University of the West of England
BRISTOL

ACADEMIC SERVICES

PROGRAMME SPECIFICATION

Part 1: Basic Data			
Awarding Institution	University of the West of England, Bristol		
Teaching Institution	University of the West of England, Bristol		
Delivery Location			
Study abroad / Exchange / Credit recognition	N/A		
Faculty responsible for programme	Faculty of Environment and Technology		
Department responsible for programme	Department of Engineering Design and Mathematics		
Modular Scheme Title			
Professional Statutory or Regulatory Body Links			
Highest Award Title	MEng Aerospace Engineering with Pilot Studies MEng Aerospace Engineering with Pilot Studies (Design) MEng Aerospace Engineering with Pilot Studies (Systems) MEng Aerospace Engineering with Pilot Studies (Manufacturing)		
Default Award Title	BSc(Hons) Engineering		
Fall-back Award Title	BSc(Hons) Engineering		
Interim Award Titles	BEng(Hons) Aerospace Engineering with Pilot Studies (Design) BEng(Hons) Aerospace Engineering with Pilot Studies (Systems) BEng(Hons) Aerospace Engineering with Pilot Studies (Manufacturing) BEng Aerospace Engineering with Pilot Studies (Design) BEng Aerospace Engineering with Pilot Studies (Systems) BEng Aerospace Engineering with Pilot Studies (Manufacturing) Diploma of Higher Education Aerospace Engineering with Pilot Studies Diploma of Higher Education Aerospace Engineering with Pilot Studies (Design) Diploma of Higher Education Aerospace Engineering with Pilot Studies (Systems) Diploma of Higher Education Aerospace Engineering with Pilot Studies (Manufacturing) Certificate of Higher Education Aerospace Engineering		
UWE Progression Route			
Mode(s) of Delivery	Full Time /Part Time, Sandwich		
Codes	**UCAS: H404**		**JACS: H400**
	ISIS2: H404		**HESA: H400**
Relevant QAA Subject Benchmark Statements	Engineering		
First CAP Approval Date	22 May 2013	Valid from	September 2013
Revision CAP Approval Date	Feb 2014 v1.1 Jan 2015 v1.2 Feb 2016 v1.3 March 2016 v2.1 16 November 2016 v3	Valid from	September 2017
Version	3		
Review Date			

Part 2: Educational Aims of the Programme

The aims of the programme are:

The aim of the Faculty's MEng programmes is to respond to the need for effective engineering practitioners by offering programmes that are an intellectually challenging mix of taught engineering science and experiential learning. The practitioner approach is intended to produce engineers with a strong orientation towards problem solving, underpinned by theoretical knowledge.

The aim of the Aerospace Engineering programme is to produce graduates with a broad understanding of engineering analysis and design, combined with awareness of engineering practice, information technology, project management and business issues. The MEng course is distinguished by a greater emphasis upon critical appraisal of existing ideas and practice,
original thought and creative ability. This is demonstrated through the higher performance level of MEng students on the part of the course which is common with the BEng(Hons), together with accelerated development in the parts of the course which are specific to MEng students, notably the level M work.

This programme will produce graduates with a wide range of expertise relevant to industry in general and in particular industries related to aerospace design, operations and manufacture. The programme covers a broad range of disciplines such as Aerospace Design, Mathematics, Systems, Electronics, Business and Manufacture. Evidence from local industries indicates a solid demand for graduates with a broad-based 'systems' approach to engineering problem solving. It is anticipated that graduates from the course will play a major role in the design, management and co-ordination of multi-disciplinary projects.

Students on this degree programme will be encouraged to take up opportunities to study and work abroad, gaining valuable inter-cultural skills, which are highly prized by the aerospace companies. These companies rely more and more on internationally integrated teams. They will also take pilot studies including ground school training and a minimum of 20 hours flight training with an approved Flying school (approved by CAA, EASA, FAA etc)

The aims are that graduates shall be able to:

- Have a firm understanding and training in piloting skills to the level of a Private Pilot License.
- Apply established and novel engineering concepts to the solution of problems involving the design, operation and manufacture of aircraft;
- Model aerospace engineering systems so as to be able to specify and assess the technical design;
- Understand the manufacturing, financial and marketing implications of design proposals;
- Identify the links between design, manufacturing and production management
- Investigate problems and identify constraints including environmental and sustainability limitations, health and safety and risk assessment issues
- Operate effectively either as individuals or as members of a multi-disciplinary team;
- Communicate effectively both orally and in written form;
- Make considered judgments and decisions on complex engineering issues in which not all facts and consequences are accurately known;
- Effectively pursue independent study and undertake enquiry into novel and unfamiliar concepts and implementations.

