

**Programme Specification**

**Title of Course: BEng(Hons) Aerospace Engineering**

**BEng(Hons) Aerospace Engineering (Space Technology**

**Date Specification Produced: August 2018**

**Date Specification Last Revised: July 2019**

This Programme Specification is designed for prospective students, current students, academic staff and 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 they take 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 the Course Guide, on Canvas and in individual Module Descriptors.

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**SECTION 1: GENERAL INFORMATION**

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| **Title:** | BEng (Hons) Aerospace Engineering with pathway in Space Technology |
| **Awarding Institution:** | Kingston University |
| **Teaching Institution:** | Kingston University |
| **Location:** | Roehampton Vale Campus, Kingston |
| **Programme Accredited by:** | Will seek accreditation with Royal Aeronautical Society (RAeS) |

**SECTION2: THE PROGRAMME**

1. **Programme Introduction**

Aerospace Engineering is a branch of engineering dealing with the design, development, construction and science of aircraft and spacecraft. The BEng (Hons) Aerospace Engineering primarily considers aircraft and the Space Technology pathway focuses on spacecraft. Aerospace engineering projects are carried out by teams of engineers, each having a specialised area of expertise. Aerospace engineers design, test and supervise the manufacture of aircraft, spacecraft and missiles. They also carry out research and develop new technologies for use in aviation, defence systems and space. The Roehampton Vale campus is located near the former factories of the British Aerospace/Hawker Siddeley Aviation (also formerly known as H.G. Hawker Engineering and Sopwith Aviation) in Kingston and Ham where many famous aircraft were designed and built. These include the legendary Harrier, Hawk, Hunters, Typhoon and Camel. It has a heritage of providing graduates to the aerospace industry. Aerospace/Aeronautical Engineering has been taught at Kingston for over 100 years.

The school has an extensive range of equipment, which includes a live Learjet business aircraft, flight simulators, composite materials lab and large wind tunnels, provides a hands-on and stimulating learning environment for students.  The Department of Aerospace and Aircraft Engineering currently delivers a wide range of undergraduate programmes in-house and through collaborative provision with partners. The teaching staff has strong expertise in the delivery of MEng and BEng(Hons) Aerospace Engineering and other Aerospace related courses. The teaching team has a diverse range of research areas that support student learning within and beyond the formal curriculum through Research-Informed Teaching (RIT).

Staff are encouraged to adopt innovative teaching practices to enhance student learning experience. A wide variety of active learning techniques will be used in the programme. These include Project Based Learning, Problem-Based Learning, Collaborative Learning, Blended Learning, Inquiry-Led Learning, and other active learning strategies. The assessment strategies are designed in such a way to ensure that they are authentic reflecting real-world engineering activities and enhancing graduate employability.

The programme is intended to equip graduates with the knowledge, comprehension, intellectual ability and subject practical skills to become professional Aerospace engineers or to follow careers in related professional areas. Employability is a key element of the programme and hence the emphasis on communication, interpersonal and other skills such as attitudes and behaviours encouraging self-management, self- reflection, resilience and life-long learning that today’s industry sees as enhancing employment prospects. Furthermore the course will equip students’ understanding of the context in which engineering is practised including economics, the environment, statutory regulations, safety requirements customer and societal needs.

The BEng (Hons) Aerospace Engineering course is designed for undergraduate students who wish to study aerospace engineering to degree level and aspire to achieve the professional status of Incorporated Engineer (IEng) with the possibility of studying a further year for an accredited Master degree to become qualified for the Chartered status (CEng).

In common with all engineering degrees at Kingston, students will take a common set of four (30 credit) modules at level 4 and share a common module in each of levels 5 and 6. This allows all students to experience engineering disciplines outside their chosen discipline. The first teaching block (TB1) of the first year is identical for all disciplines and this allows students to change disciplines with no additional work required up to the end of TB1. In the second teaching block of the first year (TB2), although the modules are their same, there is some discipline specific content. Students are still able to change disciplines at the end of the first year but are required to do some additional work over the summer to cover the discipline specific content they missed in TB2. Although students may have a firm idea of which branch of engineering they would like to study when they start, exposure to a variety of disciplines in the TB1 allows students to make a more informed choice. In addition, this structure provides valuable experience of working in interdisciplinary teams, an essential employability skill. Shared modules at level 5 and 6 give further opportunities for interaction across engineering disciplines and associated group work on real world problems. A feature of the learning and teaching strategy is a focus on active learning sessions at the expense of traditional didactic lectures.

The programme broadly follows four themes or threads. Firstly the understanding and application of the principles of engineering science through the core subject areas of: aerospace structures and materials, aerospace and mechanical systems, aerodynamics and propulsion are emphasised. Secondly, topics intended to widen the students’ knowledge base include electrical and electronic systems, control engineering, engineering mathematics and computing. Thirdly there is a professional theme, introducing the students to the practice of aerospace engineering, covering such topics as professional practice, project management, quality and business management. Lastly there is a strong design theme linking together the other threads and emphasising the holistic nature of modern day engineering. Hence, the BEng (Hons) provides both breadth and depth with an aim to develop the ability to identify, define and solve engineering problems from first principles.

The Space Technology pathway is the same as the standard programme for the first two years but students are expected to work on a space related project in the Engineering Project Management module at level 5. In the final year students must take AE6030 Space Vehicle Design and work on a space related individual project and group project.

Technology enhanced learning such as videos, discussion forums and e-learning will be used together with the best traditional methods to provide a “blended learning” experience. In particular learning is supported by Kingston University’s excellent e-learning environments: VLE system which can be easily accessed both on and off campus. Electronic submission and feedback is widely used on the programme to enable students to submit work and receive feedback from off campus

The BEng(Hons) is offered as a three-year full-time or four-year sandwich course with an industrial placement taken between level 5 and 6.

1. **Aims of the Field/Course**

The general aims of the course are:

* To equip graduates with the engineering, design, management, business and personal skills required to become professional aerospace engineers, as well as enabling them to follow careers in related professional disciplines.
* To meet the academic requirements fully for Incorporated membership as well as (when combined with approved further learning) for Chartered Membership of the Royal Aeronautical Society (RAes) by ensuring that the course is accredited by that body.

