principal components of a vehicle: motive power unit, structure and running gear.

Syllabus: The module will teach the following:

- Historical background; current environmental and safety legislation; IC engine fundamentals; power train options and system matching; suspension, steering and braking systems; materials and structural design; constraints on future development: hybrid and alternative vehicle designs.

Assessment:  Please refer to the Module Description Form

16288  Professional Studies - 10 credits (ECTS 5)

2nd Semester:   Prof J T Boyle (R)

Educational Aim: The aim of this class is to create awareness of and develop some of the skills expected in graduate professional engineers. These include development of communication skills (both oral and written), but also issues such as ethics, societal impact and future trends.

Syllabus: The module will teach the following:

- Communication skills: written and oral.
- Group working skills.
- Professional conduct, ethics and the legal aspects of professional responsibility.
- Self-presentation, the standard application form and the CV.
- Introduction to psychometric testing criteria and interpretation.
- Engineering ethics.
- Societal and contemporary issues.

Assessment:  Please refer to the Module Description Form

ME201 Aero-Design and Flight Test - 10 credits (ECTS 5)

2nd Semester:   Dr M Macdonald (R), Prof R Brown, Dr M T Stickland

Educational Aim: This module builds on the initial work carried out in Flight and Space Flight 1. The taught part of the class is reinforced by experimental investigation, flight experience and flight test. The class is also intended to introduce students to the mathematical modelling tools they will require in the third year aero design class.

Topics covered include:

- Aircraft design.
- Airworthiness and the flight envelope.
- Static, longitudinal stability and control of aircraft is considered.
- The standard atmosphere – variation of temperature, pressure and density with height is explained.

Students may opt out of the flight training course should they wish, however this is not recommended.

Syllabus: The module will teach the following:

- Aircraft design process
- Airworthiness
- Longitudinal stability and control.
- Flight performance.
- Flight test course

Assessment: Please refer to the Module Description Form

**ME203 (ME204, ME205)  Heat and Flow 2 - 20 credits (ECTS 10)**

1st and 2nd Semester: Dr I J Taylor (R), Dr Y Zhang, Dr M Oliveira

*NB: Alternative codes for incoming exchange students only: ME205 Sem 1, ME204 Sem 2 (10 credits)*

Educational Aim: This module aims to deliver fundamental knowledge on fluid mechanics and thermodynamics and illustrate their importance to engineering systems. Thermodynamics is the science that is devoted to understanding energy in all its forms and how energy changes form. The aim of the first semester of this class is to supply the necessary analytical tools to study these energy changes when applied in engineering situations, in particular for transportation and power production. Fluid mechanics and the behaviour of fluids is an important aspect in the performance of engineering systems. In the second semester the underlying physics of fluid flow and its application to simple systems is presented.

Syllabus: The module will teach the following:

1st Semester: Thermodynamics

a) 1st law of thermodynamics applied to non-flow and steady flow systems
b) the properties of perfect gases
c) the properties of liquids and vapours
d) the 2nd law of thermodynamics, its implications and thermal efficiency
e) entropy and the concepts of the principle of increasing entropy, isentropic efficiency
g) assessment of the performance of vapour and gas power cycles

2nd Semester: Fluid Mechanics

a) the influence of fluid properties on the behaviour of engineering systems
b) the concepts of conservation of mass, energy and momentum
c) dimensional analysis of an engineering process
d) significance of dimensionless parameters such as Reynolds and Mach numbers, and dimensional analysis.
e) design of simple pipe systems

Assessment: Please refer to the Module Description Form

**ME209  Mathematical Modelling and Analysis - 20 credits (ECTS 10)**
1st and 2nd Semester: Dr H Chen (R), Dr E Minisci, Dr Zhangming Wu

Educational Aim:
Mathematics (Semester 1)
To give students competence in the differential and integral calculus of functions of several independent variables, and in the solution of ordinary differential equations (with particular emphasis on the Laplace transform method).

Engineering Analysis (Semester 1 and 2)
This class develops the general approach to the solution of engineering problems and involves mathematical modelling, numerical methods and the application of computer software. A wide range of engineering topics is presented and includes problems in structures, dynamics, fluids and heat transfer to emphasise the general applicability of the solution processes. The integration of mathematical techniques and the use of the computer as an essential tool in the modelling, simulation and solution of problems in engineering is an important objective of the class. It is also designed to demonstrate the power of mathematical methods to the formulation and manipulation of equations to represent complex engineering systems.

The first 6 weeks of both semester 1 and semester 2 present the fundamentals of numerical methods and formulation techniques in an engineering context and is taught in a lecture/tutorial format. In the last 6 weeks of each semester the emphasis changes to the application of the techniques previously developed to a range of engineering problems using the MATHCAD software. This part is taught in a computer based learning environment.

Syllabus: ME209 Mathematical Modelling and Analysis is a combined module which consists of two separate modules Mathematics (MM217) and Engineering Analysis 2 (16265). The module will teach the following:

Mathematics (Semester 1)
Ordinary Differential Equations: first-order separable, linear; second-order linear; constant coefficients with forcing functions exp(kx), sin(kx), cos(kx) and polynomials, including sums of these.

Partial Differentiation: first and second derivatives, total differential, small errors, differentiation in a given direction, chain rule, implicit functions, stationary points; indicate extension to functions of more than two variables.

Double Integration: interpretation as a volume, evaluation as an iterated integral, change of order, change of variable from Cartesian to polars, application to centre of mass, moments of inertia.

Laplace Transform: definition, standard results, application to ODEs.

Engineering Analysis (Semester 1 and 2)
Concepts of mathematical modelling: case studies in formulation of equation systems and differential systems for structural, dynamic, fluid and thermal problems.

Mathematical methods: Linear algebra, matrices in engineering mechanics, linear operators, definitions; square matrices; inversion, and determinants and singularity; Gaussian elimination, LU decomposition.

Numerical methods: Solution of simultaneous linear and nonlinear equations; Jacobi and Gauss Seidel Iteration method; Newton Raphson method; Numerical differentiation and integration, applications to multiple integrals, numerical quadrature, evaluation of areas, interpolation and curve fitting.

Solution of ordinary differential equations: classification of solution methods with engineering applications in dynamics, thermodynamics, fluid mechanics, solid and structural mechanics using

**Software applications:** Use of Mathcad and MATLAB.

Assessment: Please refer to the Module Description Form

**ME212 Materials Engineering and Design - 10 credits (ECTS 5)**

1st Semester: Dr A M Galloway (R), Dr P Muñoz-Escalona

Educational Aim: The class aims to provide a grounding in concepts of material science and engineering with reference to mechanical design and material selection.

Syllabus: The module will teach the following:

Assessment: Please refer to the Module Description Form

**19222 Electrical Machines and Control - 10 credits (ECTS 5)**

2nd Semester: Dr A Roscoe (R), Dr Lie Xu

General Aims: Engineering students from non-electrical disciplines often require a working knowledge and appreciation of electrical power devices and their use. This class develops the theory underlying simple electrical circuit analysis, transformers and electrical motors, and seeks to develop an understanding of their application through example and laboratory work.

Outline Syllabus: The module will teach the following:

Practical and safety-related electrical knowledge: single-phase and 3-phase wiring colours; circuit breaker types and minimum breaking current.
Revision of DC and AC circuits: power in AC circuits; power factor and its correction;
Three phase systems: basic connections, definitions, justification, analysis of circuits with balanced loads;
Electromagnetism: concepts of magnetic fields; field quantities; material properties; permeability; B-H loop; hysteresis; eddy currents; inductance; force on a conductor and Faraday’s Law/Lenz’s Law; basic energy conversion.
Single Phase transformer: construction, operation and use; the ideal transformer; circuit model and performance analysis; tests and parameter evaluation; efficiency and regulation.
DC machines: introduction to electric motor action; basic DC motor design and construction, operation, use, and control using switched-resistor and tap-changing transformer/rectifier techniques; performance analysis using equivalent circuit models.
Induction machines: introduction to AC machines and rotating magnetic fields; induction machine construction, operation, use, equivalent circuit models and performance analysis.
Synchronous machines: introduction to synchronous machines; basic circuit model; performance analysis; relationship between inertia and rate-of-change of frequency (ROCOF) during transients.
Modern power electronics and control techniques: an appreciation of variable-speed drives - controlled rectifiers and forced-commutation power electronics; an appreciation of regenerative drives for traction applications and efficiency; an appreciation of other types of electrical machines and future applications.
Assessment: Please refer to the Module Description Form
**Third Year**

**Year Adviser:** Dr J Biggs

All enquiries about classes should be directed to the Class Registrar (R)

16309 Aero-Design 2 - 20 credits (ECTS 10)

2nd Semester: Dr M T Stickland (R), Dr T Comlekci

Educational Aim: It is essential that students should have experience in applying engineering principles in a design context. It is the aim of this class to have students experience the application of knowledge, gained primarily from previous classes, to various stages of the design process together with new knowledge gained as part of project completion.

