

## **JBM Requirements for MScs and Programmes of CEng Further Learning (FL) (‘Technical’ & ‘Non-technical’ MScs and FL Programmes)**

### **Introduction**

1. The terms ‘Technical’ and ‘Non-technical’ are used to distinguish between MScs and FL programmes that are assessed to have a strong technical content from others with a less strong overall technical content. The distinction is made as some graduates require a ‘Technical’ MSc to complete their educational requirements for registration as CEng, whereas other graduates may select either type of MSc.
2. This document provides guidance on the graduates in each situation, and on the Learning Outcome (LO) requirements of ‘Technical’ and ‘Non-technical’ MScs.

### **Technical MSc**

3. A ‘Technical’ MSc programme is one in which at least 50% of the taught modules AND the dissertation are of a technical nature. The academic credits usually provide the basis for assessing the percentage. To be of a technical nature it is likely that the topics covered will be from the JBM List A subjects (i.e. structures, materials, geotechnics) and/or fluid mechanics and water engineering, surveying, infrastructure and transportation engineering, public health and environmental engineering. Such modules should additionally focus on the science and mathematics, engineering analysis, design, and engineering practice learning outcomes that distinguish a BEng (Hons) accredited at CEng with further learning graduate from an IEng graduate (see JBMFL09b Guidelines for MScs and Programmes of CEng FL).
4. A ‘Technical’ dissertation should also be in one of the above technical subjects, 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 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.

### **‘Technical’ or ‘Non-Technical’ required?**

5. Graduates with a BEng (Hons) that is accredited by their Institution as partially meeting the educational requirements for CEng may select either type of MSc to complete their educational requirements for CEng. Graduates with other bachelor level qualifications that are accepted by their Institution for CEng, on an individual case basis, may also do so.
6. Graduates with other bachelor level qualifications or equivalent that are acceptable to their Institution for IEng registration require a ‘Technical’ MSc.

### **Content of ‘Technical’ and ‘Non-technical’ MScs and FL Programmes**

7. The requirements of Technical and ‘Non-technical’ MScs in relation to the coverage of Engineering Council learning output standards are given in Tables 1 and 2.

The Categories of LOs referred to in this document have been defined by the JBM:

**Category 1 LO:** there must be evidence to show that this LO has been achieved.

**Category 2 LO:** it is preferred that there should be evidence to show that this LO has been achieved. However, inclusion of all Category 2 LOs is not essential, subject to the minimum requirements given in Table 1.

8. Evidence must be available that all LOs included in an MSc or programme of further learning have been assessed and achieved.
9. It is encouraged that teaching/learning on MScs and FLPs should encompass all 22 of the LOs in Table 2, noting that the requirements given in Table 1 relate to the minimum for which there must be both learning and evidence of assessment of that learning.

**Table 1: Minimum number of Learning Outcomes (LOs) by Broad Area of Learning**

Broad area of learning (Note 1)	Number of LOs in each broad area of learning	Minimum number of LOs to be included in MSc/FL Prog'	
		'Technical' MSc	'Non-technical' MSc
Science and mathematics	3	2	1
Engineering analysis	3	2	1
Design	3	2	1
Economic, legal, social, ethical and environmental context	6	3	3
Engineering practice	4	3	3
Additional general skills	3	2	2
Additional LOs, selected from the 6 broad areas of learning (max 2 from any one area)		Minimum 2	Minimum 5
<b>Minimum overall total LOs:</b>		16	16

**Table 2: Learning Outcomes for MScs and FL Programmes, with JBM Categories of LO for ‘Technical’ and ‘Non-technical’**

See Table 1 for <u>minimum</u> number of LOs in each broad area of learning					
LO No.	Tech		Non-tech		Learning Outcome (LO)
	Category	Category	Category	Category	
	1	2	1	2	
<b>Science and mathematics</b>					
i		✓		✓	A comprehensive understanding of the relevant scientific principles of the specialisation;
ii	✓			✓	A critical awareness of current problems and/or new insights much of which is at, or informed by, the forefront of the specialisation;
iii		✓		✓	Understanding of concepts relevant to the discipline, some from outside engineering, and the ability to evaluate them critically and to apply them effectively, including in engineering projects.
<b>Engineering Analysis</b>					
iv		✓		✓	Ability both to apply appropriate engineering analysis methods for solving complex problems in engineering and to assess their limitations
v		✓		✓	The ability to use fundamental knowledge to investigate new and emerging technologies;
vi		✓		✓	The ability to collect and analyse research data and use appropriate engineering tools to tackle unfamiliar problems, such as those with uncertain or incomplete data or specifications, by the appropriate innovation, use or adaptation of engineering analytical methods.

LO	T 1	T 2	NT 1	NT 2	Learning Outcome (LO)
<b>Design</b>					
vii		✓		✓	Knowledge, understanding and skills to work with information that may be incomplete or uncertain, quantify the effect of this on the design and, where appropriate, use theory or experimental research to mitigate deficiencies
viii		✓		✓	Knowledge and comprehensive understanding of design processes and methodologies and the ability to apply and adapt them in unfamiliar situations
ix		✓		✓	Ability to generate an innovative design for products, systems, components or processes to fulfil new needs.
<b>Economic, legal, social, ethical and environmental context</b>					
x		✓		✓	Awareness of the need for a high level of professional and ethical conduct in engineering
xi		✓		✓	Awareness that engineers need to take account of the commercial and social contexts in which they operate
xii		✓		✓	Knowledge and understanding of management and business practices, and their limitations, and how these may be applied in the context of the particular specialisation;
xiii	✓		✓		Awareness that engineering activities should promote sustainable development and ability to apply quantitative techniques where appropriate
xiv		✓		✓	Awareness of relevant regulatory requirements governing engineering activities in the context of the particular specialisation
xv	✓		✓		Awareness of and ability to make general evaluations of risk issues in the context of the particular specialisation, including health & safety, environmental and commercial risk.

LO	T 1	T 2	NT 1	NT 2	Learning Outcome (LO)
<b>Engineering practice</b>					
xvi	✓			✓	Advanced level knowledge and understanding of a wide range of engineering materials and components;
xvii	✓			✓	A thorough understanding of current practice and its limitations, and some appreciation of likely new developments;
xviii		✓		✓	The ability to apply engineering techniques taking account of a range of commercial and industrial constraints.
xix		✓		✓	Understanding of different roles within an engineering team and the ability to exercise initiative and personal responsibility, which may be as a team member or leader;
<b>Additional general skills</b>					
xx		✓		✓	Apply their skills in problem solving, communication, information retrieval, working with others, and the effective use of general IT facilities
xxi	✓		✓		Plan self-learning and improve performance, as the foundation for lifelong learning/CPD
xxii		✓		✓	Monitor and adjust a personal programme of work on an on-going basis
xxiii					<i>(excluded - covered by LO xix)</i> Exercise initiative and personal responsibility, which may be as a team member or leader.
<b>Notes:</b>					
1. Broad areas of learning and learning outcomes (LOs) are taken from <i>The Accreditation of Higher Education Programmes</i> , Engineering Council (2014), 3 <sup>rd</sup> Ed					