JOINT BOARD OF MODERATORS

GUIDELINES FOR ACCREDITED MENG DEGREE PROGRAMMES LEADING TO CHARTERED ENGINEER

1. Programme Objectives

It is expected that programmes will vary in style and content whilst generally conforming to these guidelines, but there is a general objective that should be borne in mind; an accredited MEng programme is intended to provide the distinctive educational base that will produce graduates who are practical, articulate, numerate, literate, imaginative, versatile, confident and inquisitive. Such graduates should have the potential to take responsibility for innovation, technology transfer and change, looking for ways of exploiting emerging technologies and, where appropriate, promoting advanced designs and design methods. They will need to possess creativity founded upon a deep understanding of engineering principles and may eventually control projects involving advanced technology that require the management of risk, resources and large capital budgets. They will need to develop an understanding of the construction industry, its role in wealth creation, the social and political context within which engineering is practised, the role of civil engineering in shaping the physical and social environment and its diverse contribution to the quality of life and social justice. Professional judgement and application are likely to be key features of their role allied to the possibility of responsibility for the direction of important tasks including the profitable management of industrial and commercial enterprises and the supervision and management of others.

2. Programme Characteristics

2.1 The MEng is defined by the EC^{UK} as an integrated second cycle degree (or equivalent sandwich or part time) and the majority of the final year modules should be at QAA Level 7 (Higher/SCQF Level 11). It is intended for students with demonstrably high academic achievements and motivation, and should provide a coherent and integrated broad based programme of foundation and specialist learning in a high quality learning environment. It should be supported by the development of personal and professional competencies including information technology and be delivered against a background of current business and commercial practice and preferably include consideration of international issues. There will be a demonstrably significant additional amount of extended study by comparison with that required of BEng (Hons) programmes.

2.2 Standards of academic achievement for entry into MEng degree programmes will continue to form an important criterion for accreditation (see Annex A – Achievement Levels for Entry onto Degree Programmes). However, the Guidelines reflect the need for accreditation to be focused more upon the standards of achievement that are attained during the programmes and the standards reached upon completion of the programme (see. Guidelines for Checking Output Standards of Degree Programmes).

2.3 The content of MEng programmes will vary within the range of disciplines embraced by the

JBM and will be influenced by the needs of different sectors and employers. It is anticipated that MEng programmes will vary in emphasis between one university and another, but they should be designed to provide the base for differing careers within the same discipline. The MEng should provide depth and breadth, an intellectual approach and the development of an ability to identify, define and solve complex problems from first principles.

2.4 An MEng programme should create the platform from which individual aspirations to register as a Chartered Engineer can develop, and therefore it is essential that a recognised minimum of engineering science and technology be safeguarded within the programme as set out in 3.2. There may be variations in emphasis for study of a particular branch of engineering with some developing greater breadth and others greater depth. There will be diversity in the extent of multi-disciplinary education in a range of engineering disciplines, and differences in the extent to which elements of business issues and practice, including management, finance, marketing and cost control are covered. There should be industrial involvement in both the design and delivery of MEng programmes.

3. Academic Requirements

3.1 The essence of an MEng programme is the education of students to an appropriate depth of understanding and breadth of knowledge needed to work within and, eventually, to lead and manage inter-disciplinary teams. Because it is designed for students with high academic ability and motivation, the course needs to make provision for:

- Sufficient time to achieve the standards of the educational base for a Chartered Engineer.
- Analytical treatment, comparable in depth intellectually, to the highest standards for undergraduates.
- Both depth and breadth of coverage to meet the needs of industry in technical subjects, management and business topics and personal skills.
- A foundation for a wide range of subsequent study and the development of a positive attitude and motivation towards lifelong learning.

3.2 All programmes should place emphasis on a fundamental and thorough understanding of the principles of engineering science. Students should be able to identify, understand and apply the principles with confidence. An understanding of the concept of stability and modes of failure, referred to in 3.4, will compliment this understanding. In broad terms the development of engineering sciences (including relevant mathematics) should constitute around fifty percent of the programme, with the emphasis dependent upon the nature of the degree programmes.

