JOINT BOARD OF MODERATORS

Guidance for the Submission of Foundation Degrees in Civil Engineering for Accreditation

The following guidelines for Foundation Degrees (FDs) have taken into account current JBM guidance for the submission of BSc/BSc(Hons)/BEng programmes for accreditation at Incorporated Engineer level. They have also been written to accommodate Government Guidelines, Foundation Degree Forward (FDF), QAA, and 'The Institute of Mathematics and Its Applications' for IEng degrees.

It should be noted that an FD will fully meet the educational base requirements for registration with the Engineering Council as an Engineering Technician. It will also part satisfy the educational base requirements for registration with the Engineering Council as an Incorporated Engineer with the addition of Further Learning (see later section).

The basic design of all FD programmes lies in a balance between meeting academic educational criteria, and skills and work-based assessment. The Board (JBM) would wish to support FDs in General Civil Engineering and those which are designed to meet the needs of particular areas of employment in the civil engineering industry. The overall FD programme should meet the needs of engineers in the arts, science, and practice of an aspect of civil engineering, whilst at the same time providing a substantial base for the FD holder to continue further learning and membership of a professional body or an honours degree at IEng level.

The Quality Assurance Agency's minimum credit tariff of 240 CATs points, of which 90 should be at the level of the qualification, is accepted, as are the outcomes set out in its document on FDs in October 2004 ('Foundation Degree Qualification Benchmark').

QAA Outcomes:-

- knowledge and critical understanding of the well-established principles in their field of study and the way in which those principles have developed;
- successful application in the workplace of the range of knowledge and skills learnt throughout the programme;
- ability to apply underlying concepts and principles outside the context in which they were first studied, and the application of those principles in a work context;
- knowledge of the main methods of enquiry in their subject(s), and ability to evaluate critically the appropriateness of different approaches to solving problems in their field of study and apply these in a work context;
- an understanding of the limits of their knowledge, and how this influences analyses and interpretations based on that knowledge in their field of study and in a work context;

Typically, holders of Foundation Degrees would be able to:

- use a range of established techniques to initiate and undertake critical analysis of information, and to propose solutions to problems arising from that analysis in their field of study and in the work context;
- effectively communicate information, arguments, and analysis, in a variety of forms, to specialist and non-specialist audiences, and deploy key techniques of the discipline effectively in their field of study and in a work context;

- undertake further training, develop existing skills, and acquire new competences that will enable them to assume responsibilities within organisations.

The assessed 'work-based learning' may contribute up to 60 of the 240 credits, of which normally 30 credits are at the qualification award level. QAA (October, 2004) states, 'Payment is not a defining characteristic of the work, and 'working' is in itself not sufficient. Work-based learning requires the identification and achievement of defined and related outcomes.'

In conclusion, progression from FDs may be to an academic award of a higher degree, normally, with honours or an award validated by a professional body. QAA (Oct2004) states, that the professional bodies should be part of the validation process.

As will be seen from the above, 'work based learning and its assessment' is an integral part of a Foundation Degree. **The JBM has determined that 'Accredited' FDs will have not less than 60 credits of 'Assessed Work-Based Learning' within the 240 credits necessary to the 'Award', and that not less than 30 of these credits should be at the level of the final level of the 'Award'.**

Foundation Degree Characteristics

The characteristics of a Foundation Degree in the construction industry is predicated by the roles which they currently undertake and the roles that they will undertake in the future. These may be generalised under a number of headings:-

- A sound knowledge of science, mathematics, and civil engineering principles.
- A high knowledge and skill in the chosen branch of engineering application.
- An ability to work with others and independently.
- An ability to take responsibility for self and others.
- An ability to effect design solutions to engineering problems.
- An understanding of the impact their actions and others on the environment.
- An ability to learn and acquire new knowledge and skills independently.
- An ability to translate their acquired knowledge and skills in the work-place
- An ability to demonstrate learning which has taken place in the work-place.

Specifically, the JBM Accreditation Team will be seeking evidence that the following are present in the FD, so that the above may be met.

- The early part of the programme should contain a development of the individual's mathematical, scientific, and engineering knowledge and skills (including computing) of an applied nature.
  The minimum mathematical standard should be that as recommended by The Institute of Mathematics and its Applications proposal to meet SARTOR 3 for Incorporated Engineers (Appendix A(FD)).
  Undertaking experiments which engage the student in scientific method and rigour is considered to be as important as the knowledge gained.
  In developing the engineering principles in the student/employer's chosen area the wider context of engineering principles should not be neglected.
- All years of the programme and all modules should be related to the application of the knowledge, concepts, and skills in an engineering situation. Whilst some FDs will be very specific in their engineering application, the wider understanding of civil engineering practice should not be neglected.
- From the beginning of the programme students should be developing their personal skills and attitudes in working with others and independently.
- In taking responsibility for self and others the student should not only develop a sense of leadership but also demonstrate knowledge of health, safety and risk both in the special engineering field and the wider civil engineering context.
- A design thread should be present throughout the programme. Students should be exposed to engineering problems both in the F/HEI and the work-place, which require design solutions. The student should be able to solve design problems encountered by self or set by others. The identified problem and the factors to its solution should be considered, giving rise to a well-reasoned argument leading to the solution. The reasoning may or may not involve mathematics and/or software.

