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**Programme Specification**

**Title of Course:** Renewable Energy Engineering

**Date Specification Produced:** December 2012

**Date Specification Last Revised:** September 2016

This Programme Specification is designed for prospective students, current students, academic staff and potential employers. It provides a concise summary of the main features of the programme and the intended learning outcomes that a typical student might reasonably be expected to achieve and demonstrate if he/she takes full advantage of the learning opportunities that are provided. More detailed information on the teaching, learning and assessment methods, learning outcomes and content of each module can be found in Student Handbooks and Module Descriptors.

**SECTION 1: GENERAL INFORMATION**

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| **Title:** | MSc in Renewable Energy Engineering |
| **Awarding Institution:** | Kingston University, London  |
| **Teaching Institution:** | Kingston University, London |
| **Location:** | Roehampton Vale |
| **Programme Accredited by:** | Institution of Mechanical Engineers |

**SECTION2: THE PROGRAMME**

1. **Programme Introduction**

It is predicted that renewable energy will represent 30% of the world energy supply by 2030. This means that there will be great demand for qualified and skilled engineers with specialist knowledge of renewable energy technology. This course is designed to produce engineers with a broad understanding of renewable energy systems design and development, project engineering, and energy resource management and a detailed understanding of a range of renewable energy technologies.

The main features of the course are as follows:

* Teaching by leading academics and industry experts in the fields of solar, wind, biomass and fuel cells which considers theoretical and practical concepts for power generation from renewable sources.
* Opportunities to develop hands on skills in 3D solid modelling, FEA and CFD analysis, and specialist simulation packages such as Polysun and Wind-Pro.
* Presentations by renewable energy providers and consultancy firms outlining their activities and market experiences.
* Field trips to major renewable energy sites integrated with major assignments to motivate and enhance students teaching and learning.
* Individually tailored sponsored and non-sponsored dissertation projects in the areas of wind, solar, biofuels and fuel-cell technologies, supervised by a committed team of full time and part time staff.
* Programme accredited by the Institute of Mechanical Engineers (IMechE), as meeting the requirements for Further Learning for a Chartered Engineer (CEng) for candidates who have already acquired an accredited CEng (Partial) BEng(Hons) degree.
* High rate of employment and internship with leading renewable companies; 80% of the students graduated on this course have been recruited by relevant employers such as Atkins, Alstom Power, Inditex, Vattenfall, Shell, SGS UK Ltd.
* Possible progression to PhD research studies on completion of the programme for those students interested in following an academic or research career.
1. **Aims of the Programme**

#### The main aims of the MSc in Renewable Energy Engineering are:

* To provide students with an in-depth knowledge and critical understanding of the theoretical principles and practical approaches used in renewable energy engineering.
* To develop the skills in research, analysis, creativity and critical thinking needed to successfully plan and execute a renewable engineering project.
* To develop the skills required to work in a multi-disciplinary team within an engineering organisation with real industrial constraints and good understanding of the environmental, economical, social and legal implications of professional practice and professional codes of conduct.
* To provide a “period of further learning”, which is a requirement of the Institution of Mechanical Engineers for Chartered Engineer status for students with an accredited BEng. The Field complies with UK Spec as published by the Engineering Council.
* To equip students with the professional attitudes and wide range of transferable skills in engineering and project management which would enable them to develop and exploit their knowledge and technical expertise in the furtherance of their career and employability.
* To provide students with a strategic overview of management issues in engineering, particularly in the sustainable energy sector.

The aims of the Postgraduate Diploma and the Postgraduate Certificate are the same as those for the MSc except that, since the PgDip and PgCert student is not required to complete a project, he/she will not have the same opportunity to engage in the in-depth study which the project requires.

1. **Intended Learning Outcomes**

The programme provides opportunities for students to develop and demonstrate knowledge and understanding, skills and other attributes in the following areas. The programme outcomes are referenced to the QAA subject benchmarks for Engineering and the Framework for Higher Education Qualifications in England, Wales and Northern Ireland (2008), and relate to the typical student.

