School of Electronics Handbook

Contents

Programme Specification:

Electronic Engineering and Computer Systems Engineering

Introduction

The purpose of this document is to summarise all the important aspects of the Engineering study programme offered by the School of Electronics and to answer many of the questions you will (or should!) be asking about them. We call this a **programme specification**† because it specifies all the essential characteristics of our Degree and Certificate/Diploma schemes and tells you what you can expect from them.

We hope that the information will be useful to four groups of people:

- *Prospective students* who are considering joining one of our courses and wish to compare it with other similar provision;
- *New students* who want to understand what and how they will learn at university;
- *Experienced students* as an useful reference, perhaps as an aid to self-appraisal or expressing their educational experience when applying for employment;
- *Employers* who wish to know what they can expect of students who have followed one of our schemes of study.

Whether you have, or are about to, commit yourself to a long and intense (and probably expensive!) period of higher education, you really need to ask yourself these essential questions:

- What should I know and be able to do when I graduate?
- Do these programmes use appropriate teaching methods and will they give me the opportunity to learn?
- How will I be assessed?

We hope that this document will help you answer these questions.

† The information presented here is based on the formal *programme specifications* which we produced as we designed the courses. Look these up on our Web site by all means, but it is probably better to start with this document.

A word about quality assurance

We have put in a great deal of thought into the formation of our programmes in order to ensure that they provide all the vital elements which you would expect in a course of higher education. But how can you be sure that this is true? This is ensured by the rigorous scrutiny of our programmes by a variety of professional people who check that we are indeed delivering as we claim. This is known as *quality assurance*, which we provide in the following ways.

First, our programmes have been designed with reference to the *Engineering Benchmark Statements* which is a set of guidelines prepared by the independent *Quality Assurance Agency* (QAA). These apply to all engineering degree courses in the United Kingdom.

Second, our programmes are reviewed periodically by the QAA, who inspect in detail the content of our courses, methods of teaching and assessment, educational resources and quality assurance procedures – in fact, every facet of our operations.

Third, our programmes are accredited by the Institution of Electrical Engineers (IEE) which means that they acknowledge that our graduates fulfil some or all of their educational requirements for qualifying as a Chartered Engineer. To be accredited, we must convince an independent panel of highly qualified engineers selected by the IEE that the standard of our graduates is good enough to deserve this privilege.

Finally, the university itself has many internal procedures to ensure educational quality. All our degree schemes are subject to a rigorous re-validation process every 5 years. Detailed procedures for day-to-day QAA are to be found in the University's Quality Assurance Handbook.

It is also worth noting that we review the content of our degree schemes annually so that it reflects the rapidly changing pace of technology. In this we are assisted by an Industrial Panel, composed of several senior engineers from various branches of the electronics and computing communities who provide valuable guidance on the latest technical developments and industrial practices.

Some basic facts

We offer two full-time engineering programmes with entry at various levels:

- Electronic Engineering (UCAS codes H610, H601, H605, H602)
- Computer Systems Engineering (UCAS codes H612, H617, H651, H602)

The most common entry route is at Level 1 which leads, after 3 years of study, to a BEng(Hons) degree or, after 4 years, to a MEng(Hons) degree, awarded by the University of Wales. There is also an entry route at Level 0 which leads to a BEng(Hons) degree after 4 years of study.

Entry to the Certificate/Diploma in Higher Education courses is also at Level 0, leading after 2 years of study to the award of a Certificate and then to a Diploma after 1 further year of study.

Routes exist for transferring from one programme to another.

Full details of our current admission criteria can be found in the Appendix.

Educational Aims

We aim to produce *good graduate engineers*….but what are the hallmarks of an engineer?

Engineers address problems in a thorough and methodical fashion using sound scientific principles and mathematical techniques. They relate their work to current business and industrial practices and are aware of the social and environmental impact of their actions. This is known as the *engineering process* and we want all our students to graduate with an understanding of the essentials of this process. Then they will be in a position to use their specialist knowledge, design flair and technical skills to create and maintain advanced electronic systems or to create systems whose functions depend on computing hardware and software.

To achieve our aim of educating students in the engineering process, our programmes have several specific objectives:

- To provide knowledge and understanding of a fundamental nature, which has wide applicability and is resilient to the dramatic technological changes which an Engineer will encounter within the span of a career;
- To provide state-of-the-art know-how and skills which are immediately relevant to today's engineering industries, making the graduate a desirable recruit who can rapidly adjust to the demands of a professional post;
- To provide an appreciation of how science and technology are applied in industry and commerce and how they are related to the constraints and practices of the business environment and the needs of society;
- To provide the graduate with a range of intellectual and transferable skills;
- To provide the educational base for further professional development.