The pilot studies part of the course is in two parts.

The first part of pilot sudies is ground school study. Students may learn through online or classroom material, Passing the Ground School examination is a requirement for this degree.

The second part of the piloting study is to complete at least 20 hours flight instruction from a professional flight instructor in a real aircraft. It is not a requirement for this degree that the student completes the Private Pilots License although it is envisaged that this is a likely outcome of the flight instruction. The flight hours are intended to be undertaken in the summer and students are expected to complete the flight training before commencing their final year of study in order to be eligible to graduate with Pilot Studies

Part 2: Educational Aims of the Programme
Programme requirements for the purposes of the Higher Education Achievement Record (HEAR)
The Aerospace Engineering degree is an applied engineering degree which combines theory, experiment and practice. This ensures students have a firm engineering foundation and have experience in applying their new knowledge and skills to real world aerospace problems. Problem solving is a particular developed skill in the degree and in contact with and setting parts of the degree in an industrial context. The degree has a new of specialist opportunities. Students are required to choose to develop their knowledge in one of 3 routes: design, systems and manufacturing. The pilot studies option develops a practical aviation skill which further supports the learning in this degree. The pilot studies option develops a practical aviation skill which further supports the learning in this degree.

Part 3: Learning Outcomes of the Programme	
The award route provides opportunities for students to develop and demonstrate knowledge and understanding, qualities, skills and other attributes in the following areas:	
Learning Outcomes	**Teaching, Learning and Assessment Strategies**
A Knowledge and Understanding	
A Knowledge and understanding of 1. The principles governing the behaviour of aerospace components and systems. 2. Mathematical methods appropriate to aerospace engineering and related fields. 3. The properties, characteristics and selection of materials used in aerospace components and systems. 4. Core engineering science and technologies with greater depth in areas pertinent to aero/mechanical systems. 5. The principles of information technology and data communications from a user's perspective. 6. Management principles and business practices, including professional codes of conduct such that critical ethical considerations can be made 7. The complexity of large-scale engineering manufacturing systems and projects. A student will opt for a particular aerospace specialisation where emphasis is made in design, manufacturing or systems engineering. The above skills meet the SEEC Level Descriptors for level 1, 2 and 3 learning outcomes.	**Teaching/learning methods and strategies:** Acquisition of 1 to 12 is through a combination of formal lectures, tutorials, laboratory work, guided project work, group assignments, independent projects and case studies. The programme of study is designed to introduce basic knowledge and understanding of the technologies underpinning engineering, design and product development through a range of level 1 modules. This basic knowledge is developed through a range of taught and project modules at level 2, and further integrated through group design and project work at levels 3 and M. This approach satisfies outcomes 1-5. Advanced tools and technologies are studied in the final years of the programmes. The programme as a whole is integrated for the M.Eng students through their individual project started at level 3 and continued at level M to enable deeper analytical and reflective abilities to be developed. This satisfies outcomes 4 and 7. Outcome 6 is achieved through the business practice modules of UFMFHA-15-2 Project Management and UFMFM7-15-3 Business Environment. Throughout the student is encouraged to undertake independent reading both to supplement and consolidate what is being taught/learnt and to broaden their individual knowledge and understanding of the subject.