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| **Programme Learning Outcomes** |
|  | **Knowledge and Understanding****On completion of the course students will be able to:** |  | **Intellectual skills – able to:****On completion of the course students will be able to:** |  | **Subject Practical skills** **On completion of the course students will be able to:** |
| A1 | Demonstrate advanced knowledge and understanding of the principles governing renewable energy engineering in the context of design and development of the renewable technologies and systems. | B1 | Learn independently, and be able to critically evaluate, analyse and communicate research and data collection/analysis. | C1 | Select and apply computer-based and other advanced technologies to a wide range of renewable energy engineering applications. |
| A2 | Show knowledge and understanding in the use of computer aided technologies such as CAD, CFD, FEA ,Wind-Pro, ECLIPSE, POLYSUN for modelling, simulation and prototyping renewable energy systems. | B2 | Analyse problems and issues, taking due account of any incompleteness of data or information, and arrive at well-reasoned and supportable conclusions  | C2 | Select and use appropriate software tools for the design and analysis of mechanical components and renewable energy management and control systems. |
| A3 | Demonstrate a critical awareness of the current developments in the renewable energy sector. | B3 | Carry out independent data collection and synthesise it to enable the problems and issues to be successfully resolved. | C3 | Select modern materials and manufacturing processes for mechanical components associated with renewable energy engineering systems. |
| A4 | Comprehend and evaluate renewable project finance including the management and techniques needed for pricing and cost control of projects in respect to time, cost and the risks inherent in engineering. | B4 | Identify current issues and trends in the field of Renewable Energy Engineering. | C4 | Select and apply appropriate tools and techniques for the improvement of quality in renewable energy engineering systems products and processes.  |
| A5 | Demonstrate comprehensive knowledge of the principles and detailed requirements for the management of safety and quality issues with respect to renewable engineering projects. | B5 | Carry out a focused critical literature review. |  |  |
| A6 | Display an in-depth knowledge of the nature, scope and objectives of the varying organisations and inter-firm relationships that are present in engineering, particularly relating to efficient outcomes. | B6 | Develop original thought. |  |  |
| A7 | Demonstrate good awareness of the impact of renewable technology and related projects at social, environmental, economical and political level. |  |  |  |  |
| A8 | Demonstrate an in-depth understanding of the renewable energy engineering business environment, including legal aspects, and apply modern operations and financial management techniques and good practices in a range of contexts. |  |  |  |  |
| **Key Skills** |
|  | **Self Awareness Skills** |  | **Communication Skills** |  | **Interpersonal Skills** |
| AK1 | Take responsibility for own learning and plan for and record own personal development | BK1 | Express ideas clearly and unambiguously in writing and the spoken work | CK1 | Work well with others in a group or team |
| AK2 | Recognise own academic strengths and weaknesses, reflect on performance and progress and respond to feedback | BK2 | Present, challenge and defend ideas and results effectively orally and in writing | CK2 | Work flexibly and respond to change |
| AK3 | Organise self effectively, agreeing and setting realistic targets, accessing support where appropriate and managing time to achieve targets | BK3 | Actively listen and respond appropriately to ideas of others | CK3 | Discuss and debate with others and make concession to reach agreement |
| AK4 | Work effectively with limited supervision in unfamiliar contexts |  |  | CK4 | Give, accept and respond to constructive feedback |
|  | **Research and information Literacy Skills** |  | **Numeracy Skills** |  | **Management & Leadership Skills** |
| DK1 | Search for and select relevant sources of information | EK1 | Collect data from primary and secondary sources and use appropriate methods to manipulate and analyse this data | FK1 | Determine the scope of a task (or project) |
| DK2 | Critically evaluate information and use it appropriately | EK2 | Present and record data in appropriate formats | FK2 | Identify resources needed to undertake the task (or project) and to schedule and manage the resources |
| DK3 | Apply the ethical and legal requirements in both the access and use of information | EK3 | Interpret and evaluate data to inform and justify arguments | FK3 | Evidence ability to successfully complete and evaluate a task (or project), revising the plan where necessary |
| DK4 | Accurately cite and reference information sources | EK4 | Be aware of issues of selection, accuracy and uncertainty in the collection and analysis of data | FK4 | Motivate and direct others to enable an effective contribution from all participants |
| DK5 | Use software and IT technology as appropriate |  |  |  |  |
|  | **Creativity and Problem Solving Skills** |  |  |  |  |
| GK1 | Apply scientific and other knowledge to analyse and evaluate information and data and to find solutions to problems |  |  |  |  |
| GK2 | Work with complex ideas and justify judgements made through effective use of evidence |  |  |  |  |
| **Teaching/learning methods and strategies** |
| The range of learning and teaching strategies includes: |
| * Lectures;
* Seminars;
* Tutorials;
* Project Supervision;
* Demonstrations;
 | * Practical classes and workshops;
* Supervised time in labs;
* External visits;
* Taught study skills and academic writing sessions;
* Taught online or blended learning activities.
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| **Assessment strategies** |
| The assessment strategies employed in the Fields include the following: |
| * Written Examinations (s);
* Oral Assessments and presentations (f/s);
* Written investigative Assignments (f/s);
 | * Dissertations (f/s);
* Written Practical assignments (f/s);
* Tutorial exercises (f).
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1. **Entry Requirements**