More specific aims of the course are:

* To produce graduates with a breadth and depth of knowledge and a thorough comprehension of the key aspects of aerospace engineering.
* To allow students to develop analytical and problem-solving skills and an ability to evaluate evidence and assumptions to reach sound judgements and communicate these effectively.
* To provide graduates to industry who have a creative approach to the solution of design problems and the requisite technical skills to realise these solutions.
* To equip students with the research skills required for postgraduate study and the employability skills required for work in the aerospace and related engineering industries.
* To furnish graduates with a firm grasp of sustainability and ‘Health and Safety within the context of their discipline.
* To provide graduates who have the reflective skills to recognise the need to continually develop themselves in order to exercise their Professional judgement.

1. **Intended Learning Outcomes**

The field/course provides opportunities for students to develop and demonstrate knowledge and understanding specific to the subject, key skills and graduate attributes in the following areas. The programme outcomes are referenced to the QAA subject benchmarks for Engineering (2015) 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 successful completion of the course students will be able to: |  | **Intellectual Skills**  On successful completion of the course students will be able to |  | **Subject Practical Skills**  On successful completion of the course students will be able to |
| A1 | Demonstrate and apply their knowledge and understanding of essential facts, concepts, theories and principles associated with aerospace engineering and underpinning mathematics and science. | B1 | Recognise, evaluate and analyse problems; identify and investigate possible solutions and make sound decisions regarding the solution to adopt and/or the course of action to be taken. | C1 | Apply aerospace engineering principles and undertake practical work and analyse the data obtained for use in design and development. |
| A2 | Demonstrate a knowledge and understanding of aerospace vehicle engineering design and development. | B2 | Locate, collect, collate, interpret and critically evaluate arguments, assumptions, abstract concepts and data (that may be incomplete), and use it to make judgements, and to frame appropriate questions to help achieve a solution. | C2 | Use engineering workshop and laboratory equipment safely for manufacture and experimental investigation |
| A3 | Demonstrate a clear understanding of the legal obligations pertaining to aerospace engineers, the rules and regulations under which they must work and the importance of Health and Safety in the engineering industry. | B3 | Communicate clearly and succinctly orally, graphically and in writing having due regard for the receiving audience and intellectual property rights. | C3 | Use a range of technical equipment and instruments, gaining an understanding of their underlying technology and their application in aerospace industry. |
| A4 | Apply business methods to assess the economic and financial aspects of aerospace engineering projects and management. | B4 | Manage projects, people, resources and time, taking account of legal and statutory requirements, risk, safety, quality and reliability. | C4 | Use a range of engineering and IT equipment and software to assist with information retrieval, management and problem solving. |
| A5 | Demonstrate understanding of the economical, ethical and sustainability challenges facing aerospace industry. | B5 | Manage their own personal and professional development by identifying gaps and/or shortfalls in their knowledge, understanding and skills and taking the necessary action to rectify it. | C5 | Work independently or as part of a team to initiate, investigate, plan, manage and drive projects to a successful conclusion and produce the associated documentation (proposals, plans, reports, presentations). |

**Table 1 – BEng(Hons) Aerospace Engineering Programme Learning Outcomes**

In addition to the programme learning outcomes identified overleaf, the programme of study defined in this programme specification will allow

students to develop a range of Key Skills as follows:

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| **Key Skills** | | | | | | |
| **Self Awareness Skills** | **Communication Skills** | **Interpersonal Skills** | **Research and information Literacy Skills** | **Numeracy Skills** | **Management & Leadership Skills** | **Creativity and Problem Solving Skills** |
| Take responsibility for own learning and plan for and record own personal development | Express ideas clearly and unambiguously in writing and the spoken work | Work well with others in a group or team | Search for and select relevant sources of information | Collect data from primary and secondary sources and use appropriate methods to manipulate and analyse this data | Determine the scope of a task (or project) | Apply scientific and other knowledge to analyse and evaluate information and data and to find solutions to problems |
| Recognise own academic strengths and weaknesses, reflect on performance and progress and respond to feedback | Present, challenge and defend ideas and results effectively orally and in writing | Work flexibly and respond to change | Critically evaluate information and use it appropriately | Present and record data in appropriate formats | Identify resources needed to undertake the task (or project) and to schedule and manage the resources | Work with complex ideas and justify judgements made through effective use of evidence |
| Organise self effectively, agreeing and setting realistic targets, accessing support where appropriate and managing time to achieve targets | Actively listen and respond appropriately to ideas of others | Discuss and debate with others and make concession to reach agreement | Apply the ethical and legal requirements in both the access and use of information | Interpret and evaluate data to inform and justify arguments | Evidence ability to successfully complete and evaluate a task (or project), revising the plan where necessary |  |
| Work effectively with limited supervision in unfamiliar contexts |  | Give, accept and respond to constructive feedback | Accurately cite and reference information sources | Be aware of issues of selection, accuracy and uncertainty in the collection and analysis of data | Motivate and direct others to enable an effective contribution from all participants |  |
|  |  | Show sensitivity and respect for diverse values and beliefs | Use software and IT technology as appropriate |  |  |  |

1. **Entry Requirements**

The minimum entry qualifications for the programme are:

From A levels: 112 points to include A2 mathematics at grade B plus two suitable science subjects.

BTEC National: Distinction, Distinction, Merit (DDM) from an engineering-related BTEC Extended Diploma including Distinctions for Mathematics and Further Mathematics.

Access Diploma: 134 points at level 3 including Distinctions in Maths, Mechanics and science modules.

Plus: GCSE (A\*-C) minimum of 5 subjects including English Language and Mathematics.

A minimum International English Language Testing System (IELTS) score of 6.0 (min 5.5 in Speaking, Writing, Listening and Reading) or equivalent is required for those for whom English is not their first language.

Direct entry to level 5 of the BEng is permitted provided they have studied to an equivalent to Kingston Engineering Level 4 at another institution.

Students who have alternative or non-standard qualifications or have experience that needs to be credited on an APL or APEL basis are considered on an individual basis.