We believe that our programmes allow the student a balanced and well-integrated attainment of these objectives.

Programme Outcomes

Three questions were posed in the introduction - let's deal with the first of these. *What you should know and be able to do on graduation* is stated by means of *programme outcomes*. These are very important because they define you as an engineering graduate – they distinguish your degree from others and characterise your area of qualification and competence. The programme outcomes fall into four categories :

- Knowledge and Understanding
- Intellectual (thinking) skills
- Practical Skills
- Transferable Skills

If, at this point, you look for specific modules within the programme to address these categories then you will seek in vain. Engineers – indeed human beings in general – just do not separate their learning activities into neat compartments. Instead, we learn in an integrated manner, making myriad connections between the various parts of our educational experience. This reflects real life and certainly reflects the engineering process – so it is right that our programme is delivered in this way too. Nevertheless, it is valuable to look in a little more detail at these four categories.

Knowledge and Understanding**:** There are facts, concepts, principles and theories, that are central to their respective subject areas, which all electronic engineers or computer systems engineers should know about and understand. Our programmes are structured so that these are presented in coherent themes which run throughout the programmes, as shown in the accompanying Table.

Themes for the Engineering Programmes at the School of Electronics

Electronic Engineering Themes	Computer Systems Engineering Themes
Engineering Analysis: the basic mathematical theories and techniques relevant to Electronic Engineering.	*Engineering Analysis*: the basic mathematical theories and techniques relevant to Computer Systems Engineering.
Electronic Systems: the concepts, principles and modelling methods used to analyse and design electronic circuits and systems. *Microelectronics*: the physical characteristics of electronic devices and the design rules and methods for synthesising integrated circuits.	*Computers & Information Technology*: the principles and applications of software at all levels in the design and development of computer based systems; the practical uses of IT tools in an engineering context.
Communications: the science and mathematics of communications and information technology and their application in system design. *Computers*: the principles and applications of computers and the practical uses of IT tools in an engineering context.	*Informatics Physical Layer*: the science and mathematics of electronic devices, digital circuitry and communications methods that comprise the underlying technology on which computer systems are based.
The Engineering Dimension: the management and business practices, environmental and ethical issues and the social context which affect engineers in the conduct of their profession. *Engineering Practice*: product specification, design principles, project planning and solving problems by applying the engineering process.	

Obviously, the Table gives only a high level overview. More detail about the modules in each theme are given in the next section of the Handbook and are also available on the Intra-Net at the School of Electronics.

Intellectual (thinking) skills: To the engineer, knowledge and understanding of the subject are useless unless they can be applied to solving problems. Our programme is intended to make you think in a creative, and possibly innovative, fashion but you are also guided to the best ways of thinking about engineering problems.

For instance, is it sensible to construct umpteen versions of an electronic circuit until – by a process of trial and error – it finally functions as you wish? Certainly not – instead, a knowledge of mathematics and physics allows the engineer to produce an abstraction of the real device, circuit or system which can be used to yield a better solution much more quickly and cheaply. This way of thinking is fundamental to the engineering process.

One of the thinking skills that you will encounter is how to transform an idea into a conceptual model. No matter how good your idea, it is useless if it is locked inside your head. The engineer must learn how to express that idea so that it is accessible to others and can be turned from a dream into a concept then a plan and finally a reality.

Calculations conducted early on in the design of a product are often relatively simple, so a paper and pencil exercise is used to give broad insight into a problem and the feasibility of different methods for solving it. As the design evolves there comes a point when its complexity demands the use of a computer-aided software tool – so a different way of thinking is needed for a different stage of the project.

Innovation – a capability for thinking of novel solutions to a problem – is central to the engineer's art. But in doing so, the engineer must exercise disciplined creativity because the allowable solutions are invariably limited by what is technically possible and constrained by external factors such as time and money.

Engineers are often requested to act for a client and it is a crucial part of the engineering process to discern their wishes and turn them into a precisely stated set of requirements. From these, a firm specification for the product – a software package to perform a certain function, for example – can be produced. Thinking skills are at the heart of this activity because the engineer must interpret the client's views – often expressed inexpertly and inaccurately – and temper them with experience to achieve an outcome that satisfies both parties.

