JBM Guidelines for MScs and Programmes of CEng Further Learning (FL) (Technical' & 'Non-technical' MScs and FL Programmes)

Introduction

1. This document provides guidelines that can be used to distinguish between those MSc programmes designed to provide further learning for those graduates who have completed the educational base to become an Incorporated Engineer (e.g. graduates with an accredited BSc degree) and those designed for graduates with a CEng accredited bachelor degree. They are based on the QAA Subject Benchmark Statement (Engineering) (2015), which will be referred to as QAA (engineering).

Background

2. There are three pathways to becoming a Chartered Engineer by following an MSc programme:-
   a) Graduates with an UK accredited BEng (Hons) that is recognised as part of the educational base to become a Chartered Engineer and complete an accredited technical or non-technical MSc programme.
   b) Graduates with a degree that is accredited as the educational base for an Incorporated Engineer (IEng) (e.g. BSc) or someone who has completed the educational base to become an IEng by undertaking further learning (e.g. FD + FL) will need to apply for an academic assessment and complete the additional further learning specified by their chosen professional institution, which shall comprise a "Technical" MSc programme or a programme of further learning.
   c) Graduates with a degree in civil (or structural or transport) engineering which is not accredited or graduates with cognate degrees who complete an MSc programme in engineering will need to submit their package of qualifications (Bachelors and Masters) for assessment by their chosen professional institution. Such candidates will also need additional Further Learning, which may include but is unlikely to be wholly satisfied by a "Technical" MSc, as specified by their chosen professional institution.

3. QAA (engineering) uses the view of the engineering profession to distinguish between a CEng and an IEng. Both use creativity and innovation and are involved in activities such as design, production, construction, operation and disposal. Both are likely to be involved in commercial and technical management. CEngs are more likely to be involved in the development and application of new technologies, concepts, techniques and services, while IEngs will be concerned with the application and management of current technology. Master's programmes should also provide an opportunity to integrate the technical and non-technical aspects of engineering and to develop a commitment to professional and social responsibility and ethical codes of conduct.

4. There is also a distinction between the teaching and learning within an MEng programme and a BEng Hons programme. The MEng programme includes a deepening of technical understanding, additional emphasis on team/group working, an increase in use of industrially relevant applications of engineering analysis and an enhanced capability for independent learning and work. Thus Masters level graduates are expected to demonstrate greater capacities for independent action, accepting responsibilities, formulating ideas proactively, dealing with open ended and unfamiliar problems, planning and developing strategies, implanting and executing agreed plans, leading and managing teams, evaluating achievement against specification and plan, and decision making.

5. QAA (engineering) state that the UK-SPEC output standards are the subject benchmark statements for engineering. The learning outcomes for Masters degrees other than the Integrated Masters (MEng) over and above those for the BEng graduate* provide a useful guide for an MSc programme that is designed as further learning for a BEng graduate. These can be found in the EngC document "Accreditation of HE Programmes (AHEP): Collated learning outcomes for six areas of learning" (2014). Since the further learning for an IEng graduate** is designed to achieve the educational base for a Chartered Engineer the learning outcomes for an MSc designed for such a graduate must at least conform to those required by a BEng graduate, but must additionally address the gap between the learning outcomes required of a BEng and IEng graduate (Table 1). This implies that IEng graduates will be expected to achieve more in the MSc programme than the BEng graduates. This is not feasible given the typical period over which an MSc takes place. Therefore the MSc for an IEng graduate must differ from that for a BEng graduate and the distinguishing features outlined above have to be taken into account. Thus an MSc for an IEng graduate should cover the development and application of new technologies, concepts, techniques and services and should include technical deepening and a greater focus on analysis to enable it to be accredited as a 'Technical' MSc.

Technical / Non-Technical

6. The requirements of a 'Technical' MSc programme are given in FLJBM09a (JBM Requirements for MScs and Programmes of CEng FL - Tech/Non-Tech MScs & FLPs) and should enable IEng graduates to additionally acquire the learning outcomes in Table 1, which are those that distinguish a BEng (Hons) graduate from an IEng graduate.

7. As a consequence of the above a majority of the topics studied in a 'Technical' MSc must require the individual to apply mathematical and statistical methods, tools and notations proficiently in the analysis and solution of engineering problems and to apply and integrate knowledge and understanding of other engineering disciplines to support the study of their own engineering discipline. They should require the student to demonstrate a sound understanding of engineering principles and an ability to apply them to analyse key engineering processes. They should include opportunities to identify, classify and describe the performance of systems and components through the use of analytical methods and modelling techniques and to apply an integrated or systems approach to solving engineering problems. There must be investigative projects that require the individual apply advanced problem-solving skills, technical knowledge and understanding, to establish rigorous and creative solutions that are fit for purpose for all aspects of the problem and opportunities to demonstrate an ability to apply relevant practical and laboratory skills and to work with technical uncertainty.

8. For an MSc to be accredited as 'Technical' it is also necessary for the dissertation to be of a technical nature. Such dissertations should demonstrate a sound understanding of engineering principles and an ability to apply them to analyse key engineering problems. It should involve the use of analytical methods and/or modelling techniques, and to have required the definition and investigation of a problem, including consideration of aspects of the wider engineering context such as environmental and sustainability implications; ethical, health, safety, security and risk issues; intellectual property; and legal, contractual, quality and cost issues. The assessment of the dissertation should have required the individual to demonstrate an ability to plan, manage and evaluate the outcomes of their work and an ability to communicate it to both technical and non-technical audiences.

* A graduate possessing an accredited bachelor's degree that partially satisfies the educational base for CEng.

** A graduate possessing an accredited degree that fully satisfies the educational base for IEng.

QAA (engineering): UK Quality Code for Higher Education. Part A: Setting and monitoring academic Standards, Subject Benchmark Statement, Engineering, February 2015

Accreditation of HE Programmes (AHEP): Collated learning outcomes for six areas of learning (2014)

Table 1: Learning Outcomes that distinguish a BEng (Hons) graduate from an IEng graduate

	Science and mathematics
i	Knowledge and understanding of mathematical and statistical methods necessary to underpin their education in their engineering discipline and to enable them to apply mathematical and statistical methods, tools and notations proficiently in the analysis and solution of engineering problems
ii	Ability to apply and integrate knowledge and understanding of other engineering disciplines to support study of their own engineering discipline.
	Engineering Analysis
iii	Understanding of engineering principles and the ability to apply them to analyse key engineering processes
iv	Ability to identify, classify and describe the performance of systems and components through the use of analytical methods and modelling techniques
v	Understanding of, and the ability to apply, an integrated or systems approach to solving engineering problems.
	Design
vi	Understand and evaluate business, customer and user needs, including considerations such as the wider engineering context, public perception and aesthetics
vii	Investigate and define the problem, identifying any constraints including environmental and sustainability limitations; ethical, health, safety, security and risk issues; intellectual property; codes of practice and standards
viii	Apply advanced problem-solving skills, technical knowledge and understanding, to establish rigorous and creative solutions that are fit for purpose for all aspects of the problem including production, operation, maintenance and disposal
ix	Plan and manage the design process, including cost drivers, and evaluate outcomes

	Engineering practice
x	Ability to apply relevant practical and laboratory skills
xi	Understanding of the use of technical literature and other information sources
xii	Knowledge of relevant legal and contractual issues
xiii	Understanding of appropriate codes of practice and industry standards
xiv	Ability to work with technical uncertainty
Notes:	
1. Broad areas of learning and learning outcomes (LOs) are taken from The Accreditation of Higher Education Programmes, Engineering Council (2014), 3rd Ed	