Part 3: Learning Outcomes of the Programme	
In addition for the M.Eng. students, the learning and teaching in these skills areas meet the SEEC Level Descriptors for Masters learning outcomes: 8. Achieving depth and systematic understanding of knowledge in specialised and applied areas and across areas 9. Working with theoretical and research based knowledge at the forefront of the discipline 10. Have the awareness and ability to manage ethical implications and work towards solutions 11. Have a comprehensive understanding of applicable techniques / methodologies 12. Are able to reflect upon and critically evaluate their activities to ensure implementation of solutions can be achieved.	Students on the M.Eng programme are required to demonstrate in-depth understanding and analysis of technical topics, and to carry out a comprehensive literature review in their group design and individual project work. The SEEC Level Descriptors for Masters learning outcomes are achieved as followed: 8) The M-level assignments are designed to fulfil this learning outcome. In addition, the integrating module, which is the Group Design Project (UFMED7-30-M), is built directly around systematic learning and application of knowledge. 9) All assignments require the comprehensive and critical review of relevant literature and organisational information, to ensure the solutions presented are at the forefront of the discipline. 10) The code of practice within the Aerospace industry provides inherent ethical considerations, which are fully supported throughout the award, especially in areas of safety, technical and societal risk assessment and legal constraints and controls. 11) Every M-level module demands comprehensive training in, understanding of and the ability to use the applicable techniques and methodologies within the topic. 12) In all level M modules, the ability to critically reflect upon and evaluate activities is the only way to achieve both successful implementation of the solutions proposed and to show the academic learning outcomes have been met. This is developed both as part of the training activities, using, for example, group work, and also as part of the reflection process demanded within the assignment. The marking process displays this by considering innovative thought and self-critical reflection.
	Assessment: Testing of the knowledge base is through assessed course work, through tasks undertaken under examination conditions, through oral presentations and assessed practical work done in various laboratories.
B Intellectual Skills	
Intellectual Skills	**Teaching/learning methods and strategies:**

Part 3: Learning Outcomes of the Programme	
Students will develop: 1. The ability to produce novel solutions to problems through the application of engineering knowledge and understanding 2. The skills of selecting and applying scientific principles in the modelling and analysis of aero processes and the inter-relations between systems processes and products. 3. The ability to use a broad spectrum of technologies/techniques to solve complex design problems. 4. The capability to use scientific/technological principles in the development of engineering solutions to practical problems in the domain of aerospace engineering. 5. The ability to select and apply appropriate computer based methods for modelling and analysing problems in fields relating to the manufacture components and systems, with particular emphasis on the requirements of the aero industries. 6. The ability to understand issues relating to the marketing of products and the management processes associated with their design and manufacture. 7. A professional attitude to the responsibilities of engineering practitioners. 8. The ability to use independent thinking and analysis in the development of engineering solutions. 9. The capability to critically review available literature on topics related to aerospace engineering 10. The capability to critically evaluate evidence to support conclusions, reviewing its reliability, validity and significance. Also to be able to investigate contradictory information and identify reasons for contradictions. The above skills satisfy the SEEC descriptors for levels 1, 2 and 3. At level M the following skills are further developed in accordance with the level M SEEC descriptors: 11. Critical analysis of complex, incomplete and contradictory information communicating the outcome effectively	At all levels students are required to bring together knowledge and skills acquired in several modules and hence determine new ways of working. As the student progresses, the need to synthesise ever greater volumes of information and approaches into a coherent approach is developed and consequently so is their critical thinking. At level 1 analysis, evaluation and problem solving are developed on small-scale problems in various programming activities in a number of modules. Here the focus is on understanding the problem and then solving it free from the environmental implications of real world problems and without the need to examine alternatives and to balance conflicting goals. At level 2 there is a move away from small-scale problems to the design of larger scale systems. With this comes the need to evaluate alternative methods and designs and to balance conflicting objectives. Level 3 sees the move to specific application examples and with it the need to appreciate problem contexts is developed as well as striking the right balance when facing conflicting objectives. Work at level M focuses on skills 7-14, and requires independent thinking, information gathering and analysis. This is delivered through a combination of specialist taught modules plus group and individual project work. Skills 11-13 are instilled in all level M modules whereas skill 14 is developed particularly through the projects. The development of engineering solutions requires demonstration of all of the intellectual skills. At level 1 the focus is on the skills of Analysis, Evaluation and Problem Solving. At levels 2, 3 and M this branches out to include all the remaining skills. Independent reading is used to enable students to both broaden and deepen their subject knowledge. **Assessment:** Aerospace engineering work requires demonstration of a very wide range of skills. These skills are assessed through a combination of coursework on cross-disciplinary integrating assignments, integrating projects;