The engineer must be able to apply design rules and synthesis techniques to fulfil set specifications. What is often important here is knowing how best to think about a problem. Is it a special case of a more general problem for which there is a known answer? Or perhaps it may be possible to adapt a known technique to provide a satisfactory solution?

While much of the engineer's time – especially early on in a career – may be spent on technical problems, it is never possible to ignore the context in which the work is taking place. So the engineer must also practise broader thinking skills. For example, it may be necessary to assess the impact of uncertainty – how do the technical risk and development time-scales associated with the work affect the chances of success? Similarly, making the right decisions about the future of a project requires a trade-off of competing factors, such as its potential costs and benefits. Good product design requires that thinking about technical detail be combined with thinking about the broader issues.

Practical Skills: Engineering, of all disciplines, is a practical one and it is necessary that the graduate possess a range of skills that support the construction of prototypes and the collection of experimental data. Our programmes include a substantial element of laboratory practice, which teach the student to use electronic instrumentation safely and effectively, make accurate measurements, record data systematically and store it securely. Electronic engineers learn how to construct simple circuits while computer systems engineers will code and execute programs.

Using CAD tools is a vital skill in today's industry – producing VLSI circuits, for instance, depends entirely on a mastery of the software packages into which the complex design rules are embedded. Similarly, their use for scientific analysis and visualisation and for system simulation feature within the programmes.

The continuing explosion of information makes rapid and targeted access an essential skill, requiring the development of library search skills. Extracting information from Internet sources and presenting information on the Internet about your own work also requires the acquisition of specialised practical skills.

Transferable Skills: One of the virtues of an engineering degree is that the student learns a number of skills which are useful outside the technical discipline; these are known as *transferable* skills. It is, for example, the numeracy and analytical thinking skills of engineers which makes them attractive to employers in business and commerce.

Engineers must learn to organise data – sometimes in vast amounts – for visualisation and analysis so that the core information can be extracted and evaluated. They also prepare reports which not only describe what they have done but interpret for the reader what the results mean and discuss their potential impact. Word processors, financial spreadsheets, database packages and project management tools are all skills with wide applicability outside engineering.

Learning is itself a skill – simple observation shows that an experienced student is more adept than a novice. All companies in the high-technology sector now encourage their staff to participate in continuing professional development and the ability to learn independently is essential.

It is also expected that engineers can communicate effectively – whether this be with colleagues, clients, management or the public. This involves practising written, oral, graphical and mathematical forms of communication. Sometimes the engineer may be called upon to present a case – for developing a particular product, for instance - and to justify a course of action, such as expenditure on expensive field trials.

There are also a number of transferable skills which the engineer learns in order to function properly within a team – being able to co-operate with others to achieve a common goal and accepting leading or subordinate roles in a team are important qualities.
An engineering background is also good preparation for managerial roles as careers develop. Seeing patterns and making orderly connections in complex situations, managing people, resources and time are highly desirable general skills which you will have an opportunity to acquire within our programmes.

Methods for teaching and learning

The second question is *whether the programmes use appropriate teaching methods and give you the opportunity to learn?*

All our programmes are organised in a modular structure which allows us to cater for a wider range of individual preferences than a traditional fixed degree structure. For instance, we have programmes in Computer Science and in Electronic Engineering but – by judicious selection of modules – are also able to offer a programme in Computer Systems Engineering. This is popular with students who wish to specialise in computation but want to pursue it in the context of the engineering process.

We have many different methods of teaching and learning (usually – but not always! – we teach and you learn) and these are matched to the programme outcomes.

For *Engineering Analysis*, lectures are used to present the core knowledge but these are reinforced by tutorials and problem classes to stimulate understanding and develop a facility for mathematical manipulation.

For the Electronic Engineering programme, the three themes of *Electronic Systems*, *Microelectronics* and *Communications* are delivered in the first instance by lectures but again the concepts are reinforced during tutorials. For the Computer Systems Engineering Programme, the *Computers & Information Technology* is partly delivered by lectures but more use is made of 'hands-on' sessions and in-class exercises, supported by postgraduate demonstrators. The *Informatics Physical Layer* theme relies more on lectures and tutorials.

Audio-visual technology is used widely for presentations and for illustrating the lecture with computer simulations. Written notes and other support material are available for all modules, and are usually accessible on the School's IntraNet. Laboratory experiments are used to highlight important aspects of the science involved and allow the student the opportunity to put into practice some of the design techniques introduced during lectures.

The use of *Computers* is ubiquitous. Here, lectures are usually confined to the introductory stage and the theme is mostly taught by 'hands-on' sessions and usually requires extensive self-learning by the student. Small-group projects such as the ‘Software Hut’ place the use of computers in an engineering context.