Syllabus: The class consists of a semester-long design/build/test group exercise.

The projects available each year will depend upon the staff involved in this class. A typical project which might be available is:

**BMFA “University Challenge”**

Groups of approximately 5 students design, build and test a small scale remote control aircraft to take part in the BMFA University Challenge. Over the 12 weeks of the semester, the groups will develop their design, build, test and optimise the design. The aircraft are taken by the teams to fly off in the competition held at Elvingon Airfield, York, in June. A small budget is allocated to each group.

*Please note that group participation is dependent on satisfactory peer mark in 16351.*

Assessment: Please refer to the Module Description Form

16327 Structural Mechanics - 10 credits (ECTS 5)

1st Semester: Dr M A Wheel (R), Dr H Chen

Educational Aim: This class is a direct continuation of the structures element of class 16232 and aims to extend the students' knowledge and understanding of the behaviour of materials and structures under a variety of loading conditions.

Syllabus: The module will teach the following:

**Solid Mechanics:** Two-dimensional stress and strain; multiaxial elastic constitutive relations; multiaxial yield criteria; general equations of elasticity leading to solutions for thick and thin cylindrical structures.

**Structural Mechanics:** Equations and analysis of continuous beams, both determinate and indeterminate; introduction to energy methods of analysis; superposition and dynamic loading effects; introduction to instability and buckling, including end-loaded columns with imperfections; design analysis of columns using British Standards or Euro-Codes.

Assessment: Please refer to the Module Description Form

16351 Flight and Spaceflight 2 - 10 credits (ECTS 5)

1st Semester: Dr M T Stickland (R), Dr T Comlekci, Mr L Murphy (BAe Systems Warton)
Educational Aim: Flight and Spaceflight 2 builds on the initial work carried out in Flight and Spaceflight 1 and Aero Design 1 and is intended to develop the student's knowledge through the application of mathematical modelling of an aircraft's stability, control and performance in the design of a small scale UAV.

The equations of motion of an aircraft are developed as part of a two day short course on flight simulation given jointly by University staff and a simulation engineer from BAE SYSTEMS, Warton. This short course introduces the mathematics of flight simulation and the technology involved in flight simulator hardware and software. The course content is not examined but attendance is mandatory for the award of a credit for this class.

The design of a UAV for participation in the BMFA "University Challenge" is commenced.

Syllabus:

1. Longitudinal stability and control
2. Flight simulation
3. BMFA design project

Assessment: Please refer to the Module Description Form

16361 Dynamics & Control – 20 credits (ECTS 10)

1st and 2nd Semester: Dr I Trendafilova (R), Prof M Vasile

Educational Aim:
The 1st semester Dynamics module aims to:

- introduce the general principles of the kinematics of rigid bodies and different types of motion: translation, rotation and general plane motion;
- study the kinetics of rigid bodies focussing on plane motion, equations of motion, angular momentum and D'Alembert’s Principle;
- utilise the fundamentals taught in second year Dynamics to demonstrate the principles of analysis of the dynamic performance of mechanical engineering systems;
- Introduce the basics of modelling the vibrations of mechanical systems.
- combine the fundamental theory of free and forced vibrations of damped and undamped systems with some essential laboratory practice and demonstrations.

The 2nd semester Control element aims to:

- introduce the concept of control theory to the students,
- to provide essential knowledge to model a physical system and linearize it.
- introduce the tools to design a feedback control system.
- Develop skills to assess the performance of a feedback control system.

Syllabus:

Semester 1 will teach the following:

- General kinematics and kinetics of rigid bodies: translation, rotation and general plane motion.
- Application of plane kinematics and kinetics to rigid bodies and mechanisms.
- Vibrations of a single degree of freedom (1dof) systems. Free and forced vibrations. Damping. Analysis of free and forced vibration of damped 1dof systems. Equivalent dynamic systems.

Semester 2 will teach the following:

- Introduction to control systems.
• Measurement and Models of systems, Physical principles of measuring devices and modelling of physical systems using differential equations, linear approximations, state variable models.
• Laplace transforms, Block diagrams and transfer functions.
• The performance of Feedback control systems.
• The stability of linear feedback systems.
• The root loci method.

Assessment: Please refer to the Module Description Form

16363 (*16366, 16367) Engineering Analysis III - 20 credits (ECTS 10)
1st and 2nd Semester: Prof D Mackenzie (R), Dr B Keating, Dr E Minisci, Dr T Scanlon

*NB: Alternative codes for incoming exchange students only: 16366 Sem 1, 16367 Sem 2 (10 credits)

Educational Aim: This module aims to introduce the students to the theory and application of the two most widely used numerical methods in engineering analysis: the Finite Element Method and Computational Fluid Dynamics.

Syllabus: The module will teach the following:

1st Semester: Mathematical modelling of engineering systems using the Finite Element Method: Theory and practice. Introduction to the commercial finite element program ANSYS Workbench; structural analysis; stress analysis.

2nd Semester: Mathematical modelling of engineering systems using Computational Fluid Dynamics: Theory and Practice. Introduction of the commercial computational fluid dynamics program FLUENT; analysis of flow field; recirculation zones/stagnation points; boundary layers.

Assessment: Please refer to the Module Description Form

ME301 (*ME302, ME303) Heat and Flow 3 - 20 credits (ECTS 10)
1st and 2nd Semester: Dr W M Dempster, Dr T J Scanlon

*NB: Alternative codes for incoming exchange students only: ME302 Sem 1, ME303 Sem 2 (10 credits)

Educational Aim: The class builds on the students’ previous study of thermodynamics and extends this to cover mixtures, psychrometry exergy and its applications. It also extends the study of heat transfer. Here, heat transfer by conduction, convection and radiation is covered together with heat exchanger design.

In addition, this class takes the study of the laws of conservation of mass, energy and momentum applied to fluid flow to a more advanced level. The knowledge and understanding of fluid flow is extended and this class supplies the analytical tools to provide an appreciation of boundary layers and compressible fluid flow.

Syllabus:

Semester 1: Fluid Mechanics
This class aims mainly to prepare students to tackle high speed flow systems.

The first part introduces students to one-dimensional compressible flows: sound/shock waves, flow structure in supersonic nozzles. Students also learn manipulating the one-dimensional mass continuity, momentum and energy equations.
The second part deals with subsonic/incompressible flows and introduces students to: boundary layers (both laminar and turbulent), aerodynamic forces, lift and drag, calculation from different flow structures.

Students are introduced also during this class to solving numerically some standard fluid dynamic problems in internal/external flows (Poiseuille, Couette, Shear-driven flow.)

**Semester 2: Thermodynamics**

Heat transfer, one-dimensional conduction through plates, cylinders and spheres.

Forced and natural convection, convection correlations. Radiation, black surfaces, emissivity, simple configurations.

Overall transfer of heat, extended surfaces. Heat exchangers.

Review of basic concepts, property relations, gas mixtures, psychrometry with applications to air conditioning systems.

Review of the Second Law of Thermodynamics, Kelvin-Plank and Clausius statements, corollaries, thermodynamic temperature, Carnot cycle, exergy and its application.

**ME312 Mechanical Engineering Design 3A - 10 credits (ECTS 5)**

1st Semester: Dr M A Wheel (R), Dr J Wood

Educational Aim: This module aims to provide students with experience in applying engineering science principles in a design context. It is the aim of this class to have students experience the application of knowledge, gained primarily from previous classes, to the initial stages of the design process including product design specification, concept generation and selection, and performance analysis of a candidate design solution.

Syllabus: The module will teach the following:

The class consists of a semester-long group design exercise. Over the 12 weeks of the semester, the groups will develop their design from the conceptual stage to final detailed design. There is an initial assessment for 25% at week 6 when the product design specification is consolidated and resulting concepts that have been generated are evaluated. A group portfolio of the design, detailing its background and genesis will be submitted in week 12, along with the Peer Marking sheets.

Assessment: Please refer to the Module Description Form

**ME313 Mechanical Design 3B - 20 credits (ECTS 10)**

2nd Semester: Dr M A Wheel (R), Dr J Wood

Educational Aim: This module aims to provide students with experience in manufacturing, testing and optimizing the performance of an engineering system that they have designed previously in the prerequisite class ME312.