1. **Field/Course Structure**

This programme is offered in full-time and sandwich modes, this leads to the award of BEng(Hons) Aerospace Engineering. Intake to both modes of study is normally in September.

Entry is normally at Level 4 with A-level or equivalent qualifications (See section D). Transfer from a similar course is possible at Level 5 with passes in comparable Level 4 modules – but is at the discretion of the course team and subject to the limitations and guidance of the accrediting professional body.

**E1. Professional and Statutory Regulatory Bodies**

Accreditation will be sought from the Royal Aeronautical Society once the programme is validated.

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

All students are encouraged to make use of the opportunity to enhance their learning and personal development by undertaking an industrial placement after the second year of their programme. All placements are reviewed to ensure that they provide a relevant experience in which students can apply their learning in a practical situation. Students have the responsibility for securing an industrial placement; placement are not guaranteed. All students on the course receive support from the placement specialists (Talent Preparation Officers) within the KU Talent team in securing a position and while in the workplace.

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. Historically many sandwich placements are reasonably well remunerated.

**E3. Outline Programme Structure**

The course structure diagram is shown in figure 1. Each level is made up of four modules each worth 30 credit points. Typically a student must complete 120 credits at each level. 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.

To be awarded a BEng (Hons) Aerospace Engineering degree or BEng (Hons) Aerospace Engineering (Space Technology), students must pass all 360 credits. A student is eligible for the award of an unclassified bachelor degree if they successfully complete 300 credits of the programme.

BEng (Hons) Aerospace Engineering (Space Technology) students must take AE6030 plus either AE6020 or AE6022 and they must carry out Individual and Group projects (EG5014, EG6023 and AE6024) in their specialist area.

Key:

ica = in-course assessment

ex = examination

prac ex = practical examKey

**BEng (Hons) in Aerospace Engineering**

**LEVEL 5**

**LEVEL 4**

Aerodynamics & propulsion & Analytical Methods

AE5020

Engineering Design and Professional Practice

EG4010

**Industrial Placement**

Engineering Mechanics, Structures and Materials

EG4011

Engineering Mathematics and Computing Applications

EG4012

Fluid Mechanics and Engineering Science

EG4013

**LEVEL 6**

Business & Project Management & Group Design Project

EG6023

Individual Project (CEng)

AE6024

Further Aerospace Structures, Materials & Dynamics

AE6022

Further Aerodynamics & Propulsion & Computational Techniques

AE6020

Electronic Systems, Control & Computing

ME5012

Engineering Project Management

EG5014 – (Aero, Space Tech, Mech and Civil group projects)

Aerospace Structures, Materials & Dynamics

AE5022

**BEng (Hons) in Aerospace Engineering (Space Technology)**

Business & Project Management & Group Design Project

EG6023

Individual Project (CEng)

AE6024

Further Aerospace Structures, Materials & Dynamics

AE6022

Further Aerodynamics & Propulsion & Computational Techniques

AE6020

or

Space Vehicle Design

AE6030

**LEVEL 6**

**LEVEL 5**

**LEVEL 4**

**Industrial Placement**

Aerodynamics & propulsion & Analytical Methods

AE5020

Electronic Systems, Control & Computing

ME5012

Aerospace Structures, Materials & Dynamics

AE5022

Engineering Project Management

EG5014 – (Aero, Space Tech, Mech and Civil group projects)

Engineering Design and Professional Practice

EG4010

Engineering Mechanics, Structures and Materials

EG4011

Fluid Mechanics and Engineering Science

EG4013

Engineering Mathematics and Computing Applications

EG4012

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| **Level 4** (all core) | | | | |
| **Compulsory modules** | **Module code** | **Credit**  **Value** | **Level** | **Teaching Block** |
| Engineering Design and Professional Practice | EG4010 | 30 | 4 | 1&2 |
| Engineering Mechanics, Structures and Materials | EG4011 | 30 | 4 | 1&2 |
| Engineering Mathematics and Computing Applications | EG4012 | 30 | 4 | 1&2 |
| Fluid Mechanics and Engineering Science | EG4013 | 30 | 4 | 1&2 |

Progression to level 5 requires passes in all four modules to give 120 credits at level 4

Students exiting the programme at this point, who have successfully completed 120 credits, are eligible for the award of Certificate of Higher Education in Aerospace Engineering.

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| **Level 5** (all core) | | | | |
| **Compulsory modules** | **Module code** | **Credit**  **Value** | **Level** | **Teaching Block** |
| Aerodynamics, Propulsion and Analytical Methods | AE5020 | 30 | 5 | 1&2 |
| Aerospace Structures, materials and Dynamics | AE5022 | 30 | 5 | 1&2 |
| Electronic Systems, Control and Computing | ME5012 | 30 | 5 | 1&2 |
| Engineering Project Management | EG5014 | 30 | 5 | 1&2 |

Progression to level 6 requires passes in all four modules to give 120 credits at level 5.

Students exiting the programme at this point, who have successfully completed 120 credits, are eligible for the award of Diploma of Higher Education in Aerospace Engineering.

**BEng (Hons) Aerospace Engineering**

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| **Level 6** (all core) | | | | | |
| **Compulsory modules** | **Module code** | **Credit**  **Value** | **Level** | **Teaching Block** |  |
| Further Aerodynamics and Propulsion and Computational Techniques | AE6020 | 30 | 6 | 1&2 | Core |
| Further Aerospace Structures, Materials and Dynamics | AE6022 | 30 | 6 | 1&2 | Core |
| Business Management and Group Project | EG6023 | 30 | 6 | 1&2 | Core |
| Individual Project | AE6024 | 30 | 6 | 1&2 | Core |

**BEng (Hons) Aerospace Engineering (Space Technology)**

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| **Level 6** (90 credits core) | | | | | |
| **Compulsory modules** | **Module code** | **Credit**  **Value** | **Level** | **Teaching Block** |  |
| Further Aerodynamics and Propulsion and Computational Techniques | AE6020 | 30 | 6 | 1&2 | Optional |
| Further Aerospace Structures, Materials and Dynamics | AE6022 | 30 | 6 | 1&2 | Optional |
| Business Management and Group Project | EG6023 | 30 | 6 | 1&2 | Core |
| Individual Project | AE6024 | 30 | 6 | 1&2 | Core |
| Space Vehicle Design | AE6030 | 30 | 6 | 1&2 | Core |

Students must either study AE6020 or AE6022 plus the other three modules.