Part 3: Learning Outcomes of the Programme	
12. Show the capacity to synthesise information in an innovative fashion, including state of the art knowledge and processes in aerospace topics. 13. Critically evaluate research, advanced scholarship and methodologies and argue alternative approaches. 14. Act autonomously in planning and implementing tasks at a professional level, making decisions in complex and unpredictable situations.	and examinations.
C Subject, Professional and Practical Skills	
C Subject, Professional and Practical Skills 1 Students will be able to: 1. Use appropriate methods for modelling and analysing problems especially in their chosen specialisation area (systems, manufacture or design). 2. Use relevant design, test and measurement equipment. 3. Use experimental methods in the laboratory relating to engineering manufacture and test. 4. Demonstrate practical testing of engineering ideas through laboratory work or simulation with technical analysis and critical evaluation of results. 5. Use a wide range of computing and information technology systems. 6. Demonstrate the ability to apply engineering techniques taking account of industrial and commercial constraints especially in their chosen aerospace specialism domain of manufacturing, systems or design engineering. 7. Act autonomously, with minimal supervision or direction, within agreed guidelines. 8. Operate in complex and unpredictable contexts, requiring selection and application from a wide range of innovative or standard techniques. 9. Execute and manage multi-disciplinary projects. In addition to the above mentioned skills which satisfy SEEC descriptors at levels 1, 2 and 3, students at level M will be able to meet the	**Teaching/learning methods and strategies:** Throughout the programme, the skills listed are developed through a combination of theoretical discussion, practical laboratory based work, classroom based tutorial exercises and directed self-study. Skills 1-5 are introduced at level 1 and then drawn into sharper focus at levels 2 and 3. The general teaching/learning approach is therefore to impart these practical/professional skills by a process of moving from an overview of what is required to a specific application of an individual skill at a higher level. The more specific skill 6 is introduced at level 3 and developed further at level M. Skill 7 is developed from level 1 upwards e.g. for individual understanding of lecture material and software, and operating laboratory equipment. Skills 8 through 11 are introduced at level 2 through the Project Management module (UFMFHA-15-2) but are exercised mainly in the group project at level M (UFPED7-30-M). These skills introduced above level 1 are underpinned by the more generalised capabilities that are practiced throughout the levels in most of the modules that contribute to the award. Skills 12 and 13 are developed and tested through all M-level modules. **Assessment:** The possession of these skills is demonstrated by the development of practical laboratory work, coursework, presentations and examinations. The practical nature of the skills to be acquired means that some are specifically addressed by particular modules, whilst the more generic skills

Part 3: Learning Outcomes of the Programme	
following M level SEEC descriptors: 10. To operate in complex, unpredictable and specialised contexts, establishing an overview of the issues governing good practice 11. To be able to exercise initiative and personal responsibility in professional practice. 12. To work smoothly with precision and effectiveness. 13. To adapt skills and design, or develop new skills and procedures for new situations	are assessed across a range of modules.
D Transferable Skills and other attributes	
D Transferable Skills and other attributes 1. Communication skills: To communicate orally or in writing, including, for instance, the results of technical investigations, to peers and/or to "problem owners". 2. Self-management skills: To manage one's own time; to take responsibility for the quality of the work; to meet deadlines; to work with others having gained insights into the problems of team-based systems development. 3. IT Skills in Context: To use software in the context of problem-solving investigations, and to interpret findings. 4. Problem formulation: To express problems in appropriate notations. 5. Progression to independent learning: To gain experience of, and to develop skills in, learning independently of structured class work. For example, to develop the ability to use on-line facilities to further self-study. 6. Comprehension of professional literature: To read and to use literature sources appropriate to the discipline to support learning activities. 7. Group Working**:** To be able to work as a member of a team; to be aware of the benefits and problems which teamwork can bring. 8. Information Management: To be able to select and manage information, competently undertaking reasonably straight-forward research tasks with minimum guidance. 9. Self-evaluation: To be confident in	Teaching/learning methods and strategies: 1. Skill one is developed through a variety of methods and strategies including the following: • Students maintain laboratory log books • Students participate in workshops and group work presentation sessions. • Students participate in discussion tutorials • Students present research topic findings in tutorials • Students participate in individual tutorials 2. Skill two is developed through a variety of methods and strategies including the following: • Students conduct self-managed practical work • Students participate in practically-oriented tutorial • Students work through practical work-sheets in teams • Students practice design and programming 3. Skill three is developed widely throughout the programme. 4. Skill four is developed through a variety of methods and strategies including the following: • Students develop problem solving programs • Students practice design and programming • Students express problems in mathematical notation. 5. Skill five is developed through a variety of methods and strategies including the following: • Students are encouraged to practice programming to extend their skills