The minimum entry qualifications for the programme are:

* A good lower second class (2:2) BSc or BEng honours degree (or equivalent) in Engineering and other relevant disciplines ; or
* A BSc degree plus appropriate work experience.
* Mature applicants without adequate formal qualifications but who have substantial relevant work experience will be considered on an individual basis.

A minimum IELTS overall score of 6.5 with 6.0 in Writing and no sections less than 5.5, TOEFL 88 with 20 in Reading and Writing and no sections less than 17, or equivalent is required for those for whom English is not their first language.

1. **Programme Structure**

This programme is offered in either 1 year full-time or 2-3 years part-time mode, and leads to the award of an MSc in Renewable Energy Engineering. Entry is at level 7 with a first degree or equivalent qualifications (See section D). Intake is normally in September and January of the academic year. Block diagram of the programme structure is shown in Appendix-A.

**E1. Professional and Statutory Regulatory Bodies**

Institution of Mechanical Engineers (IMechE).

This degree is accredited by the IMechE and therefore provides elements of further learning towards Chartered status, for the graduates who have already completed an accredited first degree.

**E2. Work-based learning, including sandwich programmes**

Work placements and internships either during the project phase are actively encouraged and supported ; although it is the responsibility of individual students to source and secure such placements. This allows students to reflect upon their own personal experience of working in an applied setting, to focus on aspects of this experience that they can clearly relate to theoretical concepts and to evaluate the relationship between theory and practice. Typical examples so far are students working on sponsored projects on the employer’s premises under mutually agreed supervision arrangements. There is also provision to allow full time students to switch to part time mode of studies when work based learning changes to a full time employment offer.

**E3. Outline Programme Structure**

The MSc programme is made up of 3 compulsory core modules and choice of 1 optional module out of 3, each worth 30 credit points; and a project dissertation module worth 60 credit points.

The normal study pattern for full-time and part-time students is as follows:

* Full-Time Intakes: September intake students should complete all the required taught modules with a minimum of 90CP to progress to the summer research project with project submission due on the following September. January intake students on the other hand are excluded from taking up Biomass projects and should complete their first semester modules before progress to the summer research project, with project submission due on the following January.
* Part-Time Intakes: Part time students normally complete all 4 modules followed by the project over a two year period. In exceptional circumstances, agreed by the course director, students may complete 4 modules in the first two years followed by project in the third year.