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

The BEng course in Aerospace Engineering has been designed, taking into account the Kingston University Curriculum Design Principles, to help develop students into graduates that are professional, thoughtful, creative, resilient, proactive and globally aware independent, equipping them to be lifelong learners.

**Development of Independent learning through the course**

The learning, teaching and assessment strategy of the course is aimed at supporting progression in curriculum content and skills development through the levels of study. At level 4 there is a clear structure and guidance for students’ learning with an emphasis on the acquisition of fundamental engineering knowledge and skills (e.g. Mathematics and IT in EG4012 **Engineering Mathematics and Computing**, practical skills (EG4011 and EG4013) and the initial development of key employability skills (EG4010). This provides a solid foundation for students to undertake a deeper study in a specific engineering discipline at level 5. At level 5 there will be an increased expectation of independent study, supported by a reduced emphasis on the use of traditional lectures. Students will continue to receive clear guidance on how to assess their understanding of the material through self-assessment questions and at scheduled tutorials. At level 6 students will be expected to take greater ownership of their independent study with academics taking on more of a supervisory role of student independent study, this is exemplified in the individual and group project modules **EG6023 Business and Project Management and Group Design** and **AE6024 Individual project** and in the module **AE6020 Further Aerodynamics, Propulsion and Computational Techniques** where students undertake self-paced computer workshops for CFD and flipped classroom tutorials to present solutions to complex analysis problems.

Module guides set out clear expectations for guided independent learning. Students will be directed to reading and Technology Enhanced Learning (TEL) packages to prepare for individual topics or sessions and also to structured problem sets to consolidate and test their learning afterwards. This will be introduced at level 4 and further developed at in subsequent level. The Personal Tutor Scheme at level 4 will develop skills in reflection on learning and finding additional support if required.

The Virtual Learning Environment (VLE) at Kingston will support learning throughout the course through a variety of TEL objects such videos, screencasts, on-line MCQs, discussion boards and interactive teaching packages. It will also deliver teaching material such as lecture notes/presentations, problems sets and worked examples.This helps support an inclusive approach as studentscan access learning material at their convenience and work through it at their own pace with the opportunity to pause and rewind as they wish.

**Integrated first year and interdisciplinary collaboration**.

All engineering students at Kingston University take a common set of four (30 credit) modules. This allows all students to experience various engineering disciplines before having to commit to their chosen area of specialisation. Due to a specialist strand in TB2 for one of the modules, students are expected to confirm their chosen engineering pathway at the end of TB1. Although students may have a firm idea of which branch of engineering they would like to study when they start (e.g. civil and infrastructure) exposure to a variety of branches in the first teaching block will allow students to make a more informed choice.

The opportunity to study and work with students from different branches of engineering is a distinct feature of the course at Kingston and is extended into the second year when all students take a common level 5 module. In **EG4010** **Engineering Design and Professional Practice** students will be introduced to the principles and importance of group work. Project-based learning (PjBL) is employed requiring interdisciplinary teams to design, build and present solutions to small scale engineering challenges, the outputs of these will be part of the summative assessment. Interdisciplinary group work will be further developed at level 5 in **EG5014 Project Engineering and Management** where students are taught about group project management in TB1 and then will spend much of TB2 working on a more complex challenge that will comprise 60% of the module assessment. In this module students are likely to tackle a live, real-world problem supplied by a well know company or organization. This will give the students an opportunity to talk about how they have worked with an external company on an engineering problem as part of a team, when they apply for an industrial placement At level 6, students will consolidate their group working skills **EG6023 Business and Project Management and Group** Engineering when undertaking a group design project in their own engineering discipline, using the team working skills learned in earlier years.

**Focus on active learning and enhancing student engagement**

A feature of the learning, teaching and assessment strategy in the School of Engineering is that many instructional lectures have been replaced by collaborative, problem solving or enquiry-based learning workshops and tutorials. These require students to prepare for, and participate in, the classroom activities, rather than passively listening to the lecturer. Students are expected to engage with the guided learning to prepare for these teaching sessions and consolidate their learning after the session. These interactive sessions also provide students with opportunities for peer learning, group work and presentation practice. In these sessions the lecturer facilitates learning by supporting students in creating their own knowledge and understanding. Lecturers may also introduce and summarise key concepts with short mini-lectures.

Project based Learning (PBjL) is introduced in **EG4010** and developed further in **EG5014 and EG6023**.These collaborative activities encourage students to draw on their own set of experiences and cultural backgrounds when tackling real world challenges. The Flipped classroom approach is introduced across the two engineering science based modules (EG4011, EG4013) and the maths/computing module EG4012. Here the curriculum (lecture content) of a small topic is delivered via on-line materials (screencasts, videos or study packs) and then developed and applied in workshops. At level 5, **AE5020** has a more substantial Flipped classroom approach where roughly one third of the curriculum is taught by this method and this approach is continued in **AE6020**.

Active and collaborative learning is also incorporated in traditional lectures which may have question-and-answer sessions, brief student discussions, clicker activities integrated into the lecture. These methods ensure that valuable contact time is focussed on the application and critical analysis of knowledge and the development of key skills such as problem solving, communication, and group-work.

The high percentage use of active learning sessions in the teaching hours is aimed at improving student engagement, creativity, confidence and self-reliance. The course endeavours to further secure student engagement by making students feel part of a community and increasing their sense of belonging which is supports to improved retention and progression. This is achieved by providing opportunities to interact with staff and students both socially and academically. In addition, to the active learning sessions and group work, this is achieved through: the PT scheme, field work, industrial visits, extra-curricular seminars, research internships, course representative system, student ambassador work, peer mentoring, PAL civic engagement and outreach opportunities.