3.3 The engineering content of the programme should be constructed around at least five core subjects from those listed below that are appropriate to the Institutions concerned in the accreditation of civil, structural and highway engineering programmes. These core subjects should reflect the aims of the degree programme, and they should embrace theory, analysis, design and engineering practice. They should also provide an appropriate integration of the engineering sciences, mathematics, mechanics and materials. *The JBM would expect to see degree programmes that contain the three core subjects in List A,*

LIST A

- *structures,*

- *materials,*
- *geotechnics,*

and a minimum of two core subjects chosen from List B.

LIST B

- *fluid mechanics (hydraulics),*
- *surveying (geomatics and measurement),*
- *transport infrastructure engineering,*
- *public health,*
- *construction management,*
- *environmental engineering and*
- *architectural technology.*

The chosen core subjects should be developed to a depth where the time spent on them represents at least one third of the total curriculum.
If fluid mechanics and surveying are not included within the core subjects then the JBM would expect to see the fundamentals of these subjects covered elsewhere in the degree programmes. It is anticipated that programmes would cover at least introductory aspects of most of the subjects listed above that are not included in a core selection. Where specialist optional core subjects other than those listed above are introduced, their inclusion must be justified and it must be demonstrated that there remains a balance of core subjects which will provide the right foundation for a career in the construction and environment sectors.

3.4 The engineering subjects should be taught in the context of design (see Annex B – Design in Degree Programmes), with appropriate account of issues of:

- sustainability (see Annex C – Sustainable Development in Degree Programmes),
- health and safety (see Annex D – Health and safety risk management in Degree Programmes), and
- construction.

Each issue should form a continuous and integrating thread running through the programme, exposing students to a thorough mixture of engineering principles, the concept of stability, modes of failure, analysis, conceptual design, analysis and their synthesis. An ability to demonstrate engineering concepts and ideas using sketches and diagrams will enhance the level of understanding and will compliment the communication skills referred to in *3.8.*
Through contact with other issues*, students* should be stretched to ensure development of their capabilities to operate at a high intellectual level, including the exercise of judgement.

3.5 The teaching of mathematics both as an identifiable discipline as well as its use in developing engineering theory is important and should run for at least two years of the programme. Elements involving calculation, experiment, observation and deduction, must form a significant part of the programme.

3.6 Experimental work is important and should extend beyond routine classical testing and experiments in the laboratory. Field courses in subjects such as surveying, geology and environmental issues are also important, particularly where these subjects form an integral part of the programme.

3.7 Broadening subjects outside core engineering should form an important element in an accredited programme. Wherever possible, departments should provide opportunities for students to follow, in various degrees of depth, a range of appropriate subjects. Learning to recognise and manage risk, in its broadest sense, should be an integrated element of all

courses. This will involve the student in technical assessment and management (including project and budgetary control), and an understanding of environmental and occupational health and safety risks. An understanding of health and safety issues and the need to design and operate safe systems of work is mandatory for practising engineers; programmes must expose students to the wider social, commercial and legal contexts and engender an appreciation of the value of design and of good practice in the reduction of risk (see Annex D – Health and Safety Risk Management in Degree Programmes).

3.8 It is fundamental that engineers are able to communicate with confidence and clarity to their professional colleagues, the public and the other professions. Programmes should develop effective verbal and written communication skills, including public speaking and the preparation and presentation of written material in clear precise and grammatically correct English. Students should be encouraged to create and use sketches and diagrams as a direct means of communication or to compliment written material or verbal presentation. Effective communication interfaces with the requirements and responsibilities of leadership, as well as working within an interdisciplinary team. An opportunity to learn and to use other languages should be encouraged.

3.9 All students should be encouraged to develop competency in the use of computers and IT skills. It is important that the use of computers should reinforce the understanding of basic principles, concepts and limitations.