Part 3: Learning Outcomes of the Programme	
application of own criteria of judgement and can challenge received opinion and reflect on action. Can seek and make use of feedback. In addition to the above mentioned skills which satisfy SEEC descriptors at levels 1, 2 and 3, students at level M will be able to meet the following M level SEEC descriptors: 10. Group Working: To work effectively both as a team member and a leader and make appropriate use of the capacities of group members. Is able to negotiate and handle conflict with confidence. 11. Self-evaluation: Reflect on own and others functioning in order to improve practice. 12. Autonomy: is an independent and self critical learner, guiding the learning of others and managing own requirements for continuing professional development.	• Students develop problem-solving programs • Students are encouraged to research relevant topics • Students are encouraged to use online facilities to discover information 6. Skill six is developed through a variety of methods and strategies including the following: • Students are encouraged to access a range of material including both printed and online sources • Students are expected to include a literature review in the Individual Project 7. Skill seven is developed through a variety of methods and strategies including student involvement in group projects in a number of modules across the programme. 8. Skill eight is widely developed and tested through modules of different aerospace topics. It is also integrated strongly into the individual project. 9. Skill 9 is developed across the aerospace topics through a variety of assignments, presentations and vivas. Feedback to students from staff is frequent and specific to the individual. The M level SEEC descriptors are satisfied through the following: 10. Skill 10 is achieved through the Group Project at level M. Each student is responsible for certain aspects of the project which provides opportunity for leadership. 11. Skill 11 is required in all level M modules and demonstrated through the assessments. 12. Skill 12 is achieved through the integrating group project leadership activities where guiding the learning of others is critical to the team's success. Students may also be involved in the Peer Assisted Learning (PAL) system teaching students at other levels (see Section 7 for PAL information). Assessment: The skills are demonstrated in a variety of contexts including: examination; poster presentation; individual and group projects; practical assignments; portfolio of exercises. In addition skill two is assessed by both peers and tutors. In particular, a variety of transferable skills are assessed in modules: UFMFHA-15-2 Project Management UFMFM7-15-3 Business Environment UFMFX8-30-3 Individual Project

Part 3: Learning Outcomes of the Programme	
	UFMFY8-30-3 MEng Individual Project Part A UFPED7-30-M MEng Group Project UFMERY-30-M MEng Individual Project Part B

Part 4: Programme Structure
This structure diagram demonstrates the student journey from Entry through to Graduation for a **full time student**, including: level and credit requirements, interim award requirements, module diet, including compulsory and optional modules

<table>
<tr><td>ENTRY
↓</td><td rowspan="2">level 1</td><td rowspan="2">Compulsory modules

• UFMFH3-30-1 Stress and Dynamics
• UFMFN3-30-1 Design, Materials & Manufacturing
• UFMFJ9-30-1 Engineering Mathematics
• UFMFF3-15-1 Energy & Thermodynamics

From September 2018/19 students take:

• UFMFDK-15-1 Pilot Studies and Aeronautics

(Transitional structure – In 2017/18 students take:

• UFMFDH-15-1 Introduction to Aeronautics)</td><td rowspan="2"></td><td rowspan="2">Interim Awards:

Certificate of Higher Education Aerospace Engineering</td></tr>
<tr><td></td></tr>
<tr><td></td><td></td><td colspan="3">A student who does not pass the module UFMFDK-15-1 Pilot Studies & Aeronautics will be required to withdraw from this award and will be transferred to the standard BEng(Hons) Aerospace Engineering award, retaining their chosen pathway (either design, manufacturing or systems).</td></tr>
</table>