Syllabus: The module will teach the following:

The class consists of a semester long build/test group exercise, the design stage having been completed in the prerequisite class ME312. Over the 12 weeks of the semester, the groups will build, test and optimise the design they produced in class ME312. Final assessment will be based on an operational demonstration of their manufactured design to their academic supervisors. A group portfolio of the design, describing its final, practical realization will be submitted in week 12, along with the Peer Marking sheets.

Assessment: Please refer to the Module Description Form
ME415  Strategic Analysis of Engineering Business Case Studies  -  10 credits (ECTS 5)

1st Semester:     Dr T Comlekci (R), Dr C A Walker, Prof J McKelvie, Industrial Mentors

Educational Aim: The class is intended as an introduction to the concept of the conscious pursuit of competitive advantage by business.

Syllabus: The module will teach the following:

The class will meet weekly for 3-hour periods in semester 1. Attendance at all meetings of the class is a mandatory condition of the award of the credits for the class. The initial weeks of the first semester will consist of introductory lectures, demonstration of case study techniques and introduction to mentors. Students will work in groups before the meetings in the following weeks to analyse and prepare for presentation, engineering business case studies from a selection of sources. Each student will present an analysis of their own aspect of the case. A discussion of the presentation will ensue, moderated by industrial mentors, who will award a group mark for the case analysis and an individual mark for each presentation. Students will grade each other with the peer marking form and this grading may modulate individual marks.

Assessment: Please refer to the Module Description Form

ME416  Engineering Ethics  -  10 credits (ECTS 5)

2nd Semester:     Prof J T Boyle (R)

Educational Aim: This class follows the approach outlined for the teaching of Engineering Ethics recommended by the Royal Academy of Engineering. The study of engineering ethics within an engineering course helps students prepare for their professional lives. A specific advantage for engineering students who learn about ethics is that they develop clarity in their understanding and thought about ethical issues and the practice in which they arise. The study of ethics helps students to develop widely applicable skills in communication, reasoning and reflection. These skills enhance students’ abilities and help them engage with other aspects of the engineering programme such as group work and work placements.

Syllabus: The module will teach the following:

A Case Study approach, using interactive group sessions is adopted. Student flexibility in choice of Case Studies is an important feature of the Class. As such, the syllabus broadly covers:

Awareness of issues, obligations and responsibilities; sensitising students to ethical issues. Resolving practical problems; enabling students to identify ethical issues and to examine and weigh up opposing arguments. Reflection and critique of ethical issues; consolidation of ethics skills and practice; specialist study. Further reflection and critique of ethical issues.

Assessment: Please refer to the Module Description Form
Fourth Year

Year Adviser: Dr M A Wheel
All enquiries about classes should be directed to the Class Registrar (R)

FOURTH YEAR PROJECT CO-ORDINATOR IS PROF J T BOYLE

16402 (*16460, 16464) Case Studies in Engineering  -  10 credits (ECTS 5)
1st and 2nd Semester:   Prof M M Stack (R), Dr Shayan Sharifi, Guest lecturers

*NB: Alternative codes for incoming exchange students only: 16460 Sem 1, 16464 Sem 2  (5 credits)

Educational Aim: Professional engineers need to have an awareness of the impact of engineering and technology on society. The class aims to highlight this by taking case studies from the whole spectrum of engineering industries.

Syllabus: The module will teach the following:

- important engineering achievements
- look at examples of product design
- investigate failure analysis

Examples will be taken from the military as well as the civil field and will cover project management, technical sales, planning and industrial relations as well as the more traditional topics. Full use will be made of visiting professors as well as senior representatives from industry.

Assessment:  Please refer to the Module Description Form

16429 Computer Aided Engineering Design  -  20 credits (ECTS 10)
1st and 2nd Semester:   Dr J Wood (R), Dr T Comlekci, Dr Y Zhang

Educational Aim: This module aims to provide an appreciation of computer aided design, analysis and simulation methods over a range of engineering problems and to provide practical experience of the use of industry standard engineering simulation and analysis software to design and investigate the behaviour and performance of specific systems or components.

Syllabus: The module will teach the following:

Section 1
Introduction to geometric modelling technology and associated computational geometry. A study of data exchange issues related to analysis and simulation. An examination of rapid prototyping and rapid tooling. An overview of sensitivity studies and shape optimisation using an integrated analysis system. An insight into the analysis and simulation of plastic and composite components.

Section 2
Section 3

Analyse, using CFD, an external turbulent flow and provide hand-written validation data to support the numerical solution.

Assessment: Please refer to the Module Description Form

**ME403 (ME406) Engineering Materials Selection - 10 credits (ECTS 5)**

1st and 2nd Semester: Dr A M Galloway (R), Dr P Munoz-Escalona

*NB: Alternative code for incoming exchange students only: ME406 Sem 1 (5 credits)*

Educational Aim: It is necessary for engineers to be aware of the importance of materials selection in the design process. This module aims to review the classes of available engineering materials, with some background to the underlying factors that determine their general properties. An introduction to the philosophy of materials selection in design will be given.

Syllabus: The module will teach the following:

This module will introduce an alternative approach to the traditional teaching methods of materials selection, which, in the past, developed an understanding of the physical and chemical nature of materials as a means of providing an understanding of their usefulness in Engineering Design.

This new approach starts at the other extreme by considering the classification of materials, provides an overview of their general or specific properties and provides an insight into their uses and selection criteria. This allows for the development of a more progressive understanding of the importance of materials selection in the design process.

Assessment: Please refer to the Module Description Form

**ME404 Energy Systems Modelling - 10 credits (ECTS 5)**

2nd Semester: Professor J A Clarke (R)

Educational Aim: The aim of this class is to introduce students to the assumptions and limitations that underlie state-of-the-art modelling methods as currently used to appraise the performance of buildings, their associated environmental control plant, and renewable energy technologies suitable for deployment at the urban scale. Essentially, the class describes mathematical models for the underlying heat and mass transfer processes, along with numerical methods by which these process models may be conflated to form an integrated simulation program. Finally, the range of possible applications of integrated energy simulation is explored.

Syllabus:

**Introduction:** the need for simulation, types of energy system, energy transfer mechanisms, dynamic modelling techniques, performance assessment criteria.

**Boundary conditions:** weather parameters, severity assessment and radiation prediction.

**Integrative modelling techniques:** response function and numerical methods.

**Numerical simulation – buildings:** discretisation, conservation equations, domain integration by linking domain equations, imposing control and solving simultaneously the whole-system equation-set.

**Numerical simulation – energy supply plant and control:** HVAC and renewable energy conversion systems, control systems.
Numerical simulation – air, moisture and electricity flow: nodal network approach and computational fluid dynamics.

Convection heat exchange: buoyancy driven and forced convection at internal and external surfaces.

Radiation heat exchange: Long- and short-wave radiation at external and internal surfaces.

Modelling issues: Validity, applicability, user interfaces, use in practice, performance assessment method, uncertainty.

Tutorials: These will cover specific examples of the knowledge and theory that will comprise the final examination.

Private Study: Students are invited to deepen their learning by studying the material at www.esru.strath.ac.uk/courseware.

Assessment: Please refer to the Module Description Form

ME405  Heat and Flow 4  -  10 credits (ECTS 5)

1st Semester:  Dr T J Scanlon (R)

Educational Aim: An understanding of heat, mass and momentum transfer processes is a basic requirement for practising engineers. This class aims to build upon the students’ previous exposure to the basic energy transfer mechanisms of conduction, convection and radiation so that multi-dimensional, steady state and transient problems can be recognised and analysed.

Syllabus: Eulerian, Lagrangian viewpoints; derivation of mass, momentum, energy and species conservation equations for differential control volume, description of terms in equations.


Convection: the convection boundary layers. Order of magnitude analyses; important dimensionless groups; elementary solutions of governing equations; heat and mass transfer analogy; laminar forced convection on a flat plate; Reynolds analogy, introduction to turbulence; external and internal flows; free and forced convection correlations.


Assessment: Please refer to the Module Description Form

ME409  Individual Project  Project 400 hrs  -  40 credits (ECTS 20)

1st and 2nd Semester:  Prof J Boyle and All Project Supervisors

Educational Aim: Students pursue an intensive research, development or design project under the supervision of a member of academic staff after which they write up their work in a dissertation. In addition to the dissertation each student writes a short technical paper on completion of the project. At the end of both semesters, panels of academic staff conduct oral examinations to assess each student’s performance: these panels also assess the technical paper. The supervisor assesses the work separately.

Syllabus: The student will carry out appropriate research and scholarship to meet the learning outcomes.