All students will be provided with the University regulations and specific additions that are sometimes required for accreditation by outside bodies (e.g. professional or statutory bodies that confer professional accreditation). Full details of each module will be provided in module descriptors and student module guides.

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| **Level 7**  |
| **Compulsory modules** | **Module code** | **Credit** **Value** | **Level**  | **Teaching Block****2 Weeks** |
| Biomass and Fuel Cells Renewable Technology  | AE7202 | 30 | 7 | Block 1 |
| Wind Power Engineering | AE7201 | 30 | 7 | Block 2 |
| Solar Power Engineering | AE7203 | 30 | 7 | Block 2 |
| Project Dissertation | AE7200 | 60 | 7 | Summer + Block 1 |
| **Option modules** |  |  |  |  |
| Computational Fluid Dynamics for Engineering Applications | ME7724 | 30 | 7 | Block 1 |
| Computer Aided Product Development | ME7721 | 30 | 7 | Block 1 |
| Engineering Project and Risk Management | ME7712 | 30 | 7 | Block 1 |
| Students exiting the programme with 60 credits are eligible for the award of PgCertStudents exiting the programme with 120 credits are eligible for the award of PgDip |

1. **Principles of Teaching Learning and Assessment**

The principles of teaching, learning and assessment are in line with the University's strategy, 'Led by Learning'. The programme is designed to give students a balanced portfolio of theoretical and practical experience, embracing diversity and individuality.

Specialists in the various renewable energy fields allied with lecturers and guest speakers from relevant industries contribute to the delivery of the programme, reinforcing the theoretical aspects and provide an informed insight into industry. The external lecturers in particular promote innovation and creativity whilst offering an insight into entrepreneurial culture.

The practical workshops, open forums, company visits and group presentations introduced into the modules provide students with a detailed understanding of the approaches taken in industry.

Taught materials, knowledge gained from the practical and case studies embedded within each module give student specialised knowledge, tools and techniques. It will equip them with skills and methods for extracting and synthesising the information. These activities promote rigour, curiosity, excellence, originality and breadth of knowledge.

They must then further explore and exploit the information given, research and define outcomes accurately to produce detailed solutions and innovative work for each of the core modules and finally the project dissertation.

It is recognised that team work is a very important aspect in industry and this is implemented in the modules. The course ensures that the students are exposed to team working through group presentations, joint report writing, joint research and lab work, promoting consideration, courtesy and collegiality.

The course team is aware of the need for effective communication, both written and verbal. It takes pride in the fact that the course provides a means of preparing students for their longer term career plans and continuing professional development. Apart from the project itself, each student has to give verbal presentations during the modules, normally to the student’s peer group and module leader. Students are also helped with verbal communication skills through seminars, tutorials and discussion groups. Most modules are assessed by written assignments which are designed to improve students’ research and evaluation skills.

Research active teaching staff use their research expertise and findings to enhance students understanding and appreciation of major engineering issues such as noise and vibration, structural tower stability in the case of wind turbines, influence of feed stock on the environment and power out of CHP biomass plant and other related topics.

The individual project provides a challenge to the candidate to undertake a real world problem because most projects are industrially orientated. Students will be given close guidance to select a project which is relevant to the chosen field. During the project, the student will be expected to apply the knowledge learnt during the course to achieve agreed deliverables, whilst satisfying any given constraints. Key skills in communication, presentation, literature search, problem analysis, project planning, report writing and solution justification are all part of the learning objectives defined in the field.

A combination of assessment methods will be used throughout the course. The main elements will be a major module assignment, module examination and the project dissertation. Major assignments will be either an individual investigative assignment or a group assignment to include experimental reports, industrial or field visit reports and oral presentation based on activities outlined on the relevant module assignment brief. Each module leader is responsible for ensuring that the method of assessment reflects the aims and learning objectives of the module, is demanding and stimulating and at the appropriate master level. The level and content of courses are relevant and satisfy the Engineering Council's guidance and criteria (for further information see the Institute of Mechanical Engineering and Engineering Council links part K).

