

## THE SUMMARY OF UK-SPEC SPECIFIC LEARNING OUTCOMES

### Bachelors and Bachelors (Honours) degrees accredited for IEng or CEng

| <b>Science and Mathematics (SM)</b> |  |
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| <b>SM1i</b>                         | Knowledge and understanding of the scientific principles underpinning relevant technologies, and their evolution   |
| <b>SM1b</b>                         | Knowledge and understanding of scientific principles and methodology necessary to underpin their education in their engineering discipline, to enable appreciation of its scientific and engineering context, and to support their understanding of relevant historical, current and future developments and technologies  |
| <b>SM1m</b>                         | A comprehensive knowledge and understanding of the scientific principles and methodology necessary to underpin their education in their engineering discipline, and an understanding and know-how of the scientific principles of related disciplines, to enable appreciation of the scientific and engineering context, and to support their understanding of relevant historical, current and future developments and technologies |
| <b>SM2i</b>                         | Knowledge and understanding of mathematics and an awareness of statistical methods necessary to support application of key engineering principles  |
| <b>SM2b</b>                         | 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  |
| <b>SM2m</b>                         | Knowledge and understanding of mathematical and statistical methods necessary to underpin their education in their engineering discipline and to enable them to apply a range of mathematical and statistical methods, tools and notations proficiently and critically in the analysis and solution of engineering problems  |
| <b>SM3b</b>                         | Ability to apply and integrate knowledge and understanding of other engineering disciplines to support study of their own engineering discipline   |
| <b>SM3m</b>                         | Ability to apply and integrate knowledge and understanding of other engineering disciplines to support study of their own engineering discipline and the ability to evaluate them critically and to apply them effectively   |
| <b>SM4m</b>                         | Awareness of developing technologies related to own specialisation.  |
| <b>SM5m</b>                         | A comprehensive knowledge and understanding of mathematical and computational models relevant to the engineering discipline, and an appreciation of their limitations  |
| <b>SM6m</b>                         | Understanding of concepts from a range of areas, including some outside engineering, and the ability to evaluate them critically and to apply them effectively in engineering projects   |

| <b>Engineering Analysis (EA)</b> |  |
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| <b>EA1i</b>                      | Ability to monitor, interpret and apply the results of analysis and modelling in order to bring about continuous improvement   |
| <b>EA1b</b>                      | Understanding of engineering principles and the ability to apply them to analyse key engineering processes   |
| <b>EA1m</b>                      | Understanding of engineering principles and the ability to apply them to undertake critical analysis of key engineering processes  |
| <b>EA2i</b>                      | Ability to apply quantitative methods in order to understand the performance of systems and components   |
| <b>EA2</b>                       | Ability to identify, classify and describe the performance of systems and components through the use of analytical methods and modelling techniques  |
| <b>EA3i</b>                      | Ability to use the results of analysis to solve engineering problems and to recommend appropriate action   |
| <b>EA3b</b>                      | Ability to apply quantitative and computational methods in order to solve engineering problems and to implement appropriate action   |
| <b>EA3m</b>                      | Ability to apply quantitative and computational methods, using alternative approaches and understanding their limitations, in order to solve engineering problems and implement appropriate action |
| <b>EA4i</b>                      | Ability to apply an integrated or systems approach to engineering problems through know-how of the relevant technologies and their application   |
| <b>EA4b</b>                      | Understanding of, and the ability to apply, an integrated or systems approach to solving engineering problems  |
| <b>EA4m</b>                      | Understanding of, and the ability to apply, an integrated or systems approach to solving complex engineering problems.   |
| <b>EA5m</b>                      | Ability to use fundamental knowledge to investigate new and emerging technologies  |

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| <b>EA6m</b> | Ability to extract and evaluate pertinent data and to apply engineering analysis techniques in the solution of unfamiliar problems |
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| <b>Design (D)</b> |  |
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| <b>D1i</b>        | Be aware of business, customer and user needs, including considerations such as the wider engineering context, public perception and aesthetics  |
| <b>D1</b>         | Understand and evaluate business, customer and user needs, including considerations such as the wider engineering context, public perception and aesthetics  |
| <b>D2i</b>        | 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                             |
| <b>D2</b>         | 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            |
| <b>D3i</b>        | Work with information that may be incomplete or uncertain and be aware that this may affect the design   |
| <b>D3b</b>        | Work with information that may be incomplete or uncertain and quantify the effect of this on the design  |
| <b>D3m</b>        | 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  |
| <b>D4i</b>        | Apply problem-solving skills, technical knowledge and understanding to create or adapt designs solutions that are fit for purpose including operation, maintenance, reliability etc  |
| <b>D4</b>         | 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 |
| <b>D5i</b>        | Manage the design process, including cost drivers, and evaluate outcomes   |
| <b>D5</b>         | Plan and manage the design process, including cost drivers, and evaluate outcomes  |
| <b>D6</b>         | Communicate their work to technical and non-technical audiences  |
| <b>D7m</b>        | Demonstrate wide knowledge and comprehensive understanding of design processes and methodologies and the ability to apply and adapt them in unfamiliar situations  |
| <b>D8m</b>        | Demonstrate the ability to generate an innovative design for products, systems, components or processes to fulfil new needs  |