	level 2	**Compulsory modules** **From September 2019/20 students take:** • UFMFRK-15-2 Fundamental Aerodynamics • UFMFFK-15-2 Flight (Transitional structure: In 2017/18 and 2018/19 students take: • UFMF9C-30-2 Pilot Studies and Aerodynamics) • UFMFK9-15-2 Engineering Mathematics 2 • UFMFHA-15-2 Project Management • UFMFX6-15-2 Aero-Structures	**Optional modules** Students must opt for one of the following three pathways: <u>Aerospace Engineering with Pilot Studies (Design)</u> • UFMFD8-30-2 Design, Materials & CAD/CAM • UFMFQA-15-2 Stress Analysis <u>Aerospace Engineering with Pilot Studies (Manufacturing)</u> • UFMFD8-30-2 Design, Materials & CAD/CAM • UFMFR9-15-2 Mechatronics <u>Aerospace Engineering with Pilot Studies (Systems)</u> • UFMFB7-30-2 Aircraft Systems, Avionics & Control • UFMFR9-15-2 Mechatronics	**Interim Awards*:** Diploma of Higher Education Aerospace Engineering with Pilot Studies Diploma of Higher Education Aerospace Engineering with Pilot Studies (Design) Diploma of Higher Education Aerospace Engineering with Pilot Studies (Systems) Diploma of Higher Education Aerospace Engineering with Pilot Studies (Manufacturing**)**
		A student who does not pass the module UFMF9C-30-2 Pilot Studies & Aerodynamics cannot proceed further on this award and should be transferred to the standard B.Eng. Aerospace Engineering award, retaining their chosen pathway (either design, manufacturing or systems). **Progression statement** A student who has failed any of the compulsory modules in the specialist aerospace streams is permitted to take alternative module(s) from the other two aerospace specialisms as long as: • The pre-requisites are met • The student is able to continue with the programme at levels 3 and M towards completing the course credit requirements, or towards exiting with an interim award • The student is able to attend all timetabled sessions on the alternative module • That all aspects of UKSpec are achieved through the student's programme of study so that the student satisfies the criteria for accreditation.		
	Year out	For students wishing to take a sandwich year, the module "UFMF89-15-3 Industrial Placement" must be taken. Students may wish to take a placement abroad or in the UK. An Erasmus year may also be taken which will be detailed on the student's Transcript of Grades. This is not a credit bearing activity unless the programme of study at the visiting university is deemed by UWE aerospace staff to cover all the learning outcomes of the particular year in this degree programme at UWE.		

	Year 3	**Progression statement** A student who has failed any of the compulsory modules in the specialist aerospace streams is permitted to take alternative module(s) from the other two aerospace specialisms as long as: • The pre-requisites are met • The student is able to continue with the programme to completion to level M. • The student is able to complete the course towards exiting with an interim award • The student is able to attend all timetabled sessions on the alternative module(s) • That all aspects of UKSpec are achieved through the student's programme of study so that the student satisfies the criteria for accreditation.

	level 3	**Compulsory modules** • UFMFW6-15-3 Aero-Propulsion • UFMFY8-30-3 M.Eng. Individual Project Part A Note that UFMFX8-30-3 B.Eng. Individual Project is also an accepted module on the programme such that any B.Eng. student transferring to M.Eng can have their dissertation accepted on this programme.	**Optional Modules** One of: • UFMFM7-15-3 Business Environment, or • UFMF89-15-3 Industrial Placement, or • UFMFCL-15-3 Engineering and Society Students then continue with their chosen specialist pathway <u>Aerospace Engineering with Pilot Studies (Design):</u> • UFMFE9-30-3 Structural Design & Inspection • UFMFSA-15-3 Systems Engineering And one of: • UFMFH7-15-3 Applied Aerodynamics • UFMFCH-15-3 Spaceflight	**Interim Awards 1*:** BEng Aerospace Engineering with Pilot Studies BEng Aerospace Engineering with Pilot Studies (Design) BEng Aerospace Engineering with Pilot Studies (Systems) BEng Aerospace Engineering with Pilot Studies (Manufacturing)

	Level3		<u>Aerospace Engineering with Pilot Studies (Systems):</u> • UFMFSA-15-3 Systems Engineering • UFMFL7-30-3 Avionics & Control 3 And one of: • UFMFH7-15-3 Applied Aerodynamics • UFMFCH-15-3 Spaceflight <u>Aerospace Engineering with Pilot Studies (Manufacturing)</u> • UFMFE9-30-3 Structural Design and Inspection • UFMFWF-15-3 Managing Advanced Manufacturing • UFMFC9-15-3 Machine Vision	**Interim Awards 2*** The degree certificate will have the title: BEng(Hons) Aerospace Engineering with Pilot Studies (Design) BEng(Hons) Aerospace Engineering with Pilot Studies (Systems) BEng(Hons) Aerospace Engineering with Pilot Studies (Manufacturing) BEng(Hons) Aerospace Engineering with Pilot Studies

	Level M	**Progression statement** A student who has failed up to 30 credits at level M of the compulsory modules in the specialist aerospace streams is permitted to take alternative module(s) from the other two aerospace specialisms as long as: • The pre-requisites are met • The student is able to attend all timetabled sessions on the alternative module(s) • That all aspects of UKSpec are achieved through the student's programme of study so that the student satisfies the criteria for accreditation. • That all aspects of UKSpec are achieved through the student's programme of study so that the student satisfies the criteria for accreditation.