1. **Support for Students and their Learning**

Students are supported by the course director, acting as their pastoral tutor, from the pre-application all the way to graduation and career development.

The University and School support structure includes:

* A Module Leader for each module
* A Course Director to help students understand the programme structure
* Personal Tutors to provide academic and personal support using teaching staff
* A placement tutor to give general advice on placements
* Technical support to advise students on IT and the use of software
* A designated programme administrator
* An induction week at the beginning of each new academic session
* Staff Student Consultative Committee
* Study Space - a versatile on-line interactive intranet an learning environment
* A substantial Study Skills Centre that provides academic skills support
* Student support facilities that provide advice on issues such as finance, regulations, legal matters, accommodation, international student support etc.
* Disabled student support
* The Students’ Union
* Careers and Employability Service
1. **Ensuring and Enhancing the Quality of the Course**

The University has several methods for evaluating and improving the quality and standards of its provision. These include:

* External examiners
* Boards of study with student representation
* Annual review and development
* Periodic review undertaken at the subject level
* Student evaluation
* Moderation policies
* Professional body reaccreditation is required every four years

In addition to the University quality systems, the course currency and quality is continuously supported and evaluated by the School's Industrial Advisory Board. The module content and delivery methods are informed by the research and enterprise activities of academic staff. The course is also supported, monitored and accredited by the Institute of Mechanical Engineers (IMechE), under license from the UK regulator, the Engineering Council, as meeting the requirements for further learning for a Chartered Engineer (CEng) status for candidates who have already acquired an accredited CEng (Partial) BEng(Hons) degree.

Accreditation is a mark of assurance that the degree meets the standards set by the Engineering Council in the UK Standard for Professional Engineering Competence (UK-SPEC). Some employers recruit preferentially from accredited degrees, and an accredited degree is likely to be recognised by other countries that are signatories to international accords.

1. **Employability Statement**

Students who successfully complete the MSc will have acquired significant research and analytical skills in the broader engineering disciplines allied to renewable energy engineering and will have substantially enhanced prospects of gaining employment or career progression in the renewable energy engineering industry. Such skills acquired includes computational fluid flow dynamics and simulations, economic and NPV calculations, 3D system design and modeling, operational performance and field characteristics evaluation using Polysun and Wind-Pro advanced software simulation and analysis.

Typical examples of the graduated student destination so far are as follows:

* Business Analyst, full time employee of Smartest Energy Plc.
* CFD analyst, worked on internship programme with Nuclear Institute in Netherland.
* Inspection Engineer, full time employee of Garrad Hassan Plc.
* Project Cost Controller, full time employee of Vattenfall Wind Power Ltd specializing in off-shore wind farm installation.
* PV Design Engineer, full time employee of Renewable Resources Ltd, specializing in commercial PV installation.
1. **Approved Variants from the Postgraduate Regulations**

There is no variant to the PR.

1. **Other sources of information that you may wish to consult**
* www.qaa.ac.uk/publications/fheq08(1)
* *www.qaa.ac.uk/publications/fheqselfcert*
* [www.engc.org.uk/ukspec](http://www.engc.org.uk/ukspec)
* www.imeche.org/Home
* www.kingston.ac.uk/postgraduate-courses/renewableenergyengineering-msc

**Development of Programme Learning Outcomes in Modules**

This map identifies where the programme learning outcomes are assessed across the modules for this programme. It provides an aid to academic staff in understanding how individual modules contribute to the programme aims, and a means to help students monitor their own learning, personal and professional development as the programme progresses and a checklist for quality assurance purposes.