Project work features heavily in *The Engineering Dimension* and the *Engineering Practice* themes. Small-group projects and role-play exercises are used to place students in situations similar to those which they could encounter in industry. All students undertake a substantial individual project in their third year, supervised by a member of staff in their chosen field of specialisation. For MEng students, there is also substantial team project at Level 4 which emphasises the application of the engineering process and is directed towards the design and development of a product of real industrial value.

Whatever programme outcome is involved, the importance of independent reading is stressed and guides to further sources are included in course material. This is particularly the case at Level 3 and Level 4 where the content begins to interface with current state-of-the-art and research topics, and you may be thinking in terms of specialisation and advanced studies.

Intellectual skills are not taught as an explicit subject being, instead, pervasive throughout the programmes. The idea of modelling a device – an equivalent circuit for a transistor for instance – would usually be met first in a lecture. This would later be reinforced by a laboratory experiment where the parameters of the model were measured and followed by the use of a CAD package to predict the performance of the device, based on the model.

Similarly, methods for requirements analysis and specification – such as the Yourdon Systems Method – would first be introduced formally in lectures. Practising with the technique would be done by individual assignments and in small-group projects.

Individual projects allow the student to demonstrate innovation and creativity and a capacity for solving problems logically and systematically. Teamwork projects require the student to think in a clear and organised manner to deal with uncertainty, complexity and conflict.

Practical Skills are developed in the laboratory by a combination of demonstrations and student ‘hands-on’ experiments with experienced staff available to advise.

Transferable Skills Data manipulation and presentation is taught in laboratory experiments. Laboratory and project reports help develop precise description of objectives and methodology followed by interpretation and discussion of the results. 'Hands-on' sessions during lectures are used to teach databases; word processing and spreadsheets are self-taught by the student. The importance of independent learning is stressed by encouraging students to keep a Continuing Professional Development record. The essentials of effective communication are introduced in lectures, developed in the 'Enterprise Project' and reinforced by advice from supervisors during individual projects. Similarly, peer-group discussion within team projects and one-to-one discussion with individual project supervisors encourage constructive criticism and judicious argument. The MEng Teamwork Project is performed in the context of an industrial/business situation and the student learns to manage people, resources and time. The flexible and highly variable scenario presented by the Teamwork Project reflects the industrial environment and success depends on a high level of co-operation with others to achieve a common goal. During the project all students will take leading and subservient roles within the group.

Assessment Methods

The final question asks *how you will be assessed*, perhaps conjuring up a mental picture of the dreaded examinations hall! Unseen examinations certainly remain an important assessment tool but they are only part of an array of assessment methods which are matched to the learning outcomes of each module.

For each module in the programme, there is a published set of learning outcomes. The purpose of assessment is to confirm that you have achieved them, at least at the Threshold level (in which case you 'pass' the module).

Unseen examinations are mostly used to test knowledge and understanding of the technical components of the course but there is often an element of assessed assignment involved as well or (often in the more mathematical subjects) a series of in-class tests.

Some specific thinking skills, particularly those involving detailed analysis and solving well-defined problems, are assessed objectively by means of unseen written examinations. Modelling (whether at device or systems level) and the appropriate use of computerised tools are assessed by laboratory reports and assignments. Broader thinking skills are assessed by project reports, oral/poster presentations and the application of reasoned judgement by experienced staff.

Practical skills are assessed by means of laboratory experiment reports, project reports and presentations.

Some transferable skills, such as organising data for visualisation and analysis, preparing reports and effective communication are assessed explicitly. Oral presentations may be assessed by an adjudicating panel, in some cases composed of industrial engineers. Other transferable skills are not assessed separately but their impact on the efficiency, thoroughness and quality achieved in other learning outcomes is a good indicator of attainment.

It should be clear that the old-fashioned pattern of three (or four) years of study, followed by a cataclysmic fortnight in which your 'Finals' examinations determine your degree classification, has vanished. Instead, there is a variety of assessment methods which address all aspects of the initial formation of an engineer, which reflects the variety of activities typically found during a professional engineering career.

The 'bottom line'

It is right that your efforts as a student be rewarded!

This is done by the award of a qualification which is endorsed by the authority of the university. Our qualifications comply with the descriptors as defined by the national framework for higher education, as follows:

MEng degree	M level (Masters)
BEng degree	H level (Bachelors with Honours)
Diploma in Higher Education	I level (Intermediate)
Certificate in Higher Education	C level (Certificate)

This means that potential employers (in the United Kingdom and abroad), and indeed the public in general, will understand what you have achieved in obtaining your qualification and have confidence in the standard it represents.