	Level M	**Compulsory modules** • UFPED7-30-M MEng Group project • UFMERY-30-M MEng Individual Project Part B	**Optional modules** Students continue with their chosen specialist pathway <u>Aerospace Engineering with Pilot Studies (Design)</u> • UFMEWA-15-M Aerodynamics C • UFMEWB-15-M Aircraft Structures • UFMEWC-15-M Aeroelasticity • UFMEWD-15-M Aeroacoustics <u>Aerospace Engineering with Pilot Studies (Systems)</u> • UFMEEA-15-M Electromechanical Systems Integration • UFMEEC-15-M Concurrent Engineering • UFMEE8-15-M Principles of Lean Engineering **Option: choose one module (subject to availability) from:** • UFMEWH-15-M Flight Test & Airworthiness • UFMFGB-15-M Avionic Systems • UFMF7D-15-M Safety Critical Embedded Systems • UFMFCC-15-M Industrial Applications of Vision and Automation <u>Aerospace Engineering with Pilot Studies (Manufacturing)</u> • UFMEEA-15-M Electromechanical Systems Integration • UFMEEC-15-M Concurrent Engineering • UFMEE8-15-M Principles of Lean Engineering • UFMF74-15-M Advanced Manufacturing	**Interim Awards:** As described at level 3 *provided the student has completed all the required modules and dependent on the route taken.

Part 4: Programme Structure: Part Time				
This structure diagram demonstrates the student journey from Entry through to Graduation for a **part time student**, including: • level and credit requirements • interim award requirements • module diet, including compulsory and optional modules				
ENTRY	Year 1.1	**Compulsory Modules** UFMFN3-30-1 Design, Materials & Manufacturing UFMFJ9-30-1 Engineering Maths	**Optional Modules**	**Interim Awards** None available
	Year 1.2	**Compulsory Modules** UFMFH3-30-1 Stress & Dynamics UFMFF3-15-1 Energy & Thermodynamics From 2018/19 students take: UFMFDK-15-1 Pilot Studies and Aeronautics (Transitional structure for 2017/18 students take: UFMFDH-15-1 Introduction to Aeronautics)	**Optional Modules**	**Interim Awards** Certificate of Higher Education Aerospace Engineering
	Year 2.1	**Compulsory Modules** UFMFK9-15-2 Engineering Mathematics 2 UFMFHA-15-2 Project Management	**Optional Modules** Students must take one of the following three pathways: <u>Aerospace Engineering (Design)</u> • UFMFD8-30-2 Design, Materials & CAD/CAM <u>Aerospace Engineering (Systems)</u> • UFMFB7-30-2 Aircraft Systems, Avionics & Control <u>Aerospace Engineering (Manufacturing)</u> • UFMFD8-30-2 Design, Materials & CAD/CAM •	**Interim Awards** As described at level 1.2

	Year 2.2	**Compulsory Modules** UFMFX6-15-2 Aero-Structures **From 2019/20 students take:** UFMFRK-15-2 Fundamental Aerodynamics UFMFFK-15-2 Flight (Transitional structure for 2017/18 and 2018/19 students take: UFMF9C-30-2 Pilot Studies and Aerodynamics)	**Optional Modules** Students must take one of the following three pathways: <u>Aerospace Engineering (Design)</u> • UFMFQA-15-2 Stress Analysis <u>Aerospace Engineering (Systems)</u> • UFMFR9-15-2 Mechatronics <u>Aerospace Engineering (Manufacturing)</u> • UFMFR9-15-2 Mechatronics	**Interim Awards*** Diploma of Higher Education Aerospace Engineering with Pilot Studies Diploma of Higher Education Aerospace Engineering with Pilot Studies (Design) Diploma of Higher Education Aerospace Engineering with Pilot Studies (Systems) Diploma of Higher Education Aerospace Engineering with Pilot Studies (Manufacturing)
	Year 3.1	**Compulsory Modules** UFMFW6-15-3 Aero-Propulsion UFMFSA-15-3 System Engineering	**Optional Modules** 15 credits from: UFMFM7-15-3 Business Environment UFMF89-15-3 Industrial Placement UFMFCL-15-3 Engineering and Society	**Interim Awards** As described at level 2.2