**Developments of employability skills**

The progressive development of a range key employability skills is another feature of the course as exemplified in teamwork/groupwork discussed above. Regarding communication skills, at level 4 the focus is on writing individual practical reports (**EG4013 Fluid Mechanics & Engineering Science**) using a standard format and style, and encouraging students to orally communicate the outcomes of small group exercises in the active learning teaching sessions in **EG4010 and EG4011(Engineering Mechanics, Structures & Materials)**. At level 5 students will be required to produce a substantial written group report and present their individual findings in **EG5014** and in modules **AE5020** **and AE5022** individual laboratory reports on more challenging topics. To help development of these skills student will be required to submit a draft of a report for **EG4011** to the Support for Academic Success Centre for feedback and to discuss this with their personal tutor. At level 6 in the Individual Project module **AE6024**, students will further develop their ability to synthesise and critically review information from a variety of sources and report this and their research results in a formal research report and an oral presentation.

To complement the development of employability skills within the curriculum, Personal tutors will encourage students to engage in a range of extra-curricular activities such as student representation, part-time work, sports and recreation,  society membership,  volunteering ; student ambassadorship, leadership and mentoring; cultural and creative activities;   academic and professional collaboration; placement activity; enterprise activity; KU Talent events and opportunities. Activity in these areas is recognised by the university’s Kingston Award Scheme. KU Talent offers a range of events, including Careers Uncovered fairs, which include employers coming to campus to promote internship, placement and graduate opportunities, Spotlight on engineering networking activities where employers and alumni are invited on campus to talk about career pathways.

Engineering is fundamentally a creative industry and innovation is embedded throughout the curriculum, primarily through individual and group project work. This starts in level 4 with **EG4010** and is further developed in **EG5014.** In **EG6023**, a major group project is embedded within the Applied Business Management module. This encourages students to consider the broader business context in their project work. In addition, this module gives students the opportunity to compete in the annual Bright Ideas competition, which is a university wide competition to encourage entrepreneurship.

**Hands-on Practical work**

Hands on practical experience in workshops and laboratories is a fundamental in developing practical skills as well as enhancing data collection and analysis skills. Students will have the opportunity to work in laboratories and workshops in most of their modules. Practical work is closely related to the taught content to provide context for the theoretical work. At level 4 students are introduced to basic measurement and manufacturing processes and how to apply these in a laboratory and testing environment (**EG 4010, EG4011, EG4013)** at level 5 the focus is on more sophisticated measurement techniques and interpretation (**AE5020**, **AE5022**). This is delivered through supervised practical sessions with experiment protocols. At level 6 students and expected to select and apply requisite practical skills in their own independent research work in **AE6024** the individual project module

**Research Informed Teaching**

The majority of the course team are either engineering research active or are involved in industry related professional activities, through KTPs or other direct involvement with industry. These activities played a major part in informing the course design and content, as did the direct input from industry through the activities of the Industrial Advisory Board.

Most of the teaching staff are also actively involved in the various Research Centres and/or Research Groups of the Faculty, or may be following interest areas of their own. These activities take them into, amongst other areas, materials research both coatings and compound, fire and explosion research both cause and prevention, dynamics and control research and on through sustainable power generation to electric vehicle technology with particular success of the zero emissions electric motorbike. The modules at levels 6 and 7 are mainly taught and managed by academic staff who are engaged in research in various areas and include their research findings in addition to well established principles, for example in the modules **AE6022** the areas such as structures, materials including composites, structural dynamics, modal testing, rotating machinery are taught and in the module **AE6020** the research in aerodynamics and CFD is discussed.

Students are encouraged to develop their own research skills which are a fundamental part of the curriculum throughout all levels of the programme. They are often encouraged, through project work, to work with research active staff on elements of live projects, and these research skills enable students to determine, distinguish and present appropriate evidence in an argument, which is of great value to employers.

Academic staff are also engaged widely with the research and development of ideas in teaching and learning in Higher Education and into wider pedagogic issues which will then feed through to support learning in lectures and other forms of student engagement the programme, both formal and extra-curricular. As parts of pedagogic research computing resources in fundamental subjects such as Maths and Mechanics/Physics have been developed and been embedded into VLE system. The use of an Electronic Voting System in the class room for summative and formative assessments is another example of pedagogic research undertaken by the teaching staff. This reflective, evidence-based professional practice by academic staff serves as exemplar to students in their future professional practice

**Assessment for Learning**

The assessment strategy has been designed help students to learn and prepare them for employment, rather than just a tool to measure their learning. The assessment is designed to be authentic, inclusive and transparent. The assessment tasks focus on the real world-engineering activities that enhance students’ employability. **(EG4010, EG5014, AE6023)**. All modules have explicit formative assessments to provide opportunities for practice and the chance to use ‘feed forward’ to help students improve their work in subsequent summative assessments (**EG5020, EG5022, AE6020**). Examinations are still used as they are an effective way of assessing basic knowledge and understanding, and professional bodies expect to see examination covering key curriculum content. However, the strategy recognises that other assessment methods are better suited to assessing higher level problem solving skills. This is reflected in the decreasing use of examination from level 4 to level 6. The use of a well-balanced range of assessment methods is key part to of our inclusive assessment strategy. Group and teamwork assessment is instrumental in developing and recognising this important employability skill.

**Engineering curriculum**

Level 5 of the core programme builds on the fundamental knowledge and skills gained at Level 4. It focuses on knowledge and understanding of the engineering principles underpinning aerospace technologies. **AE5020 Aerodynamics and Propulsions and Analytical Methods** builds on the knowledge of students from Thermo-fluids at level 4 to application in aerodynamics of aerospace vehicles. The mathematical skills required to solve and analyse the resulting equations and deal with the complex data for the purpose of improving efficiency will be taught in this module The module involves the use of wind tunnel laboratories to enhance students learning experience through Learning-By-Doing. Staff encourage students to develop curiosity and a desire to learn for life using active learning techniques. The problem-based and inquiry-based group work fosters collaborative thinking and develops attributes expected of an aerospace graduate.