Assessment: Please refer to the Module Description Form
ME410  Aerodynamic Performance - 10 credits (ECTS 20)

1st Semester:  Dr M T Stickland (R), Dr I J Taylor, Dr T J Scanlon

Educational Aim: This module aims to introduce students to the principles of experimental aerodynamics and computational aerodynamics performance assessment. The course also provides an introduction to the importance of aeroelastic phenomena on aerodynamic design. Various aeroelastic phenomena will be introduced, with both static and dynamic problems investigated for a range of applications. The aim is to provide students with an understanding of the importance of understanding the aerodynamic flow field and its importance in the design process, and the interaction of the aerodynamic loading with the structure. A range of analysis techniques will be used to develop an understanding of the aerodynamic performance of aircraft and industrial aerodynamic problems.

Syllabus: The module will teach the following:

- Experimental aerodynamics and their use in the verification of simulation data.
- Simulation using open source CFD codes
- Programming in NI Labview.
- Aeroelasticity fundamentals – static and dynamic aeroelastic phenomena; resonant and self-excited oscillations.
- Wing divergence and control reversal.
- Flutter - Classical coupled flutter; stall flutter.
- Bluff body aeroelasticity – Vortex induced vibration; galloping.

Assessment: Please refer to the Module Description Form

ME414  Advanced Mechanics & Dynamics - 20 credits (ECTS 10)

1st and 2nd Semester:  Dr M A Wheel (R), Dr T Comlekci

Educational Aim: The aims of this module are twofold:-

- to develop the students' ability to apply analytical techniques to the solution of engineering problems where dynamic behaviour is important.
- to provide practical experience in designing lightweight structures to ensure that they have sufficient strength and stiffness to prevent failure, particularly by buckling, when in service. This experience will be obtained by undertaking an aerospace themed or similar design, construct and test activity.

Syllabus: The module will teach the following:

Fundamentals of the analytical approach to the behaviour of dynamic systems.


Students, working in groups, will construct a standard specification BMFA (British Model Flying Assn.) Arrow class indoor aeromodel or similar lightweight structure. Its operational and structural performance will then be assessed. The design of the model will then be progressively modified to enhance performance and the expected enhancement measured through further testing. Through
this exercise students will gain the knowledge and experience summarized in the learning outcomes.
Fifth Year

Year Adviser: Dr I J Taylor

All enquiries about classes should be directed to the Class Registrar (R)

NB: THE PASS MARK FOR LEVEL 5 CLASSES IS 50%

16565  Engineering Composites  -  10 credits (ECTS 5)

2nd Semester:  Prof J Thomason, (R), Prof M M Stack

Educational Aim: The promise claimed for new materials in engineering is most likely to be realised through the use of composites and ceramics. This class aims to give a basic understanding of modern composite materials and an appreciation of predictive modelling and design implications when composites are applied to engineering structures. The main composite manufacturing processes will be outlined.

Syllabus: The module will teach the following:

Classification and definition of composites; properties of fibres and matrices; micromechanics – elastic properties of lamina with unidirectional and random long fibre reinforcement; short fibre composites; macromechanics – constitutive relations for lamina and laminates; strength concepts and prediction; failure criteria; applications to load bearing structures; – tribology of composites; exposure to aggressive environments e.g. high temperatures.

Assessment: Please refer to the Module Description Form

16587  Pressurised Systems  -  10 credits (ECTS 5)

1st Semester:  Dr D H Nash (R)

Educational Aim: This module aims to introduce the subject of industrial Pressurised Systems and ensure competency in the use of Standards and Design Codes. Pressurised Systems are inherently dangerous since they contain stored energy which must be carefully controlled.

The class aims to set down a methodology whereby a range of pressurised components (spheres, cylinders, cones, etc.) can be designed, manufactured, installed and operated to a high degree of safety.

Syllabus: The module will teach the following:

Provide a basic understanding of the behaviour of components used in pressure and storage containment. 30% of the class is devoted to a fundamental development of the appropriate stress analysis of thin shells, including spheres, cylinders, cones, etc. under pressure, temperature and local loadings; discontinuity analysis is employed to derive the forces and moments that arise at nozzle-shell, shell/head junctions, etc.

The remainder of the class uses the ideas developed above to examine design methodologies established in the British/American and EU Pressure Vessel Design Codes. In these, ‘design by rule’, ‘design by analysis’, stress categorisation - primary and secondary stresses and peak stresses are explored. These are applied to the design of pressure and storage vessels of various geometries, treatment of local loads, openings and branches, supports, heads and the design for external pressure loading and stability and design for fatigue.

The syllabus is as follows:
An introduction to the design philosophy and the manufacture of pressurised systems. The stress analysis of thin shells including cylinders, cones and spheres under pressure and temperature.
Pressure vessel design: British and American Design Codes, design by rule, design by analysis. Stress categorisation - primary and secondary stresses, peak stress. Applications to the design of pressure vessel components, cylindrical and spherical pressure vessels, treatment of local loadings, openings, supports and heads. External pressure loading, buckling and stability. Local loads, supports and fatigue assessment. Simple piping systems design. Use of computer packages for pipework and pressure vessel design.

Assessment: Please refer to the Module Description Form

16599  Aerodynamic Propulsion Systems - 10 credits (ECTS 5)

2nd Semester: Dr I J Taylor (R)

Educational Aim: This module aims to provide an understanding of the principles of propulsion systems for aircraft and rockets. Throughout the course, the overall procedure and methodology for designing a propulsion device, starting from the aircraft concept and the associated engine requirements, through to the aero-thermal design of engine components is presented and discussed. Using a combination of lectures and project based activities, students will develop an understanding of the overall design process and the performance of aerospace propulsion systems.

Syllabus: The module will teach the following:

Introduction –
- the various types of propulsion systems,
- historical development of gas turbine power units for jet propulsion.

The general thrust equation

Propulsion performance characteristics

Aerothermodynamics of
- intakes,
- combustors and
- nozzles –
- compressible flow governing equations,
- nozzle flows,
- subsonic and supersonic intakes,
- combustion chamber and afterburner design.

Analysis of jet propulsion power units –
- the ram jet,
- pure turbojet,
- by-pass turbojets,
- turbofan engines and
- prop fan engines.

Design of axial flow compressors and turbines, free vortex designs

Off-design Performance

Rockets

Assessment: Please refer to the Module Description Form

ME501  Systems Engineering 1 - 10 credits (ECTS 5)

1st Semester: Dr C Maddock

This module aims to introduce concepts of modelling and control design for engineering systems. The approach is to present an engineering methodology that, while based on mathematical fundamentals, stresses physical systems modelling and practical control systems design with realistic system specifications. In particular, the aim is to study the performance, characteristics
and advantages of feedback control systems, and to introduce control design techniques based on steady state and transient response specifications. Use of Simulink as a standard software tool will enhance the understanding and the ability to simulate and design.

Syllabus: The module will teach the following:

Introduction to engineering systems, system modelling, block diagram models, control systems design, simulation of systems using Matlab/Simulink, second order systems, transient response of control systems, feedback control systems characteristics.

Assessment: Please refer to the Module Description Form

ME502  Systems Engineering 2 - 10 credits (ECTS 5)

2nd Semester: Dr C Maddock (R)

Educational Aim: This class will follow on directly from ME501 Systems Engineering 1. The aim is to use advanced modelling and control design techniques appropriate for complex engineering systems, understanding both the underlying theory, and the practical application of modelling dynamics systems and developing control laws through the use of Matlab/Simulink.

Syllabus: The module will teach the following:

Stability of engineering systems, frequency response design methods, design of state variable feedback systems, robust control and systems under uncertainty, estimator and observer design, system error signal and error analysis, performance of feedback control systems, steady-state response, time-domain specifications.

Assessment: Please refer to the Module Description Form

ME505  Machine Dynamics - 10 credits (ECTS 5)

1st Semester: Dr J Biggs (R)

Educational Aim: This module aims to cultivate an analytical approach to the dynamic problems which occur in conventional and modern machines from piston engine systems to autonomous system control with a view to developing good design and control practice and analytical skills. The course focusses on the dynamics and control of rotating components and machines both in 2-dimensions e.g. wind turbine dynamics and control and 3 dimensions e.g. spacecraft attitude dynamics and control. The course involves using complex numbers, linear algebra and ordinary differential equations to solve practical engineering problems.

Syllabus: The module will teach the following:

- Introduction to machine dynamics.
- Mathematical preliminaries of rotating mechanisms.
- Out of balance and balancing of rotor-dynamic machines.
- Out of balance and balancing of reciprocating machines.
- Passive and active control of low-dimensional systems (rotations in the plane).
- Passive and active control of High-dimensional machines (spatially rotating machines) such as autonomous underwater vehicles and spacecraft.