- Where applicable, all taught modules should contribute to the environment thread in the programme. This area of development, together with health, safety and risk, could be incorporated into the work-place learning.
- All situations, both academic and industrial, should be contributing to the student's attitude and ability to acquire new knowledge and skills independently.
- The subject of work-based learning and its assessment is considered to be a key element in the FD. Some guidance is offered in Appendix B.

Teaching and Learning

Whilst the JBM member Institutions do not want to be prescriptive, the JBM Accreditation Team would be looking for clear signs of integration of learning in all academic modules and the work-place. With regard to the teaching and assessment of mathematics, the recommendations of the Institute of Mathematics and its Applications is supported (Appendix A). Whilst F/HEIs may require modules to be scored numerically to meet recording mechanisms, minimum competencies should be met in all areas of mathematics studied. In mathematics the standard examination may not be the appropriate vehicle to achieve this.

The Accreditation Process

The accreditation process will consist of two parts. Part 1 will be the submission and review of the F/HEI's submitted documentation. Part 2 will be a visit to the F/HEI/centre/s.

Part 1.

The Documentation

- Title, duration and modes of study.
- Location of programme delivery.
- Originator of the programme.
- Entry qualifications.
- Advanced standing given to entrants.
- Regulations associated with APL and APEL.
- Programme structure
- How JBM FD characteristics are met
- Learning outcomes and assessment strategy for each academic module.
- Learning outcomes and assessment strategy for the industrial element of the programme.
- Teaching and learning strategy.
- Staffing.
- Institution environment and ethos.
- Links with industry.
- Progression and employment
- For each programme submitted, a brief statement should be provided to explain how Annexes B, C and D (Design, Sustainability and Health and Safety) of the JBM degree guidelines have been met at the appropriate level and especially how the ethos of health and safety risk management is introduced to the students through laboratory procedures, field courses, project work and any other situations encountered by students during their course of study.
- Where accreditation is sought for a Foundation Degree which is employer or subject-specific, a case must be made by the F/HEI and the employer for its inclusion as an engineering award in the civil engineering field of employment.

Note:- Much of the above information may be encapsulated in the 'Student Programme Handbook'.

Part 2

The Visit

The primary purposes of the visit are to establish the veracity of the statements in the submitted documentation; to visit laboratories and student learning facilities; to assess the standard of the Award through assignments, examinations, projects, etc; to meet with staff, student, and employers.

A visit will take place where the FD Award is the sole accredited award for the F/HEI. Normally the visit will be concluded in one day.

Where the F/HEI has a number of awards accredited by the JBM, the visit to accredit the FD will be encompassed in the next scheduled full JBM accreditation visit, subject to the submission document being acceptable.

Further Learning

All successful students should have the opportunity to continue their Further Learning and meet the academic base to register as an Incorporated Engineer. This may be achieved through completion of the final academic year of a BSc in Civil Engineering, with or without Honours (excluding Scotland, where Ordinary degrees are not accredited for IEng level)).

Alternatively, for some F/HEIs and employers an accredited route which is based on the F/HEI and the work-place may be appropriate. The construction of such a route is indicated in Appendix C. An F/HEI proposing such a route may include it in their initial FD proposal or submit it at a later date.

It should be noted that registrants for the Institution of Structural Engineers may proceed from their FD base to the Associate Membership examination, which is appropriate Further Learning to meet the requirements for an Incorporated Engineer.

Appendix A(FD)

Mathematics for Foundation Degrees

F/HEI's offering IEng degrees in Civil Engineering normally complete the study of Mathematics in the first two years of the programme. The study of an FD in Civil Engineering will, therefore, cover the same minimum material.

Whilst Universities may have a requirement for a higher standard of mathematics, the minimum accepted level is that which was recommended by The Institute of Mathematics and its Applications (IMA). This minimum was proposed to meet SARTOR 3 in its publication, 'Engineering Mathematics Matters', published in September 1999.

The main findings to which the attention of HEI's is directed are as follows:

4.1
- a significant reduction in content from the syllabus requirements of a traditional course and of the SEFI Core Curriculum (1)
- a low-level starting point, allowing a thorough consolidation of basic techniques
- an emphasis on developing confidence in the application of basic techniques
- a thorough integration of modern mathematical technologies as tools
- a motivation thorough transparent and modern applications
- a relevance to the career aspirations of an Incorporated Engineer
- a high-threshold criterion-referenced achievement stated in terms of learning outcomes

Upon completion of an IEng (FD) accredited degree programme a student will
- be confident in the application of a range of arithmetic and algebraic techniques
- be competent in the application f a range of arithmetic and algebraic techniques
- be able to solve problems using simple calculus-based techniques
- be able to make appropriate use of modern technology, for example computer algebra
- be able to make appropriate use of spreadsheets
- have a working knowledge of simple probability and basic statistical techniques.