**AE5022 Aerospace Structures, Materials and Dynamics** introduces the application of aerospace engineering principles to aerospace vehicle materials and structures under static and dynamic loading. The module enhances the development of students’ analytical, problem-solving, critical thinking and laboratory skills. It provides an understanding of how the principles of structures and materials science all determine the configuration, performance and stability of aircraft. It also develops the software modelling skills of analysing composite aerospace structures using FEM techniques. The module involves the use of laboratory experiments in the areas of structures, composites and vibrations.

**ME5012 Electronic Systems, Control and Computing** is designed to broaden students’ knowledge and understanding of the fundamentals of the electronics and control systems used in aerospace applications. The live Learjet business aircraft is used to demonstrate the typical operation of each of the systems and to facilitate Learning-By-doing through the hands-on practice of real-world hardware.

The **Engineering Project Management Module EG5014** introduces the principles and commercial practices for the management of engineering projects and related wider business operations. The nature of project engineering and business management is considered in the context of time, quality, risk and sustainability aspects. It introduces the legal, commercial, social and ethical framework in engineering environments. This module provides opportunities for developing the team-working in industrially based group design activities which would enhance students’ communication skills in group discussions and seminars.

Level 6 of the programme continues the aerospace theme but it emphasises the development of self-management, independent learning, professional skills, and deep understanding of knowledge required in aerospace engineering.

In **AE6020 Further Aerodynamics and Propulsion and Computational Techniques** students are taught Aerodynamics and Propulsion at a more advanced level together with the application of Computational Fluid Dynamics (CFD) using ANSYS a widely used commercial package. In **AE6022 Further Aerospace Structures, Materials and Dynamics** students are taught more advanced level topics in structures, materials and rigid body as well as flexible body dynamics together with use of computational tools such as Finite Element Analysis using ANSYS and MATLAB

In **EG6023 Business Management and Group Project** students are taught about various key aspects of project planning and management before engaging in a group project based in the aerospace field and drawing on knowledge and experience gained previously. It will consist of substantial Project-Based Learning (PjBL) driven by the students with supervisor/facilitators encourage professionalism and leadership in a group activity support. It provides students with an understanding of the process of project planning and an opportunity to put theory into practice in a virtual industrial project. The module encourages professionalism and leadership in a collaborative group setting in which sustainability and ethicsare embeddedwithin the project context. The above two modules develop the analytical and problem-solving skills of the students.

**AE6024 Individual Project** combines the technical and academic facets of the programme and provides students with an opportunity to complete a capstone project applying the knowledge and skills learnt during the course to achieve agreed deliverables. It enables students to develop their research skills using and applying information from the technical literature.

The programme is designed to develop the students’ academic and technical knowledge and understanding, their academic and professional skills, and their personal qualities, and ultimately prepare them for employment. The assessment strategy has been designed in the same way: to develop the students rather than simply assess them to make sure they satisfy learning outcomes. The assessment is designed to be authentic, engaging and transparent that contributes to helping students to learn and develop effective attributes. The assessment tasks focus on the real world-engineering activities that enhance students’ employability. A large variety of different assessment methods are used in the programme and all modules in the programme have formal and informal assessment, and formative and summative assessment associated with them. The forms of assessment include portfolio, Clicker quizzes, online tests using VLE system, informal in-class tests, workbooks, practical exercises, tutorial questions, end-of-module examinations and even an individual viva exam which enable assessment of understanding of a broad range of aerospace topics. All of the coursework that students complete is formative as well as summative. The formal and informal feedback from coursework and the informal assessment given enable the students’ to improve knowledge and skills. The informal feedback includes group discussion in classes, one-to-one dialogue, rehearsal of oral presentation, draft reports and peer assessment.

The university is strongly committed to the Inclusive Curriculum. Students will be encouraged to see themselves as belonging to a professional community. A set of employability criteria will be identified using insight from employers and the Employability Team. We will identify skills that employers think are needed from graduates using alumni or the Royal Aeronautical Society. This involves the support from DARE ( Development, Alumni Relations and Events department) to identify alumni who have graduated at least a year ago. Each module will be examined to determine the opportunity to embed employability into the curriculum. Academic staff and members of the employability team will identify appropriate provision in the Centre for Graduate Excellence and, where necessary, tailored opportunities to bridge any gaps. Personal Tutors will enhance student engagement with these opportunities. Learning and teaching staff will highlight opportunities within their sessions that enable students to acquire the employability skills. Students will develop a CPD record in VLE to draw upon in applications and interviews. Personal Tutors include employability criteria and reflective questions in first meeting and record on system.

**Inclusive Teaching Practice**

Staff Student Consultative Committees and Boards of Study provide opportunities for student to make suggestion on how to develop a more inclusive curriculum by taking into account the specific circumstances of the student body. The variety of teaching activities also takes account of the student’s different learning preferences and experiences and there is a careful balance of individual and group based activities.

Marking criteria are provided for all assessments as part of the assessment booklet at the beginning of the year for each module and care is taken to ensure that the language used is clear**.** Assessment and marking criteria for all substantial assessments are discussed in class so all students have an opportunity to interrogate the criteria.

In the programme as a whole, the following components are used in the assessment of the various modules:

* Practical exercises: to assess students’ understanding and technical competence
* Individual and group-based case project work: to assess ability to understand requirements, to provide solutions to realistic problems and to interact and work effectively with others as a contributing member of a team. The outcomes can be:
* Written reports, where the ability to communicate the relevant concepts, methods, results and conclusions effectively will be assessed.
* Oral presentations, where the ability to summarise accurately and communicate clearly the key points from the work in a brief presentation will be assessed.
* Video, which may replicate features of oral presentations but allows advance preparation away from the audience (which may suit some students better).
* Multiple choice or short answer questions: to assess competence in basic techniques and understanding of concepts.
* Long answer structured questions in coursework assignments: to assess ability to apply learned techniques to solve simple to medium problems and which may include a limited investigative component
* Long answer structured questions in end-of-module examinations: to assess overall breadth of knowledge and technical competence to provide concise and accurate solutions within restricted time
* Project: The individual project module represents an opportunity for students to draw together different aspects of their learning on the course and to apply the techniques learned in an extended study. As such the assessment here will place a greater emphasis on ability to plan work, manage time effectively, and research background information, culminating in a written report and interview.
* Individual and group practical laboratory reports

**Employability/Placement**

Initially students are guided towards learning about employability skills and career pathways, but as they move through the course they are expected to become more independent and take ownership of their career development by engaging with classes provided by KU Talent, including; Professional Communication, Time and Self-Management and Identifying and Articulating Skills. There are also opportunities to perfect skills required to gain employment such as; CV writing, Psychometric Test and Using LinkedIn. A student’s development and career options are discussed in personal tutor meetings and guidance given as appropriate. This is in liaison with the KU Talent team, the University’s Careers Service.