Conclusions

We trust that this document gives you a good insight into our courses and our approach to the initial formation of an engineer. You should now have a better idea of what can be expected of a graduate of this School, of the teaching and learning methods we use to produce graduates and the means by which we confirm that they deserve to graduate. We hope, also, that we have convinced you that we run high quality engineering courses which compare with the best in the United Kingdom in their content and delivery, leading to degrees which are well-respected by industry and other universities, and of a standard you can trust.

Further Information

The Programme Leader for the engineering programmes is:

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Appendix - Criteria for Admission in September 2006

Certificate/Diploma in Higher Education

- The Admissions Tutor considers the merits of each application individually.

BEng (at Level 0)

- 140 UCAS points, including at least 1 pass at A2 level, in any subject plus (normally) GCSE passes (or equivalent) in Maths plus GCSE pass (grade C or above) in English Language or Welsh Language.

BEng (at Level 1)

- 240 UCAS points from A-levels, with 2 passes at A2 level, including grade C in Maths and Physics (or equivalent) plus GCSE pass (grade C or above) in English Language or Welsh Language.
- 240 UCAS points from AVCE in appropriate subjects plus (normally) additional Mathematics Units plus GCSE pass (grade C or above) in English Language or Welsh Language.
- 240 UCAS points from BTEC National Diploma in an appropriate subject plus GCSE pass (grade C or above) in English Language or Welsh Language.
- 240 UCAS points from Scottish Highers with including Maths and Physics (or equivalent), plus English Language at the standard grade.
- 240 UCAS points from Irish Leaving Certificate including Maths and Physics (or equivalent) and at least grade D in English.

BEng (at Level 2)

- For direct entry at Level 2, the Admissions Tutor considers the merits of each application individually.

MEng (at Level 1)

- 300 UCAS points, including A2 grade B in Maths and Physics (or equivalent) and a GCSE pass (grade C or above) in English Language or Welsh Language.
- 300 UCAS points from AVCE, BTEC ND, Scottish Highers, Irish Leaving Certificate with subject conditions as for the BEng.

MEng (at Level 2)

- Students who attain an average of 65% or more at Level 1 and have no more than 1 module mark below 40% but not less than 30% may be offered transfer to the MEng scheme, subject to the approval of the Examining Board.

For both degree schemes, mature and overseas students are considered on an individual basis.

Continuing Professional Development

The Engineering programmes at the School of Informatics are accredited by the Institution of Electrical Engineers (IEE) and provide the first step towards becoming a professional Chartered Engineer.

- The MEng degree fulfils all the educational requirements for Chartered Engineer;
- The BEng (Hons) degree fulfils the educational requirements at an interim stage and can be enhanced to satisfy the final stage requirements by completion of an accredited Master's degree (learning equivalent to one further academic year of study with the aim of broadening to achieve equivalence with MEng graduates both in foundation learning and specialist enhancement).

As for doctors, lawyers and most other professions, your educational base must be enhanced by a period of further training and practice to ensure that you have certain *competences* before you can be registered as a Chartered Engineer. Consider the Engineering Council's view of the roles, responsibilities and capabilities of a Chartered Engineer:

"Chartered Engineers are concerned primarily with the progress of technology through innovation, creativity and change. Their work involves the application of a significant range of fundamental principles, enabling them to develop and apply new technologies, promote advanced designs and design methods, introduce new and more efficient production techniques, marketing and construction concepts, and pioneer new engineering services and management methods. They may be involved with the management and direction of high risk and resource intensive projects. Professional judgement is a key feature of their role, allied to the assumption of responsibility for the direction of important tasks, including the profitable management of industrial and commercial enterprises".

The process of bridging the gap between graduation and registration is known as *Initial/Qualifying Professional Development* (IPD). It involves building competence and professional breadth, including the business aspects of engineering. It is achieved by acquiring further learning and experience, often in a specialist role or field of engineering. Additionally, it develops the breadth of capability required to carry responsibility and to make engineering decisions which take account of social and economic factors. This cannot be acquired solely by formal study; it involves some structured learning from experience. In order to demonstrate that you deserve to qualify as a professional engineer, it is important that you keep a *Professional Development Record* (PDR) which is a summary of all the activities you have undertaken which contribute to your professional formation.