Assessment: Please refer to the Module Description Form
ME507  Machinery Diagnosis and Condition Monitoring - 10 credits (ECTS 5)

1st and 2nd Semester:  Dr I Trendafilova (R), Dr G West, Dr V Caterson

Educational Aim: Condition monitoring and fault detection in structures and machinery plays an important part in the maintenance and protection of equipment, and has come to the fore since the recent advances in computer-based systems. The aim of the class is therefore to provide an understanding of Condition Monitoring (CM) and its relevance to industry. This is achieved by studying different CM and integrity assessment techniques, the instrumentation and use, and how they are applied. Particular attention is paid to vibration-based health monitoring and signal (time series) analysis.

Syllabus: The module will teach the following:
The basic idea of health monitoring and CM of structures and machines. Some basic techniques. Study of periodic and random signals, probability distribution, statistical properties, auto and cross correlation and power spectral density functions of commonly found systems, spectral analysis. Fourier transform: the basic idea of Fourier transform, interpretation and application to real signals. Response of linear systems to stationary random signals: FRFs, resonant frequencies, modes of vibration. Introduction to vibration-based monitoring. Machinery CM by vibration analysis: use and selection of measurements, analysis procedures and instruments. Typical applications to rotating machinery. Some other health monitoring techniques: acoustic emission, oil debris and temperature analysis. Applications.

Assessment: Please refer to the Module Description Form

ME511  Mathematical Modelling in Engineering Science - 10 credits (ECTS 5)

2nd Semester:  Dr J Biggs (R)

This module is designed to provide insights into generic problems in Engineering Science through the use of ordinary differential equations. Mathematical modelling will be presented as an important tool for Engineers to understand complex phenomena and to predict the behaviour of complex systems. The development of key topics in differential equation theory will be cast in the context of real problems in Engineering Science. An example is the use of bifurcation methods to understand buckling. Since the main goal of the class is to explore the relationship between mathematics and real phenomena, simple differential equations are used for illustration to avoid excessive mathematical complexity. This course requires a strong mathematical ability and understanding.

Syllabus:
- Engineering Science: Overview of common themes in Engineering Science.
- Mathematical modelling: Models, assumptions, scaling and real data.
- Linear systems: 1st and 2nd order linear ODEs with applications, phase space methods.
- Non-linear systems: Non-linear ODEs with applications, simple prototype equations.
- Stability: Classification of fixed points, linearization, Lyapunov methods, limit cycles.
- Bifurcations: Bifurcation in simple prototype equations, application to buckling.
- Perturbation methods: Regular and singular, application to fluid boundary layers.
- Chaotic systems: Routes to chaos, chaotic systems in Engineering Science.

Assessment: Please refer to the Module Description Form
ME512  Spaceflight Mechanics - 10 credits (ECTS 5)

1st Semester: Dr M Vasile (R)

Educational Aim: This class is designed to provide a comprehensive overview of spaceflight mechanics, including both orbit and attitude dynamics. The two-body problem will be solved from first principles to allow the solution of the two-body position-time problem. This analysis will then be used to investigate various modes of orbit transfer. Attitude stabilisation will be investigated for both spin- and 3-axis stabilised spacecraft. Finally, the various elements of the class will be brought together to illustrate the mission analysis and design process.

Syllabus: The module will teach the following:

- Dynamical Systems: Review of the basic concepts and methods of kinematics and dynamics.
- General perturbation theory: perturbed two body motion
- Basics of N-body dynamics
- Orbit Transfer: Use of impulse and low thrust manoeuvres for two-body orbit transfer.
- Attitude Stabilisation: Analysis of spin- and 3-axis stabilised spacecraft.
- Mission Analysis and Design: Application of spaceflight mechanics to mission design.

Assessment: Please refer to the Module Description Form

ME514  Advanced Topics in Fluid Systems Engineering - 10 credits (ECTS 5)

2nd Semester: Dr Y Zhang (R), Dr T J Scanlon, Dr I J Taylor, Dr M Oliveira

Educational Aim: Complex and interesting fluid flow and heat transfer problems are central to many advanced fluid engineering systems often at the cutting-edge of modern engineering. These include human biological flows, multiphase flows, micro and nano scale flows. In all of these our physical understanding is limited, which limits our engineering design ability. This class will give students the opportunity to identify and explore a number of advanced topics in heat transfer and fluid flow. We will investigate the limitations of current engineering knowledge and the new approaches that engineers are seeking to develop. Where appropriate, computational fluid dynamics techniques will be used to explore some advanced modelling approaches and to carry out simulations of complex fluid systems. The range of flow systems the students will encounter may include (in addition to those mentioned above): refrigeration and power systems, high speed flows important for modern air- and spacecraft design, nanotech desalination and water purification, and flows encountered in urban environments and structures.

Syllabus: Up to four topics selected from the following will be explored:

- Multiphase flows
- Phase change heat transfer (boiling, condensation, melting, solidification)
- Micro and nano flows
- Very-high-speed aerodynamics
- Wind effects on structures
- Turbulence
- Microdroplet technology
- Computational fluid dynamics

Assessment: Please refer to the Module Description Form
ME515  Finance for Mechanical Engineers  -  60 credits (ECTS 30)

1st and 2nd Semester:  Dr Ian Taylor (R)

General Aims:  To give a broad understanding of accounting and finance and an appreciation of
the role of these disciplines in an engineering context.

Syllabus:  The module will teach the following:

Finance and accounting classes will be selected from a range of modules as agreed by the
Department of Finance and Accounting and the MAE UG course director.

Syllabus for the ME515 module will depend on the chosen classes.

Assessment:  Please refer to the Module Description Form

ME517  Spaceflight Systems – 10 credits

2nd Semester:  Dr M Macdonald (R), Visiting Lecturers

Educational Aim:  This class is designed to provide a comprehensive overview of spaceflight
systems. An overview of the complete spacecraft lifecycle from proposal, through delivery and
operations is covered, along with the function and purpose of the spacecraft sub-system level
components. In addition to the technical detail of spaceflight systems, the importance of ancillary
skill-sets is introduced such as project management. Finally, the various elements of the class will
be brought together through the production of competitive proposals for a typical spaceflight
system development program.

Syllabus:  The module will teach the following:

• Spacecraft (sub-)systems
• Spacecraft design and trade-offs
• Spacecraft operations
• Spaceflight systems lifecycle
• Proposal writing, production and presentation

Assessment:  Please refer to the Module Description Form

ME518  Topics in Automotive Engineering – 10 credits

1st and 2nd Semester:  Prof D Mackenzie (R), Mr C M Johnstone, Dr B Keating

Educational Aim:  This module aims to allow students to gain a deeper understanding of the state
of the art in Automobile design and manufacture and to develop an insight into future
developments, through self study and seminar presentations.

Syllabus:  Topics will be selected from inter alia:

• Materials for Automotive Applications
• Manufacturing methods in the Automotive Industry
• Automobile Aerodynamics
- Advanced and innovative motive power units
- Power train configuration and design

Assessment: Please refer to the Module Description Form

**ME519  MEng Group Project – 40 credits**

1st and 2nd Semester: Dr A J McLaren (R)

Educational Aim: This module aims to give students an authentic experience of managing and contributing to a complex group project. This will include an opportunity to demonstrate mastery of the technical aspects of the project, in addition to demonstrating competence in project management, technical risk management and safety risk assessment.

Syllabus: Students will form into groups and be allocated a project topic, supervised by a member of staff. All students will take part in intensive workshops on project management, technical risk management and safety risk assessment. Each group will then write a statement of purpose detailing the deliverables and schedule for the project. This will be agreed with the supervisor, who will take on the role of client. The statement of purpose will form a contract between the group and the client.

Students will carry out the project, and report to the assessment team in December (interim presentation/report) and at the conclusion of the project (time agreed in contract). Groups will be assessed on the extent to which they have met the deliverables set out in the contract, as well as on the quality of reflection on the group process and project management experience.

Assessment: Please refer to the Module Description Form

**ME520  Advanced Research Project A – 10 credits**

1st Semester: Dr A J McLaren (R) and Supervisors

Educational Aim: The object of the project is to expand and enlarge on work completed in the 4th year Individual Project, in order to carry out a feasibility study for the preparation of a full paper for submission to a refereed engineering journal. Students who have performed well in their Individual Project, may be registered for this class in first semester of 5th year. Satisfactory completion of this class by December is a condition of registration for the follow-up class ME521 Advanced Research Project B, in which a full paper will be prepared for submission by April.

Syllabus: The student will carry out appropriate research and scholarship to prepare a feasibility study and project plan.