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

Student support recognises that the student experience is unique to each student. A key part of our approach to an inclusive curriculum is that we acknowledge and where possible accommodate their individual circumstances. The personal tutor scheme is central to the efforts to provide a personalised learning experience. (See PT section of programme specification) At level 4 and 5 a core set of problems for each engineering module are issued to students. These cover the whole curriculum for a particular level. Students are required to work through these formative assessment problems as they cover the relevant curriculum. This allows students to test their learning and measure their progress. Discussion of progress on these problem sets will be a key part of the personal tutor scheme. Students are required to upload their progress on these activities onto the **Learning Log** created on the University VLE system. The Learning Log will be available to the relevant personal tutors for further discussion during one-to-one meetings. There will be milestones for students to meet at every level, and it will be one of the personal tutor’s roles to monitor the students’ progress and give appropriate advice*.*  Where difficulties are encountered PTs will be able to help or direct students to available support including peer mentoring schemes, PAL, Maths aid and on-line resources etc.

Students are supported by:

* **A Module Leader** for each module
* **A Course Leader** to help students understand their programme structure and provide academic support
* **A Personal Tutor** (PT) to provide academic and personal support
* There is a **Student Support and Engagement Team** to help students with any problem that is affecting their studies.
* A dedicated Undergraduate Course Administrator
* **An induction programme** and study skills sessions at the start of each academic year
* **SEC Academic Success Centre (SASC)** is a one-to-one drop-in Study Skills session for students every weekday. Help is available on a range of academic skills from writing reports, note-taking, to exam revision, referencing, programming and mathematical skills.
* **VLE** – a versatile on-line interactive intranet and learning environment accessible both on-site and remotely
* **Course Representative scheme**
* **Talent A University Careers** and Employability Service
* Comprehensive University support systems including the provision of advice on finance, regulations, legal matters, accommodation, international student support, disability and equality support.
* The Students’ Union
* An Academic Team that seeks to maintain an open door policy in the spirit of supporting students.

**Personal Tutor Scheme (PTS) in the School of Engineering**

The following provides the aims and structure of the Personal Tutor Scheme (PTS) for the School of Engineering. It is intended that the PTS be embedded within the provision of the BEng programme.

**Overall Aims**

* To build a rapport between staff and students and contribute to personalising students’ experience within the School of Engineering
* To support students in the development of their academic skills providing appropriate advice and guidance to students throughout their time at Kingston, while monitoring their progress, helping to identify individual needs and referring students to other University services as appropriate
* To help students to develop the ability to be self-reliant and confident self-reflective learners who use feedback to their best advantage
* To encourage students to reflect on how their learning relates to a wider context and their personal career progression

**Allocation of Personal Tutors**

* Personal tutors will be allocated during induction week
* Tutors will be allocated on a course basis where appropriate with student numbers being equally divided amongst the staff within the school
* Students will keep the same tutor throughout their course of study
* Since the Personal Tutor scheme is aligned with the student’s discipline, they will change Personal Tutors if they change disciplines.

There are specific aims and outcomes for each level, as the PTS is progressive and cumulative students will find that they are building on the skills developed in previous levels. Formative assessment will be provided in the form of regular feedback during meetings. The assessment in modules **EG4010** and **EG5014** are directly linked with the PTS scheme.

**Level 4: Settling in and building confidence**

**Aims and Learning Outcomes**

* To assist students in making the transition to Higher Education and to generate a sense of belonging to the School Engineering with an emphasis on widening participation issues
* To help students to develop good academic habits and to gain the confidence to operate successfully in a university context
* To prepare students to make the most of feedback throughout their course

**Contact:**

* Teaching block 1: three one-to-one meetings during induction week, weeks 2 and 6-7
* Teaching block 2: two one-to-one meetings during week 1 and week 6-7
* End of academic year individual ‘wrap up’ email

In addition to a core set of problems for each module students are also given a list of engagement activities that they are encouraged to take advantage of at level 4. PT will discuss progress on problem sets and engagement with certain activities with tutees throughout the year.The Learning Log will be available to the relevant personal tutors for further discussion during one-to-one meetings. There will be milestones for students to meet at every level, and personal tutor’s will monitor the students’ progress and give appropriate advice.

The module **EG4010 Engineering Design and Professional** Practice is closely linked to the Personal tutor scheme as it introduces key academic and employability skills. In addition it focuses on reflective practice on feedback and their progress with academic and employability skills. It is expected that these are topics of conversation personal tutor meetings.

**Level 5: Stepping it up and broadening horizons**

**Aims and Learning Outcomes**

* To help students comprehend and plan for the academic demands of level 5 and to support increasing independence
* To encourage students to look forward, to take up opportunities to develop wider skills and to take responsibility for their personal development
* To foster students’ ability to build on and respond proactively to the feedback they have received
* To assist students in reflecting on the skills that they are developing and consider how they relate to employability

**Contact:**

* One-to-one meeting in week 1
* Email contact at the end of teaching block 1
* Individual ‘wrap up’ email at end of academic year

**Level 6: Maximising success and moving on**

**Aims and Learning Outcomes**

* To support students with the planning necessary to maximise success in their penultimate undergraduate year
* To encourage students to reflect on the employability skills they have developed and be proactive in moving towards a professional life and/or further study
* To help students to make best use of the feedback they have received so that they can build on their strengths and take steps to address any weaknesses

**Contact:**

* One-to-one meeting in week 1
* Email contact at the end of teaching block 1
* Individual ‘wrap up’ email at end of academic year

Personal Tutors would have access to all the formative and summative assessment results of their tutees and would be responsible to discuss them with their tutees and assist them to prepare plans for further improvements and advise on any academic issues they may have. The personal tutors are also responsible for giving a bigger and more complete picture of learning, teaching, learning outcome and assessment and their linkage to the tutees.