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|  |  |  | **Level 7** |
| **Compulsory Core Modules** | **Optional Modules** | **Project Dissertation** |
|  | **Module Code** |  | AE7202 | AE7201 | AE7203 | ME7724 | ME7721 | ME7712 | AE7200 |
| **Programme Learning Outcomes** | **Knowledge & Understanding** | A1 | S/F | S/F | S/F | S | S | S | S/F |
| A2 | S/F | F | F | S | S | F/S | S/F |
| A3 | F | F | F |  | F | S | S/F |
| A4 | F | S/F | SF | F | F | F/S | S/F |
| A5 | F | S/F | S/F |  |  | F/S | S/F |
| A6 | F | F | F |  |  | F/S | S/F |
| A7 | S/F | S/F | S/F |  |  |  | S/F |
| A8 | F | F | F |  |  |  | S/F |
| **Intellectual Skills** | B1 | S/F | S/F | S/F | F/S | S | F/S | S/F |
| B2 | S/F | S/F | S/F | S | S | F/S | S/F |
| B3 | S/F | S/F | S/F | S | S | S | S/F |
| B4 | S | S | S | S | S | S | S |
| B5 | F | F | F |  |  | S | S/F |
| B6 | S/F | S/F | S/F | S |  |  | S/F |
| **Subject Practical Skills** | C1 | F | F | F | F/S | F/S | S | S |
| C2 | S/F | S/F | S/F | S | S | F/S | S/F |
| C3 | F | F | F | S | S | S | F |
| C4 | F | F | F |  |  | S | S/F |
| **Self Awareness Skills** | AK1 | F | F | F |  | F | F | F |
| AK2 | S/F | S/F | S/F | F | F | F/S | S/F |
| AK3 | F | F | F |  | S | F | F |
| AK4 | F | F | F | S | S | F | F |

**S**  indicates where a summative assessment occurs (i.e. one that carries formal marks)

**F** where formative assessment/feedback occurs

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|  |  |  | **Level 7** |
| **Compulsory Core Modules** | **Optional Modules** | **Project Dissertation** |
|  | **Module Code** |  | AE7202 | AE7201 | AE7203 | ME7724 | ME7721 | ME7712 | AE7200 |
| **Programme Learning Outcomes** | **Communication Skills** | BK1 | S/F | S/F | S/F | S | S | F/S | F |
| BK2 | S | S | S | S | S | F/S | F |
| BK3 | F | F | F | F | F | F | S/F |
| **Interpersonal Skills** | CK1 | S/F | S/F | S/F |  | S | F/S | S/F |
| CK2 | S/F | S/F | S/F | F | F | F | S/F |
| CK3 | F | F | F |  | F | F | F |
| CK4 | S | S | S | F | F | F/S | S |
| **Research and information Skills** | DK1 | S/F | S/F | S/F | S | S | S | S/F |
| DK2 | S/F | S/F | S/F | S | S | S | S/F |
| DK3 | F | F | F |  |  |  | F |
| DK4 | S | S | S | S | S | F/S | S |
| DK5 | S | S | S |  |  | F | S |
| **Numeracy Skills** | EK1 | S/F | S/F | S/F | S | S | F/S | S/F |
| EK2 | S/F | S/F | S/F | S | S | S | S/F |
| EK3 | S/F | S/F | S/F | S | S | S | S/F |
| EK4 | S/F | S/F | S/F | S | S | S | S/F |
| **Management & Leadership Skills** | FK1 | S/F | S/F | S/F | S | S | F | S/F |
| FK2 | S/F | S/F | S/F | S | S | F | S/F |
| FK3 | S/F | S/F | S/F | S | S | F/S | S/F |
| FK4 | F | F | F |  |  | F | S/F |
| **Creativity and Problem Solving Skills** | GK1 | S/F | S/F | S/F | S | S | S | S |
| GK2 | S/F | S/F | S/F | S | S | F/S | S |