Assessment: Please refer to the Module Description Form

**ME521  Advanced Research Project B – 20 credits**

2nd Semester: Dr A J McLaren (R)

Educational Aim: The object of the project is to expand and enlarge on work completed in the individual 4th year project, in order to prepare a full paper for submission to a refereed engineering journal. This may involve further research and background study, further experimental and/or simulation work, more detailed analysis and discussion of results, or other activities, to be agreed by the individual supervisor. The full paper will be prepared by the student, under supervision, in the correct format for submission to the chosen journal. In exceptional circumstances, work carried out during a university based summer research internship may be written up for submission of a journal paper.
Syllabus: The student will carry out appropriate research and scholarship to prepare a paper for submission.

Assessment: Please refer to the Module Description Form
Appendix 1
Departmental Safety Regulations

Emergency telephone numbers (internal) - Extension 2222 or 3333
Emergency telephone number (external)  9/999 Fire/Police/Ambulance

1. Safety Organisation
Health and safety within the Department is organised in accordance with the University Safety Code (Section 6.6 of the University Calendar) which should be studied by all members of staff. All members of staff will be issued with a copy of these Regulations and are required to sign a declaration stating that the Regulations have been read and understood. Supervisory staff should ensure that the attention of students is drawn to the provisions of the Safety Code and Departmental Safety Regulations.

The Head of the Department has ultimate responsibility for all health and safety matters.

Health and safety management is undertaken by the Departmental Safety Convener.

An Area Safety Committee has been formed to monitor health and safety issues within specific areas. The identities of current post-holders and their areas of responsibility can be obtained from Central Services or from the Departmental Safety Convener.

General information on any health and safety matter should be directed to the Departmental Safety Convener in the first instance.

The University's Safety Services Unit can be contacted on Ext 2726.

2. Departmental Safety Committee
A Departmental Safety Committee has been appointed consisting of at least three persons representative of the main groups of staff working in each area and include, where appropriate, at least one student. The Departmental Safety Convener convenes the meetings of the Departmental Safety Committee and acts on its behalf as necessary.

3. Fire
In the event of a General Fire Alarm the procedure is set out in the Fire Regulations posted at every floor of the James Weir Building and any other building you may occupy. Read these carefully and check from time to time for any changes which may be made.

- Fire drills will be held at least once per semester.
- Know the meaning of the audible fire alarms.
- Know every escape route in the building.
- Exit by a different route at each drill.
- Note locations of fire extinguishers - all are clearly marked.

In the event of a fire being discovered:-

- Leave the room, close the door and raise the alarm by activating the nearest "break-glass" fire alarm call point and informing the security wardens (Ext 2222 or 3333).
• If it is safe to do so, use an appropriate fire extinguisher to attack the fire. Do not use water where electrical equipment or flammable liquids are involved.

• In the case of laboratory fires, if it is safe to do so, switch off all electrical and fuel supplies to the equipment involved or, if necessary, to the entire laboratory.

• Do not store combustible materials on or near electric heaters.

• Do not accumulate waste material.

• Keep litter bins covered.

• Keep fire exits clear of obstructions

4. Accident or Illness

Emergency Telephone Numbers - Extension 2222 or 3333

• If possible give immediate assistance to the patient. General First-Aid Guidance notes are contained in all First-Aid boxes. A First Aid box may be found in all of the Departmental Laboratories.

• Get help of colleagues.

• Telephone 2222 or 3333 giving own name and department, exact location (building, floor, room number) and nature of incident.

• Say if a doctor is required.

• Do not move the patient from reported position (unless obviously necessary to avoid further injury) until the arrival of the ambulance services.

• The patient should be accompanied to the hospital by a colleague.

5. Reporting of Accidents and Dangerous Occurrences

All accidents and dangerous occurrences, however apparently trivial, should be reported to the member of staff in charge or to the technician in charge of the laboratory. The Convener of the Area Safety Committee should also be informed.

An official Accident or Occurrence Report Form S.1 should be completed for all accidents and dangerous occurrences and sent to the University Safety Officer via the Convener of the Area Safety Committee. Should an incident result in hospital attendance, the Safety Office should be informed by phone as soon as possible.

6. COSHH

Under the Control of Substances Hazardous to Health Regulations 1988 (COSHH), it is incumbent upon anyone involved in the use of hazardous materials to ensure that a safe working practice is agreed upon. No work is permitted until a RISK ASSESSMENT FORM (S20/S21) has been completed. Copies of each assessment must be lodged with the Safety Convener.

All staff and relevant students should be acquainted with the Regulations.

Copies of the approved Guidance handbook on COSHH may be obtained from the Safety Convener or the University Safety Office.

Failure to comply with the Regulations may result in that area of activity being shut down BY LAW.
7. Hazardous Operations

Work should not proceed unless a Risk Assessment has been issued and signed.

Suitable protective clothing must be worn for all potentially dangerous operations (e.g. grinding/welding) supplies of which are available from the technician in charge of the laboratory.

All areas in which special hazards exist (e.g. lasers) are clearly marked and entry to these regions is restricted to those personnel having permission to work in them. Refer to the Protection of Eyes Regulations 1974.

All hazardous materials and glassware should only be transported or carried in properly designed safety containers. Winchesters should be carried only in proper holders, not in the hand. Passenger lifts should not be used unless special precautions are taken.

8. Permits to Work

All persons, other than trained workshop staff, who wish to use machine tools, hand held tools or welding equipment, etc must have a Permit to Work signed by the Head of Department or his appointed Deputy and an appropriate Academic Supervisor. Permits will only be granted to persons who can show evidence of satisfactory training and relevant experience. Permit holders must liaise with the Laboratory Superintendent before using any equipment. Permit application forms can be obtained from the Departmental Safety Convener.

9. General Laboratory/Workshop Procedure

- Protective clothing and safety glasses must be worn at all times.
- Coat racks or lockers are provided and should be used for outdoor clothing (coats, scarves, etc.).
- Food and drink is not permitted in laboratories or workshops.
- Always use machine guards where provided.
- Clean tools and machines after use and deposit all scrap material in the bins provided.
- Keep litter bins covered.
- Observe and obey No Smoking signs.
- Observe and obey all warning signs.
- Horseplay is forbidden.
- When operating equipment in the laboratories, at least two people should be present. One of these should be a technician or a member of the academic staff. Where working alone is essential, the completion of a Risk Assessment must be performed and endorsed by the Laboratory Superintendent or Academic Supervisor prior to the commencement of such work.
- Avoid loose clothing, long hair and badly fitting footwear.
- Keep all chemicals in suitable storage (see under COSHH).
- Switch off all gas cylinders, water, gas and other taps when not in use.
- Keep labs and workshops tidy.
- Keep floors clean and free of oil and grease deposits.
- Do not obstruct passages, doorways or other thoroughfares.
- Keep clear of overhead lifting-gear.
- Lifting tackle should only be used by trained personnel under the overall supervision of the technician in charge and in accordance with appropriate regulations. Replace all guard rails which may have been removed to facilitate the movement of equipment.
- Do not overload electrical power points.
- Trip hazards, such as trailing cables must not run across working areas.

9.1 **Office Areas**
- Office areas should be kept clean and tidy and free of trailing electrical cables.
- Cables should be inspected regularly and replaced if the insulation shows signs of wear.
- Materials should not be stored on top of filing cabinets or cupboards particularly near eye level.
- Filing cabinets should be filled from the bottom to ensure stability and drawers kept closed.
- Solvents should only be used in well ventilated areas and kept clear of heat sources.

10. **Access to Buildings outwith Normal Hours**
See Access to University Premises (Appendix 2) and page 14 of this Handbook.

11. **Supervision of Postgraduate and Project Students**
Supervisors should establish a mode of working with their students such that the supervisor is aware of and agrees to, each element of work, that safe working practices are agreed and where appropriate set down on paper and that regular, active, supervision is established.

12. **Visitors to Laboratories**
Visitors to the laboratories who are not accompanied by a member of staff should report to the relevant Laboratory Superintendent.

Maintenance staff should report to the relevant Laboratory Superintendent before commencing work in any laboratory area.

Children under the age of 14 are not normally permitted to enter laboratories or workshops.
(See Appendix 2 of this Handbook).

13. **Electricity at Work Regulations 1989**
All offices, storerooms, workshops and laboratories, of whatever kind, within the Department must comply with these Regulations.

It should be noted that the University’s Estates Management Department is responsible for all electrical services in the University, e.g. isolators, sockets and other such fixed equipment and no one may break into the electrical system for any reason without the authorisation of the University Electrical Engineer. Persons involved in the use of, and/or responsible for the use of electrical equipment, must read the Regulations and the University’s own handbook entitled “Local Rules for Electrical Safety” (November 1991), a copy of which may be obtained from the Departmental Safety Convener. Work on ‘live’ equipment is prohibited unless in the most
exceptional circumstances; before any such work is undertaken permission in writing must be granted by the Departmental Safety Convener.