4.2
At present it seems that emphasis has been placed on cramming students who are poorly-prepared mathematically with large amounts of material which they often fail to assimilate. Satisfactory progression is usually based on testing a subset of this material in an examination in which, frequently, students are able to select from a range of questions. A nominal threshold of 40% as an overall pass is usually sufficient to progress further in their chosen programme. It is clear that such a system is seriously flawed when questions are asked as to what students can be expected to know or be able to do on completion of their studies. The intention is that very high standards based on a firm understanding of a reduced core should be the norm.

(The Institute of Mathematics and its Applications)

Note (1) Barry MDJ and Steele NC (1992) 'A core curriculum in Mathematics for the European engineer' Document 92.1, SEFI Brussels.

The Core Curriculum

Further, the IMA recommends the minimum core curriculum for IEng students as listed below.

Core Level 3/4 (National Qualifications Framework)

This level comprises material to be assimilated by all students, regardless of entry qualifications.

Representation of numbers: decimal system, place value, decimal places, significant figures, scientific notation, conversion of SI units.
Arithmetic of fractions and directed numbers (without the aid of a calculator).
Percentages, ratios, powers and roots.
Removing brackets, simplification, factorisation, indices, evaluation and transposition of formulae, manipulation of algebraic fractions.
Linear and quadratic equations, linear simultaneous equations (with two unknowns).
Graphs and functions: Cartesian co-ordinates, functions as a process, graphs of functions, distance between two points, gradient of straight line, equation of a straight line.
Mathematical notation: summation, modulus, factorial, inequalities.
Angles and circular measure. Pythagoras' theorem, trigonometric ratios for right –angled triangles: sine and cosine rules. Trignometric ratios and their graphs, simple trignometric identities.
Exponential function: properties and graph. Natural logarithm as inverse of exponential function, graph and properties.
Representation of data (pie charts, histograms, etc), measures of centrality and spread, simple probability.

Note: It is expected that some level of flexibility of mathematical study beyond the basic core will take place to suit the employment and academic needs of the students.

Work-Based Learning Appendix B(FD)

Introduction

The purpose of 'Work-Based Learning' (WBL) within the framework of a Foundation Degree is to formalise, assess and credit the learning achieved whilst the student is in the workplace. As part of a Foundation Degree, not less than 25% of the assessment for the award shall be attributed to WBL. The WBL will equate to not less than 60 credits and relate to 600 hours of student learning in the workplace. Of the 60 credits a minimum of 30 credits should be at the level of the award.

Work-Based Learning should be productive and can not be simulated or replaced by an alternative.

Aim of Work Based Learning

The aim of WBL modules is to credit the student's knowledge, learning, understanding and skills, which have been gained in the workplace. The module/s will also enable the student to integrate the skills and knowledge they have acquired during their formal study part of the programme into the workplace environment.

Main Topics of Study

The emphasis of WBL will vary depending upon the F/HEI and the work placement, but it should be in a distinctive area appropriate to the work placement. Any arrangement of WBL should encourage the employer/supervisor to be involved in ensuring that the student is receiving appropriate agreed experiences.

The following are to be considered as the minimum topic areas to be developed in WBL:

- Construction technology
- Industry specific skills and techniques
- Health, safety, welfare, and risk management
- Environmental impact assessment
- The development of inter personal skills

Teaching and Learning

It is to be desired that all F/HEIs will examine the content of each taught module to determine which elements could best be achieved in the workplace. The resulting freeing of time in the F/HEI could then enable more theoretical learning to take place in the Institution. However, the WBL may be an independently developed module or modules that suit either the F/HEI's or employer's specific requirements.

Appendix C(FD)

Accredited Further Learning for FDs in Civil Engineering

It should be noted that an FD will fully meet the educational base requirements for registration with the Engineering Council as an Engineering Technician. It will also part satisfy the educational base requirements for registration with the Engineering Council as an Incorporated Engineer with the addition of Further Learning..

F/HEI's may wish to offer an accredited Further Learning programme to holders of an accredited Foundation Degree to meet the academic standards for registration as an Incorporated Engineer. Such a programme may be constructed in a number of ways to meet the needs of the institution, employers, or students, and delivered in a variety of forms, including distance learning.

All accredited programmes will have a number of features in common.

- The total learning credits will be 60 at level 3 (Level 6 (Intermediate) on the National Qualifications Framework or .Level 9 on the Scottish Credit and Qualifications Framework
- Not less than 20 credits to be awarded for a work based, individual project.
- Not less than 2 modules of academic study will have taken place. These may be either deepening or broadening the students knowledge and understanding.
- The programme to be assessed and certified by the F/HEI

More information on Further Learning can be found on the JBM website at www.jbm.org.uk.