| <b>Economic, legal, social, ethical and environmental context (EL)</b> |   |
|--|---|
| <b>EL1</b>   | Understanding of the need for a high level of professional and ethical conduct in engineering and a knowledge of professional codes of conduct  |
| <b>EL1m</b>  | Understanding of the need for a high level of professional and ethical conduct in engineering, a knowledge of professional codes of conduct and how ethical dilemmas can arise  |
| <b>EL2</b>   | Knowledge and understanding of the commercial, economic and social context of engineering processes   |
| <b>EL3i</b>  | Knowledge of management techniques that may be used to achieve engineering objectives   |
| <b>EL3b</b>  | Knowledge and understanding of management techniques, including project management, that may be used to achieve engineering objectives  |
| <b>EL3m</b>  | Knowledge and understanding of management techniques, including project and change management, that may be used to achieve engineering objectives, their limitations, and how they may be applied appropriately   |
| <b>EL4i</b>  | Understanding of the requirement for engineering activities to promote sustainable development  |
| <b>EL4</b>   | Understanding of the requirement for engineering activities to promote sustainable development and ability to apply quantitative techniques where appropriate   |
| <b>EL5</b>   | Awareness of the relevant legal requirements governing engineering activities, including personnel, health & safety, contracts, intellectual property rights, product safety and liability issues   |
| <b>EL5m</b>  | Awareness of the relevant legal requirements governing engineering activities, including personnel, health & safety, contracts, intellectual property rights, product safety and liability issues, and an awareness that these may differ internationally |
| <b>EL6i</b>  | Awareness of risk issues, including health & safety, environmental and commercial risk  |
| <b>EL6b</b>  | Knowledge and understanding of risk issues, including health and safety, environmental and commercial risk, and of risk assessment and risk management techniques   |
| <b>EL6m</b>  | Knowledge and understanding of risk issues, including health and safety, environmental and commercial risk, risk assessment and risk management techniques and an ability to evaluate commercial risk   |
| <b>EL7m</b>  | Understanding of the key drivers for business success, including innovation, calculated commercial risks and customer satisfaction  |

| <b>Engineering Practice (P)</b> |   |
|---------------------------------|---|
| <b>P1i</b>                      | Knowledge of contexts in which engineering knowledge can be applied (eg operations and management, application and development of technology, etc)                              |
| <b>P1</b>                       | Understanding of contexts in which engineering knowledge can be applied (eg operations and management, application and development of technology, etc)                          |
| <b>P2i</b>                      | Understanding of and ability to use relevant materials, equipment, tools, processes, or products  |
| <b>P2b</b>                      | Knowledge of characteristics of particular materials, equipment, processes or products  |
| <b>P2m</b>                      | Knowledge of characteristics of particular equipment, processes or products, with extensive knowledge and understanding of a wide range of engineering materials and components |
| <b>P3i</b>                      | Knowledge and understanding of workshop and laboratory practice   |
| <b>P3</b>                       | Ability to apply relevant practical and laboratory skills   |
| <b>P4i</b>                      | Ability to use and apply information from technical literature  |
| <b>P4</b>                       | Understanding of the use of technical literature and other information sources  |
| <b>P5</b>                       | Knowledge of relevant legal and contractual issues  |
| <b>P6i</b>                      | Ability to use appropriate codes of practice and industry standards   |
| <b>P6</b>                       | Understanding of appropriate codes of practice and industry standards   |
| <b>P7</b>                       | Awareness of quality issues and their application to continuous improvement   |
| <b>P8</b>                       | Ability to work with technical uncertainty  |
| <b>P9m</b>                      | A thorough understanding of current practice and its limitations, and some appreciation of likely new developments  |
| <b>P10m</b>                     | Ability to apply engineering techniques taking account of a range of commercial and industrial constraints  |
| <b>P11i</b>                     | Awareness of team roles and the ability to work as a member of an engineering team  |
| <b>P11b</b>                     | Understanding of, and the ability to work in, different roles within an engineering team  |
| <b>P11m</b>                     | 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 (G)</b> |   |
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| <b>G1</b>                            | Apply their skills in problem solving, communication, information retrieval, working with others and the effective use of general IT facilities |
| <b>G2</b>                            | Plan self-learning and improve performance, as the foundation for lifelong learning/CPD   |
| <b>G3i</b>                           | Plan and carry out a personal programme of work   |
| <b>G3b</b>                           | Plan and carry out a personal programme of work, adjusting where appropriate  |
| <b>G3m</b>                           | Monitor and adjust a personal programme of work on an on-going basis  |
| <b>G4i</b>                           | Exercise personal responsibility, which may be as a team member   |
| <b>G4</b>                            | Exercise initiative and personal responsibility, which may be as a team member or leader  |