14. General Electrical Safety

Open-bar electric fires and non-automatic kettles are not allowed in the University.

Multi-way distribution boards with 13 amp shuttered outlets may be used from a socket provided the total load does not exceed 13 amps and they are designed to BS1363. Adaptors are not permitted.

Plugs must be fitted by, and new equipment inspected by, a competent person, before being taken into service, normally by arrangement with the relevant Laboratory Superintendent. A record of the equipment must be kept (see 15 below). The Departmental Safety Convener may approve members of staff bringing in their own personal electrical equipment (except those banned items shown above), however, such items must also be included in the Departmental inventory of electrical equipment and appropriately inspected and tested (see 15 below).

All staff have individual responsibility to report obviously faulty equipment, e.g. broken plug tops, damaged cables, etc. to their supervisor or directly to the relevant Laboratory Superintendent. Equipment thought to be defective should not be used and must be reported immediately to the relevant Laboratory Superintendent. Such equipment should be removed from service until compliance with Section 15 is established. Users of equipment should regularly inspect for damage to casings, cables and plugs etc. and for loose screws.

Where specific hazards exist in laboratory/workshop areas they will be clearly marked at the direction of the relevant Laboratory Superintendent.

All persons wishing to use new or existing equipment in laboratory areas must liaise with the relevant Laboratory Superintendent before commencing work.

15. Inspection and Testing of Electrical Apparatus

All electrical apparatus is required to be inspected and tested at certain intervals. Portable electrical equipment should not be used unless it possesses an approved PAT label.

All fixed installations are the responsibility of the University Electrical Engineer.

All other equipment which can be plugged into a socket, including extension cables, etc. (and can also include battery operated equipment) is the responsibility of the Head of Department.

The Regulations require records to be kept of the maintenance, inspection and testing of all equipment in some detail for the duration of its working life. These records will be maintained centrally by the Departmental Safety Convener. Advice should be sought from the relevant Laboratory Superintendent prior to the introduction of any new electrical equipment.

16. Control of Noise at Work Regulations 2005

Loud noise at work can damage hearing therefore, measures have to be put in place to prevent or reduce risks from exposure to noise at work. It can also be a safety hazard at work, interfering with communication and making warnings harder to hear.

The Regulations require the employer to assess the risks to your employees from noise at work; take action to reduce the noise exposure that produces those risks; provide your employees with hearing protection if you cannot reduce the noise exposure enough by using other methods; make sure the legal limits on noise exposure are not exceeded; provide your employees with information, instruction and training; carry out health surveillance where there is a risk to health.

The Noise at Work Regulations 1989 have been revised and the new 2005 updated legislation comes into force on 6th April 2006 (with the exception of the music and entertainment sectors where the Regulations come into force on 6th April 2008).
1. The new Regulations require employers to take specific action at certain action values (previously called action levels). These relate to:

- the levels of noise employees are exposed to averaged over a working day or week (e.g. use of weekly exposure would be appropriate in situations where noise exposures varied markedly from day to day e.g. gardening staff using power tools on two days of the week); and,

- the maximum noise (peak sound pressure – noises due to impacts e.g. hammering, pneumatic impact tools) to which employees are exposed in a working day.

Noise levels are measured in decibels (dB) and the following new values are:

a. **Lower exposure action values**:
   - daily or weekly exposure of 80dB (previously 85dB);
   - peak sound pressure of 135dB.

b. **Upper exposure action values**:
   - daily or weekly exposure of 85dB;
   - peak sound pressure of 137dB.

**Exposure limit values**: (these are levels of noise exposure which must not be exceeded)
   - daily or weekly exposure of 87dB, peak sound pressure of 140dB. These exposure limit values take account of any reduction in exposure provided by hearing protection ie personal protective equipment.

2. There is a new specific requirement to provide **health surveillance** where there is a risk to health.

Hearing protection must now be made available where there is exposure above the new lower exposure action value (80dB).

Hearing protection must be worn and a programme of control measures (see below) implemented where there is exposure above the new upper exposure action value (85dB).

Noise assessments will require to be reviewed to take into account the changes in the action levels. (See below).

Health surveillance must be provided for all individuals, staff or students where there is a risk to health from exposure to noise e.g. employees who are likely to be regularly exposed above the upper exposure action values, or are at risk for any reason, e.g. they already suffer from hearing loss or are particularly sensitive to damage. More information on health surveillance is available from the University’s Occupational Health Service. If you have any concerns regarding occupational noise induced hearing loss or tinnitus (ringing or buzzing in the ears) please contact the Occupational Health Service on extension (JA) 4824 or email occupationalhealth@strath.ac.uk

The implementation of these Regulations can be quite complex and advice should be obtained from the Safety Officer by anyone affected by them.

17. **Buildings and Equipment**

Building structural faults should be brought to the attention of the University’s Estates Management Department.

The safety and installation of electrical equipment and the clearance of electrical faults up to the normal 13 Amp socket outlets are the responsibility of the University’s Electrical Engineer who is based in Estates Management.
18. **Radiation Hazards**  
Radiation Hazards are the responsibility of the Area Radiation Protection Supervisors. The identities and locations of current post-holders can be obtained from your Departmental Safety Convener.

19. **Compressed Gas Safety**  
Only persons within the Department who have been specifically trained may transport, attach or detach gas cylinders from equipment. These persons will follow the University Guidance on Compressed Gas Safety (15th December 2009).
## Appendix 2

### Access to University Premises - John Anderson Campus

6.7.1 The University Court has approved the following regulations to control access to premises belonging to or in the occupation of the University in order to balance the need for access on the one hand and considerations of general and personal safety (of users), security (of property), and economy (in light, fuel and security staff) on the other.

6.7.2 The normal hours of access to departmental accommodation are as follows:

<table>
<thead>
<tr>
<th>Time</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Monday-Friday</td>
<td>Andersonian Library (as stated in Regulation 3.5 of the University Calendar)</td>
</tr>
<tr>
<td></td>
<td>Computer Centre 0800-2200</td>
</tr>
<tr>
<td></td>
<td>Sports Centre (as stated in the Regulations of the Centre for Sport and Physical Activity)</td>
</tr>
<tr>
<td></td>
<td>All other departments 0800-1800</td>
</tr>
</tbody>
</table>

6.7.3 Some University buildings may be open beyond 1800 hours. Nevertheless, the normal hours of access for departmental accommodation is 0800-1800 hours. Every other time is considered outwith normal working hours.

6.7.4 Saturdays, Sundays and public holidays are considered to be outwith normal hours of access.

6.7.5 Academic, senior administrative and academic related staff are granted automatic rights of access outwith normal hours of access (please see the above) to communal accommodation and departmental accommodation within the area with which they are identified.

6.7.6 Estates Management personnel are granted automatic rights of access outwith normal hours of access (please see above) to communal accommodation and departmental accommodation, normally by prior arrangement with the Head of Department or other departmental staff responsible for the departmental accommodation. However, obviously, in an emergency, for example, flood, Estates Management staff may have to enter departmental accommodation without prior notification. It is, therefore, imperative that any hazardous operations or particularly hazardous material which by necessity is left on open benches be appropriately labelled.

6.7.7 Computer Centre staff are granted automatic rights of access outwith normal hours of access to all areas where that department has computer and communications equipment.

6.7.8 University Safety Services personnel are granted automatic right of access to all University accommodation at all times.

6.7.9 Research fellows, research assistants, individual postgraduate students and members of the technical, secretarial, clerical and manual staff may be granted rights of access to communal accommodation and departmental accommodation outwith normal hours of access. Buildings may be open until 2200 hours but permission (for those who require it) to enter departmental accommodation is required from the Head of Department or their deputy. Individual undergraduate students may also be granted such rights of access through the same procedure. The levels of access available are as follows:

1. **Unlimited Access**
   - An unlimited authorisation access card (RED) must be issued by the department and signed by the Head of Department or their deputy and the person being granted access.
   - The department and those areas specified within it which have been authorised for entry must be stated on the card.
   - The card may be valid for up to one year from issue. However, the expiry date must be shown on the card.
   - The card is only valid if used in conjunction with an unexpired student/staff identity card or other photographic identification.
(v) The card is issued on the understanding that the cardholder has read and understood that part of the appropriate Departmental Safety Regulations pertaining to out of hours working.

(vi) Unlimited access should only be granted when considered essential by the Head of Department.

(vii) Requests for red cards for lab access must be accompanied by a risk assessment (S20 form) and signed by the project supervisor.