3.10 Sustainability issues in their broadest sense are of vital concern in professional engineering. It is important that graduates have an understanding of these and are able to take them into account in the design and construction processes. Wherever relevant, these issues should be woven into the separate subjects within the programme (see Annex C – Sustainable Development in Degree Programmes).

3.11 Programmes should introduce the concept of quality systems and the need for a quality approach to be intrinsic to all activities.

3.12 All students should undertake a major investigative project in a subject that is not of a routine nature, which will lead to an individual report. This should provide scope for initiative, creative thinking, understanding the research method, and should be intellectually challenging and individually assessed. Where research is taking place within the department, every endeavour should be made to see that students are exposed to and are aware of these activities. Additionally, students should be engaged in a group design project, preferably interdisciplinary, which provides opportunities for integrating earlier modules, and will assist in the development of team working. Both forms of project should normally be linked to real problems. These projects should be undertaken within the final two years of the programme.

3.13 There should be strong, viable and visible links between departments and the profession. It is essential that local practising engineers should become involved with the education of students by, for example, giving appropriate lectures, internal talks, assisting with design projects, acting as industrial tutors, and enabling students to make site visits. Regular site visits should be seen as an important element within the programme. It is strongly recommended that an Industrial liaison group is established and should meet regularly to implement change and identify how local and national needs for graduate employment might influence programmes. Please also refer to the JBM Guidance Note on Industrial Contact

3.14 Programmes should not be overloaded and need to encourage the development of exploratory self-learning. Time should be available within the programmes to allow students to take advantage of a range of other opportunities.

4. Sandwich Courses, Vacation Work Experience and Work-Based Education.

4.1 Undergraduates will enhance their academic knowledge and graduates will be more appreciated by their first employer if they have gained some industrial experience or training during their degree programme. This experience or training may be obtained during the industrial periods of a sandwich course or during the long vacations, preferably in periods of at least eight weeks duration. In either case, it is preferable if the students are introduced to engineering applications both on site and in the design office where they can form an integral part of the degree programme. Where they form part of the degree programme, universities should monitor all periods of industrial experience, with the undergraduates required to produce reports on their experiences.

4.2 Students receiving sandwich course/vacation/industrial experience should expect to participate in any training/development opportunities that are available.

4.3 Site visits and attendance at professional body/institution meetings are important elements of engineering education and the JBM actively encourages these activities. Direct links between universities and professional bodies are encouraged.

4.4 Good practice for industrial placements is outlined in Annex E – Industrial Placements in Degree Programmes.

4.5 It is possible for the JBM to accredit work-based education that is designed as part of an accredited degree programme. Work-based education in a degree programme can include work placements, a sandwich course, and vacation placements and work placements as part of a module. A degree programme is made up of periods of learning which are assigned credits. An undergraduate year (usually thirty weeks of formal education) is equivalent to 120 credits. The credits for *work-based education* are different because the student is developing professionally while acquiring knowledge in the work place.

4.6 *Work-based education* modules or placements that bear credits have to occur between the end of second year (third year in Scotland) and graduation. They have to meet the principles described in the sections on Process and Assessment of the JBM Guidance note on “Work-Based Education forming part of the educational base for a Chartered Engineer” (available to download from the JBM website) and the learning outcomes and the appropriate level of competency have to fit within the *accredited degree programme*. Please refer to Appendix and Appendix B of this JBM guidance note.

4.7 A *work based education* module is a more intense learning experience than a placement. In both cases there has to be an individual *Learning Plan* for each student.

4.8 The assessment is based on a **portfolio of evidence** including an explanation to place the evidence in context, and how the key learning outcomes were achieved, a number of **assignments that test the knowledge and understanding and the ability to apply that knowledge**, and an **oral presentation**.

5. Extra Mural Activities

It should also be remembered that many qualities upon which employers place considerable importance are developed by involvement with activities external to the department, so these should be encouraged.

6. Programme Amendments

Planned substantial modifications to an accredited programme should be notified to the JBM.