In fact, IPD is only the first part of a process of learning that a professional engineer is expected to undertake throughout his or her career. This is known as *Continuing Professional Development* (CPD) and it is necessary in order to keep pace with the rapid changes which take place in science and technology, the economy, business practices, the law, environmental factors and the wishes of society.

In the first-year module *Engineering Perspectives*, you will be introduced to the structure of the engineering profession, the 'engineering process' and methods for considering and monitoring your own professional development. During this module, further material will be distributed on these topics and you are encouraged to think of this section of the Handbook as the foundation of your own PDR.

So, your Initial Professional Development starts now. A good way to proceed is to join the IEE as a student member – see the Student Counsellor, Dr Dewi Jones (Room 424) for an application pack or join directly on their website: http://www.iee.org.uk/.

Course Structure and Module Descriptors for the Engineering Programmes

This section provides information on the modules provided by the School of Informatics for its Engineering Programmes:

- **Electronic Engineering**
- **Computer Systems Engineering**

Course Structure

As stated in the Programme Specification, our courses are structured into coherent themes which run throughout all years of study. The course structure charts (overleaf) show the themes as horizontal bands. Progress to more advanced academic study is indicated by the Level of the module, shown by the columns in the course structure.

The course structure is revised on an annual basis and has to be produced some time before the start of the academic year. Inevitably, there will be some small modifications to the course structure caused, for example, by changes in technology and movement of academic staff. We try to keep to the planned course structure as closely as possible but we can't guarantee that it will be maintained exactly as shown in the charts throughout your years of study.

Module Descriptors

You will be given copies of the module descriptors for your programme and year of study at Registration. **DO NOT** throw away previous years' module descriptors – they build up into a valuable record of what you studied at university and may be required by employers and for your professional development record. The contents of modules do vary from one year to the next which is inevitable – and desirable – in a fast-moving technical subject. Some modules within the programmes are provided by other departments of the university. You should obtain module documentation directly from them and insert it here as part of your record.

Learning Outcomes

Each module descriptor states the learning outcomes you can expect by successful study of that module. Successful study will not be achieved simply by attending lectures and copying notes. This is only one element. You must spend time outside the timetabled lectures and laboratories discussing the work with your contemporaries and studying quietly by yourself. The module descriptors give a rough guide to the time that the lecturer expects a typical student to spend on each element of the course, in order to pass the module. The nominal total for a 10-credit module is 100 hours of study. Over the two semesters you study 12 modules and this works out at a nominal 40 hours of study per week. Bear in mind, however, that a student of average ability who wishes to excel in their chosen discipline would need to study for more than this nominal number of hours. Resist the temptation to concentrate exclusively on your favourite modules at the expense of others. It is important to show your competence across the whole study programme.

Self-study time should be spent understanding concepts, using recommended text books to amplify lecture notes and solving problems, e.g. set tutorials, past examination papers and appropriate examples from text books. Learning to work effectively on your own is essential. It will benefit you in studying for your degree and in your subsequent career and is an important part of university education. Your personal tutor will be pleased to talk to you about study skills.

Insofar as your financial resources allow, you should purchase your own copies of recommended text books, especially those coded ‘A’.

Consulting lecturing staff

The names of lecturers (‘conveners’) responsible for each module are given as well as their contact details. The best times to contact staff are during tutorials or laboratories or, briefly, at the end of lectures. You are also welcome to see staff members in their offices and they will do their best to respond immediately to your queries. However, staff do have major research and administrative commitments within (and outside) the School and this will not always be possible. For prolonged discussions, it is advisable to make an appointment either directly with the member of staff or through the departmental secretary.

Assessment

The method of assessment and the contribution that each component makes to the overall module mark is tabulated in each module descriptor. There may be occasions when a lecturer chooses to vary the assessment method (e.g. as a consequence of introducing recent material in a fast-changing technological subject). Such changes will be small and will be announced to the class at the commencement of the module.

How your module marks are pooled together in the end of year assessment, and how they affect your year-to-year progression and degree classification, are described in the General section of this handbook under 'Assessment'. Please refer any questions about assessment rules to personal tutors in the first instance or, in the case of detailed questions, to the Senior Examinations Officer.

Engineering benchmark references

In the module descriptors you will find the codes **E1 .. E6** used as references in the Learning Outcomes. These are a statement of how the learning outcomes contribute to the content of Engineering programmes as published by the QAA in the handbook "Academic Standards – Engineering", as follows :

E1 – Mathematics
E2 – Science
E3 – Information Technology
E4 – Design
E5 – Business Context
E6 – Engineering Practice