ANY BREACH OF REGULATIONS WILL RESULT IN IMMEDIATE CANCELLATION OF OUT OF HOURS ACCESS AND DISCIPLINARY PROCEEDINGS.

**Computer Centre Access**

6.7.10 RED card access needs a countersignature by Computer Centre staff as well as Head of Department signature.

**Temporary Rights of Access**

6.7.11 The Head of a Department or, in their absence, a deputy previously authorised by the Head of Department may, exceptionally, grant temporary rights of access to departmental accommodation, including laboratories and workshops, outwith normal hours of access for a maximum period of one year at a time to a named visitor of not less than 16 years of age in respect of an individual person deemed by the Head of Department on their own responsibility to be suitable.

6.7.12 Some departmental equipment may only, by statute, be used by persons over 18 years of age. The Head of Department must ensure the visitor granted access is fully aware of all appropriate University/Departmental Safety Regulations and Procedures including evacuation.

6.7.13 The name of the visitor granted access and a note of the duration of the access granted must be lodged with Security Control.

6.7.14 Members of staff and students who would normally need RED CARD access are exempt from this requirement when attending social functions authorised by the Head of Department, in departmental rest areas, for example, common rooms, tea rooms, etc. This exemption is only valid until 2200 hours. If it is expected that the function will continue after this time, special permission must be granted by the Chief Operating Officer. Please see Regulation 6.7.15.

6.7.15 The Chief Operating Officer may, exceptionally, grant temporary rights of access to persons other than those granted rights of access under previous Regulations for the purpose of attending specific meetings, examinations or other functions on University premises. When temporary rights of access are so granted Security Control must be notified.

6.7.16 Departmental Safety Regulations must make adequate provision for the health and safety of all persons using departmental premises outwith normal hours of access as defined in the Regulations above.

6.7.17 All persons granted rights of access who use premises outwith normal hours must inform Security Control of their intention to enter, remain in or leave the premises in order that the security staff may arrange for them to be granted access to or exit from the building concerned. They must also record their presence on the premises either by telephoning Security Control or by signing the log book at Security Control (or, in the case of the Royal College, the James Weir or Thomas Graham Building, the log book held at the James Weir Building, Montrose Street entrance) before they enter the premises. All University staff must carry a University staff identity card or other photographic identification. Students must carry a current student identification card plus the appropriate departmental authorisation (for example, BLUE or RED card). Persons using premises outwith normal hours of access may be refused entry or requested to leave by a member of the Security or University Safety Services staff if they cannot show proof of identity.

6.7.18 Security staff must check periodically the safety of individuals recorded as being on the premises outwith normal hours of access.

6.7.19 Persons using premises outwith normal hours of access must have access to a telephone in order to contact Security Control in the event of an emergency.

6.7.20 Operations outwith normal working hours which have been assessed and identified as having a particular risk associated with them must have appropriate control measures in place to handle the foreseeable consequences of the work.
6.7.21 Abuse of the system may result in confiscation of the access card and identity card by Security or Safety Services personnel.

Children - Special Access

6.7.22 Children (persons under the age of 16) are permitted to enter the office accommodation and sports and recreational facilities of the University during the normal hours of access. Access to University premises is only permitted if accompanied by a parent or other responsible adult. Outwith normal working hours, children may be allowed access to office accommodation only; they must be accompanied by the parent or legal guardian who must directly supervise the child.

6.7.23 Children are not permitted to enter laboratories or workshops or other accommodation whose sole means of access is by way of a laboratory or workshop unless for the purpose of attending a supervised course, demonstration or exhibition in which case all sources of potential hazard will have been removed or rendered safe by other means.

Pet Animals

6.7.24 Pet animals of any nature may only be brought on to University premises under extraordinary circumstances. A Head of Department, on advice from a Departmental Safety Convener, may exceptionally authorise access to department premises in which case the animal must be kept under the direct supervision of the owner or other responsible person. A guide dog accompanying a blind person will normally be permitted unrestricted access to University premises but the nature of equipment in certain areas may make it necessary to deny access to such guide dogs.
DEPARTMENT OF MECHANICAL & AEROSPACE ENGINEERING

RED CARD FORM

PLEASE USE THIS FORM IF YOU ARE REQUESTING A RED CARD FOR AFTER HOURS WORK IN THE LABORATORIES OF THE JAMES WEIR BUILDING (6PM – 8AM MON-FRI; SAT/SUN & HOLIDAYS)

Please complete the following and make two copies. The Safety Convener will retain the original. A copy should be passed to your supervisor and one kept by yourself for reference.

Is this Red card (permission to be in the building after hours);

A) Being issued to allow the researcher to conduct non-hazardous work and/or paper work?
B) Being issued to allow the continuation of practical work (covered by your scheme of work) involving chemicals or hazardous equipment?

[If you are unclear if the latter applies, you are directed to your S20 and/or S21 form. You and your supervisor need to be clear that your after-hours activities do not pose a risk to Health as defined by section E.]

Name:……………………………………………………………………………………………………………………………
Supervisor(s):………………………………………………………………………………………………………………
Area(s) of the building to which access is requested (floors and/or labs):
……………………………………………………………………………………………………………………………………

For all persons requesting access for activities associated with A only (no partner required)

In return for permission to be in the building after hours, I agree to register my presence with Security on every occasion that I work out of normal hours (6pm - 8am Mon-Fri; or Sat/Sun or when the Univ. is officially closed)

Signature ……………………………………… Date:…………………………………………
For all persons requesting access for activities associated with B.

In return for permission to be in the building after hours, I agree to register my presence with Security on every occasion that I work out of normal hours (6pm - 8am Mon-Fri; Sat/Sun or when the Univ. is officially closed).

It is understood that I can only work when I have a partner who is prepared to remain in the building until my activity has been completed. The onus is on me to ensure that this person has been identified prior to 6pm weekdays and 6pm Fri for Sat & Sun work or for days when the Univ. is to be officially closed.

The programme of work to be conducted will be discussed in advance and approved by my supervisor or his nominee prior to its commencement.

Signature .................................................. Date:..................................................

______________________________

Supervisors

It is my wish that the above be provided with permission to work out of normal hours. Where the researcher has requested access to continue practical work, the programme will have been approved in advance. I understand that I have a duty of care (defined in the area safety regulations Sec. 9) to the researchers under my direction working after hours.

Signature .................................................. Date:..................................................

The department will not be held responsible for any accident or incident which occurs should you deviate from the above. Should you be found within the building working alone after hours on activities covered by section B your permission to work out of normal hours will be withdrawn.
# Key to Buildings

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Building Name</th>
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<tbody>
<tr>
<td>AB</td>
<td>Robertson Wing, John Arbuthnott Building</td>
</tr>
<tr>
<td>AR or ARC</td>
<td>Architecture Building</td>
</tr>
<tr>
<td>AT</td>
<td>Alexander Turnbull Building</td>
</tr>
<tr>
<td>CL or CB</td>
<td>Collins Building</td>
</tr>
<tr>
<td>CU or Cur</td>
<td>Curran Building</td>
</tr>
<tr>
<td>CV or Col</td>
<td>Colville Building</td>
</tr>
<tr>
<td>GH or P</td>
<td>Graham Hills Building</td>
</tr>
<tr>
<td>HW</td>
<td>Hamnett Wing, John Arbuthnott Building</td>
</tr>
<tr>
<td>HD</td>
<td>Henry Dyer Building</td>
</tr>
<tr>
<td>ICC</td>
<td>International Christian College</td>
</tr>
<tr>
<td>JA or K</td>
<td>John Anderson Building</td>
</tr>
<tr>
<td>JW or M</td>
<td>James Weir Building</td>
</tr>
<tr>
<td>LT or L</td>
<td>Livingstone Tower Building</td>
</tr>
<tr>
<td>LH</td>
<td>Lord Hope Building</td>
</tr>
<tr>
<td>MC or McC</td>
<td>McCance Building</td>
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<tr>
<td>RAM</td>
<td>Ramshorn Building</td>
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<tr>
<td>RC or R</td>
<td>Royal College Building</td>
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<tr>
<td>SB</td>
<td>Strathclyde Business School</td>
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<tr>
<td>ST or S</td>
<td>Stenhouse Building</td>
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<tr>
<td>TG or C</td>
<td>Thomas Graham Building</td>
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<tr>
<td>UC</td>
<td>University Centre</td>
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<tr>
<td>USSA or SU</td>
<td>Student’s Union</td>
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<tr>
<td>WC</td>
<td>Wolfson Centre</td>
</tr>
<tr>
<td>WD or DUN</td>
<td>Sir William Duncan Building</td>
</tr>
</tbody>
</table>