**S**  indicates where a summative assessment occurs (i.e. one that carries formal marks)

**F** where formative assessment/feedback occurs

**Technical Annex**

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| **Final Award(s):** | *MSc in Renewable Energy Engineering* |
| **Intermediate Award(s):** | *PgCert in Renewable Energy Engineering**PgDip in Renewable Energy Engineering* |
| **Minimum period of registration:** | *1Year Full-Time, 2 Years Part-Time* |
| **Maximum period of registration:** | *2 Years Full-Time, 4 Years Part-Time* |
| **FHEQ Level for the Final Award:** | *7 (Masters)* |
| **QAA Subject Benchmark:** | *N/A* |
| **Modes of Delivery:** | *Week Blocks (2 Weeks)* |
| **Language of Delivery:** | *English* |
| **Faculty:** | *Science, Engineering & Computing* |
| **School:** | *Aerospace & Aircraft Engineering* |
| **JACS code:** | *H800* |
| **UCAS Code:** | *N/A* |
| **Course Code:** | *NFOKPMAIFREE(FT), NFOKPMAZPREE(PT)* |
| **Route Code:** | *NTREE* |
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**APPENDIX-A**

**MSc in Renewable Energy Engineering**

**Course Structure**

**Core Modules**

**AE7200**

**Individual Project**

**(60CP)**

**AE7201**

**Wind Power Engineering**

**(30CP)**

**AE7202**

**Biomass and Fuel Cells Renewable Technology**

**(30CP)**

**AE7203**

**Solar Power Engineering**

**(30CP)**

***Plus any 1 of the Optional Modules below:***

**MEM7724**

**Computational Fluid Dynamics for Engineering Applications**

**(30 CP)**

**ME7721**

**Computer Aided Product Development**

**(30 CP)**

**ME7712**

**Engineering Project and Risk Management**

**(30 CP)**

MASTER OF SICENCE (MSc)

(Minimum of 180 Credit Points)

POST GRADUATE CERTIFICATE

(Minimum of 60 Credit Points)

POST GRADUATE DIPLOMA

(Minimum of 120 Credit Points)

