Technical and Non-Technical MSc Guidelines: Guidelines for MSc programmes that enable an Incorporated Engineer to become Chartered through the academic route

These guidelines have been written for universities who are developing MSc programmes. The aim is demonstrate how MSc programmes can be part of the pathway to become a Chartered Engineer. There are several pathways to becoming a Chartered Engineer by following an MSc programme:-

1. Graduates with an UK accredited BEng (Hons) that is recognised as part of the educational base to become a Chartered Engineer completes an accredited MSc programme. This is a standard route.
2. Graduates with a degree that is accredited as the educational base for an IEng (e.g. BSc) or someone who has completed the educational base to become an Incorporated Engineer (IEng) (e.g. FD + FL) completes a technical MSc programme in engineering will have to submit to the Individual Case Procedure. This pathway is a recommended pathway. In this case the MSc programme could be accredited. This reflects the fact that accredited MSc programmes can be followed by incorporated engineers.
3. Graduates with a degree in civil (or structural or transport) engineering which is not accredited (e.g. overseas) completes an MSc programme in engineering will have to submit to the Individual Case Procedure. This pathway is a recommended pathway. In this case the MSc programme could be accredited. This reflects the fact that many accredited MSc programmes are followed by overseas students.
4. Graduates with a cognate degree in science or mathematics completes an MSc programme in engineering with a prequalifying year in civil, structural or transport engineering will have to submit to the Individual Case Procedure. This pathway is a recommended pathway. In this case the MSc programme could be accredited. This reflects the fact that accredited MSc programmes can be followed by non engineering graduates.

These guidelines cover the recommended pathway (2).

This document suggests guidelines that could be used to distinguish between those MSc programmes designed to provide further learning for those engineers 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) published in 2006 (henceforth referred to as QAA (engineering) 2006)

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.

QAA (engineering) state that the CEng accredited bachelor degree plus further learning or an integrated MEng provide the educational base for a Chartered Engineer. It is not clear that QAA (engineering) assume that it is possible to move from an IEng accredited qualification to become a Chartered Engineer through further learning but given the need to provide flexible routes to chartership the JBM is of the opinion that such a route is possible.

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 MEng 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.

QAA (engineering) state that the UK-SPEC output standards are the subject benchmark statements for engineering. The general learning outcomes apply to graduates at all levels. The distinct learning outcomes for an MEng graduate 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 are reproduced in Table 1. 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 that for a BEng graduate. But the entry standards will be different which implies that there has to be additional learning outcomes for an MSc for further learning for an IEng graduate to ensure that IEng graduates can achieve the correct exit standard. 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 a MSc for an IEng graduate must cover the development and application of new technologies, concepts, techniques and services; that is the MSc for an IEng graduate has to be concerned with technical deepening and a greater focus on analysis. Therefore the learning outcomes for engineering analysis and design are those that distinguish an MSc for IEng graduate. The learning outcomes are listed in Table 2.

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

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

TABLE 1 **The learning outcomes for graduates part-satisfying the educational base for CEng**	**TABLE 2** **The learning outcomes for Honours graduates satisfying the educational base for IEng**
• Ability to o integrate knowledge and understanding across the whole degree programme; o develop, monitor and update a plan of work to reflect a changing operating environment; o monitor and adjust a personal programme of work and to learn independently; o learn new theories, concepts, methods, etc, in unfamiliar situations; o ***and make evaluations of commercial risks*** • Knowledge of o new and emerging technologies; o ***and mathematical and computer models.*** • An understanding of o a wide range of concepts, including some outside engineering; o ***current engineering practice and its limitations;*** o and team roles, and the ability to exercise leadership. • Application of o innovative design processes in unfamiliar situations; o and engineering techniques in a range of commercial and industrial constraints. • Knowledge and understanding of o management and business practices; o and a wide range of engineering materials and components. A greater degree of industrial involvement through project work. — Examples of Non-Technical MSc courses: **Civil Engineering Design & Project Management** **Construction Management** **Transport Planning Practice**	• Ability to o ***apply and integrate knowledge and understanding of other engineering disciplines to support study of their own engineering discipline;*** o ***identify, classify and describe the performance of systems and components through the use of analytical methods and modelling techniques;*** o ***apply quantitative methods and computer software relevant to their engineering discipline, in order to solve engineering problems;*** o integrate knowledge and understanding across the whole degree programme; o develop, monitor and update a plan of work to reflect a changing operating environment; o monitor and adjust a personal programme of work and to learn independently; o learn new theories, concepts, methods, etc, in unfamiliar situations; o ***and to work with technical uncertainty.*** • Knowledge of o new and emerging technologies; o ***and application of mathematical methods, tools and notations proficiently in the analysis and solution of engineering problems.*** • An understanding of o ***engineering principles and the ability to apply them to analyse key engineering processes;*** o a wide range of concepts, including some outside engineering; o and team roles, and the ability to exercise leadership. • Application of o innovative design processes in unfamiliar situations; o and engineering techniques in a range of commercial and industrial constraints. • Knowledge and understanding of o management and business practices; o and a wide range of engineering materials and components. A greater degree of industrial involvement through project work. — Examples of Technical MSc courses: **Civil Engineering** **Geotechnical Engineering** **Structural Engineering** **Transportation Engineering**