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 subject level
* Student evaluation
* Moderation policies

1. **Employability Statement**

This curriculum embeds the development of employability skills throughout the Course and is designed to equip students with the ability to relate the knowledge and skills that they have learnt to the real world contexts in which they may work in the future. Group work in conjunction with external organisations at level 4 will provide students with relevant experience to add to their CV when they are applying for placement in level 5. Students are required to produce a CV early at level 5 and to improve this following feedback. The School strongly encourages and supports all students in applying for positions in industry for an Industrial Placement year between levels 5 and 6, the School emphasises the benefits to be obtained from an approved placement in industry.

An Industrial Placement comprises a period of at least 36 weeks with an approved employer. Students are required to maintain a log book of their activities and involvement and produce a final report on their activities as well as organisational and business aspects of the company. They are supported throughout the period by their personal tutor, who will visit them at their place of work on at least one occasion. The University tutor will discuss progress with the student and employer and will recommend any improvements to the learning opportunities.

This programme has been designed to fully meet the exemplifying academic benchmark requirements, for registration as an Incorporated Engineer (IEng) and (with further learning) for Chartered Engineer (CEng) status. Most graduates will aspire to careers in mechanically related industries and to becoming Chartered Engineers. Graduates develop careers in all branches of aerospace/ mechanical and related engineering industries both here in the UK and throughout the world; as contract and consulting engineers, within local authorities, utility, manufacturing and transport companies, government organisations and the defence industry. In many cases, students taking an industrial placement are able to secure employment with the placement organisation following graduation. The academic and key skills developed throughout an engineering course also allow graduates to follow careers in other professions such as ICT, finance, accountancy and teaching.

Professional practice in aerospace engineering is introduced in the first year in the module **EG4010,** in which the students are introduced to the employment opportunities in the specialist engineering field, this is followed through all other modules at levels 5, 6 and 7, specifically in **EG5014 Project Engineering and Management, EG6023 Business and Project Management and Group Design and AE6024 Individual project.**

1. **Approved Variants from the Undergraduate or Postgraduate Regulations**

The following proposed variants are subject to approval by the Education Committee

**Compensation**

Compensation is not permitted at level 6

**Reassessment of Individual Projects**

Reassessment of AE6024 Individual Project, will normally be by repeat only with a new project brief unless the student has achieved a grade of F5 in which case a retake in the form re-writing the dissertation will be allowed.

1. **Other sources of information that you may wish to consult**

Engineering subject benchmark:

www.qaa.ac.uk/Publications/InformationAndGuidance/Pages/Subject-benchmark-statement-Engineering-.aspx

Professional bodies:

[www.raes.org/](http://WWW.raes.org/)

[www.imeche.org/](http://www.imeche.org/)

Professional accreditation:

[www.engc.org.uk/](http://www.engc.org.uk/)

[www.raes.org/](http://WWW.raes.org/)

School Website:

<http://sec.kingston.ac.uk/about-SEC/schools/aerospace-and-aircraft-engineering/>*,*

1. **Development of Field/Course Learning Outcomes in Modules**

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

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Module code** | | **Level 4** | | | | **Level 5** | | | | **Level 6** | | | |  |
| EG4010 | EG4011 | EG4012 | EG4013 | AE5020 | AE5022 | ME5012 | EG5014 | AE6024 | EG6023 | AE6020 | AE6022 | AE6030 |
| **Knowledge & Understanding** | A1 |  | S |  | S | S | S | S | S | S |  |  | S | S |
| A2 | S |  |  |  | S | S | S | S |  | S |  |  | S |
| A3 | S |  |  |  |  |  |  | S | S | S |  |  |  |
| A4 | S |  |  |  |  |  | S | S | S | S |  |  | S |
| A5 | S | S |  |  | S | S | S | S | S | S |  |  |  |
| **Intellectual Skills** | B1 |  | S | S | S | S | S | S | S | S | S | S | S | S |
| B2 |  | S | S |  | S | S | S | S | S | S | S |  |  |
| B3 | S | S | S | S | S | S | S | S |  | S | S | S | S |
| B4 | S |  |  |  |  |  | S | S | S | S |  |  |  |
| **Practical Skills** | C1 | S |  |  |  | S | S |  | S | S | S |  |  | S |
| C2 | S | S |  | S | S | S | S |  | S |  |  |  | S |
| C3 | S | S |  | S | S | S | S |  | S |  |  |  | S |
| C4 | S | S | S | S | S | S | S | S | S |  | S | S | S |
| C5 | S | S | S | S |  |  |  | S | S | S |  |  |  |

**Students will be provided with formative assessment opportunities throughout the course to practise and develop their proficiency in the range of assessment methods utilised.**

**Technical Annex**

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| --- | --- |
| **Final Award(s):** | BEng (Hons) Aerospace Engineering  BEng (Hons)Aerospace Engineering (Space Technology) |
| **Intermediate Award(s):** | Cert HE in Aerospace Engineering  Dip HE in Aerospace Engineering  BEng Aerospace Engineering |
| **Minimum period of registration:** | FT-3 years SW – 4 years |
| **Maximum period of registration:** | FT- 6 years SW- 8 years |
| **FHEQ Level for the Final Award:** | Level 6 |
| **QAA Subject Benchmark:** | Engineering |
| **Modes of Delivery:** | Sandwich and Full-time |
| **Language of Delivery:** | English |
| **Faculty:** | SEC |
| **School:** | Engineering |
| **Department:** | Aerospace and Aircraft Engineering |
| **JACS code:** | H400 |
| **UCAS Code:** | H421 (FT), H422 (SW) |
| **Course/Route Code:** | To be determined |
|  |  |