**APPENDIX-B**

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|  | **Improving the world through engineering** |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  | **THE SUMMARY OF UK-SPEC SPECIFIC LEARNING OUTCOMES** |
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| **Undergraduate programmes:** |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
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| ***Underpinning Science and Mathematics and associated engineering disciplines (US)*** |
| **US1m** | A comprehensive understanding of the scientific principles of mechanical and related engineering disciplines. |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |  |  |  |   |
| **US2m** | A comprehensive knowledge and understanding of mathematical models relevant to the mechanical and related engineering disciplines, and an appreciation of their limitations. |   |   |  |  |  |   |
| **US3m** | An understanding of concepts from a range of areas including some outside engineering, and the ability to apply them effectively in engineering projects. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |   |
| **US4m** | A comprehensive knowledge and understanding of the role and limitations of ICT, and an awareness of developing technologies in ICT. |  |  |  |  |  |  |  |  |  |  |  |  |  |   |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |   |
| ***Engineering Analysis (E)*** |
| **E1m** | Ability to use fundamental knowledge to investigate new and emerging technologies. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |   |
| **E2m** | Ability to extract data pertinent to an unfamiliar problem, and apply its solution using computer based engineering tools when appropriate |  |  |  |  |  |  |  |  |  |  |  |  |  |   |
| **E3m** | An understanding of the capabilities of computer based models for solving problems in engineering, and the ability to assess the limitations of particular cases. |  |  |  |  |  |  |  |  |  |   |
| **E4** | Understanding of and ability to apply a systems approach to engineering problems. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |   |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |   |
| ***Design (D)*** |
| **D1m** | Wide knowledge and comprehensive understanding of design processes and methodologies and the ability to apply and adapt them in unfamiliar situations. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |   |
| **D2** | Understand customer and user needs and the importance of considerations such as aesthetics. |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| **D3** | Identify and manage cost drivers. |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| **D4m** | Ability to generate an innovative design for prodcuts, systems, components or processes to fulfil new needs. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |   |
| **D5** | Ensure fitness for purpose for all aspects of the problem including production, operation, maintenance and disposal |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| **D6** | Manage the design process and evaluate outcomes. |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
|  |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| ***Economic, social and environmental context (S)*** |
| **S1m** | The ability to make general evaluations of commercial risks through some understanding of the basis of such risks |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| **S2m** | Extensive knowledge and understanding of management and business practices, and their limitations, and how these may be applied appropriately *to strategic and tactical issues.* |  |  |  |  |  |   |
| **S3** | Understanding of the requirement for engineering activities to promote sustainable development. |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| **S4** | Awareness of the framework of relevant legal requirements governing engineering activities, including personnel, health, safety, and risk (including environmental risk) issues.  |  |  |  |  |  |  |   |
| **S5** | Understanding of the need for a high level of professional and ethical conduct in engineering. |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |   |
| ***Engineering Practice (P)*** |
| **P1m** | A thorough understanding of current practice and its limitations and some appreciation of likely new developments |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| **P2m** | Extensive knowledge and understanding of a wide range of engineering materials and components |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| **P3** | Understanding of contexts in which engineering knowledge can be applied (e.g. operations and management, technology, development, etc). |   |   |   |   |   |   |   |   |   |   |   |   |   |
| **P4** | Understanding use of technical literature and other information sources. |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| **P5** | Awareness of nature of intellectual property and contractual issues. |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| **P6** | Understanding of appropriate codes of practice and industry standards. |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| **P7** | Awareness of quality issues. |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| **P8m** | Ability to apply engineering techniques taking account of a range of commercial and industrial constraints |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
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| **Postgraduate Programmes:** |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
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| ***Summary of QAA Descriptors*** |
| **Q1** | a systematic understanding of knowledge, and critical awareness of current problems or new insights much of which is at, or informed by, the forefront of their academic discipline, field of study or area of professional practice; |
| **Q2** | a comprehensive understanding of techniques applicable to their own research or advanced scholarship |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| **Q3** | originality in application of knowledge, together with a practical understanding of how established techniques of research and enquiry are used to create and interpret knowledge in the discipline |   |   |   |   |   |   |
| **Q4** | conceptual understanding to evaluate critically current research and advanced scholarship in the discipline; and evaluate methodologies and develop critiques of them and, where appropriate, to propose new hypotheses |   |
| **Q5** | deal with complex issues both systematically and creatively, make sound judgements in the absence of complete data, and communicate their conclusions clearly to specialist and non-specialist audiences |   |   |   |
| **Q6** | demonstrate self-direction and originality in tackling and solving problems, and act autonomously in planning and implementing tasks at a professional or equivalent level |   |   |   |   |   |   |   |   |   |   |
| **Q7** | continue to advance their knowledge and understanding, and to develop new skills to a high level |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| **Q8** | *and will have* the qualities and transferable skills necessary for employment requiring the exercise of initiative and personal responsibility |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| **Q9** | *and will have* the qualities and transferable skills necessary for decision-making in complex and unpredictable situations; |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| **Q10** | *and will have* the qualities and transferable skills necessary for the independent learning ability required for continuing professional development |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
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| ***UK-SPEC threshold Statements of Competence and Commitment*** |
| **A1** | Maintain and extend a sound theoretical approach in enabling the introduction and exploitation of new and advancing technology and other relevant developments |   |   |   |   |   |   |   |   |   |   |   |
| **A2** | Engage in the creative and innovative development of engineering technology and continuous improvement systems |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| **B1** | Identify potential projects and opportunities |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| **B2** | Conduct appropriate research, and undertake design and development of engineering solutions |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| **B3** | Implement design solutions, and evaluate their effectiveness |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| **C1** | Plan for effective project implementation |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| **C2** | Plan, budget, organise, direct and control tasks, people and resources |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| **C3** | Lead teams and develop staff to meet changing technical and managerial needs |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| **C4** | Bring about continuous improvement through quality management |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
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