	Year 3.2	**Compulsory modules** UFMFY8-30-3 MEng Individual Project Part A Note that UFMFX8-30-3 B.Eng. Individual Project is also an accepted module on the programme such that any B.Eng. student moving to M.Eng. can have their dissertation accepted on this programme.	**Optional Modules** Students then continue with their chosen specialist pathway <u>Aerospace Engineering (Design):</u> • UFMFE9-30-3 Structural Design & Inspection And one of: • UFMFH7-15-3 Applied Aerodynamics • UFMFCH-15-3 Spaceflight <u>Aerospace Engineering (Systems):</u> • UFMFL7-30-3 Avionics & Control3 And one of: • UFMFH7-15-3 Applied Aerodynamics • UFMFCH-15-3 Spaceflight <u>Aerospace Engineering (Manufacturing):</u> • UFMFE9-30-3 Structural Design and Inspection • UFMFC9-15-3 Machine Vision	**Interim Awards 1*:** BEng Aerospace Engineering with Pilot Studies BEng Aerospace Engineering with Pilot Studies (Design) BEng Aerospace Engineering with Pilot Studies (Systems) BEng Aerospace Engineering with Pilot Studies (Manufacturing) **Interim Awards 2*:** BEng(Hons) Aerospace Engineering with Pilot Studies (Design) BEng(Hons) Aerospace Engineering with Pilot Studies (Systems) BEng(Hons) Aerospace Engineering with Pilot Studies (Manufacturing) BEng(Hons) Aerospace Engineering with Pilot Studies

	Year 4.1	**Compulsory Modules** UFMERY-30-M MEng Individual Project Part B	**Optional Modules** <u>Aerospace Engineering (Design)</u> • UFMEWA-15-M Aerodynamics C • UFMEWB-15-M Aircraft Structures <u>Aerospace Engineering (Manufacturing)</u> • UFMEEA-15-M Electromechanical Systems Integration • UFMEEC-15-M Concurrent Engineering <u>Aerospace Engineering((Systems)</u> • UFMEEA-15-M Electromechanical Systems Integration • UFMEEC-15-M Concurrent Engineering	**Interim Awards** As described at level 3.2
	Year 4.2	Compulsory Modules UFMED7-30-M MEng Group Project	Optional Modules <u>Aerospace Engineering (Design)</u> • UFMEWC-15-M Aeroelasticity • UFMEWD-15-M Aeroacoustics <u>Aerospace Engineering (Systems)</u> • UFMEE8-15-M Principles of Lean Engineering **Option: choose one module (subject to availability) from:** • UFMEWH-15-M Flight Test & Airworthiness • UFMFGB-15-M Avionic Systems • UFMF7D-15-M Safety Critical Embedded Systems • UFMFCC-15-M Industrial Applications of Vision and Automation <u>Aerospace Engineering (Manufacturing)</u> • UFMEE8-15-M Principles of Lean Engineering • UFMF74-15-M Advanced Manufacturing	**Interim Awards:** As described at level 3.2 *provided the student has completed all the required modules and dependent on the route taken.

GRADUATION for MEng students

Part 5: Entry Requirements

The university's minimum requirements for entry to a degree apply to this programme. In addition for entry to year 1 of the MEng Aerospace Engineering degree, the tariff point requirement is normally 300 points.

This should include the equivalent of A level Mathematics Grade C plus another science or technology subject. Equivalent qualifications include Scottish Highers, the European Baccalaureate, the International Baccalaureate; and other European and international qualifications which are nationally recognised.

Students with a BTEC National Diploma must have passed Further Mathematics, and those with the 14 – 19 Diploma must also offer the Additional Specialised Learning in Mathematics.

For the University's general entry requirements please see http://www.uwe.ac.uk/study/entryReqs.shtml

Part 6: Assessment

The programme will adhere to the standard assessment regulations of the University as specified in the Academic Regulations and Procedures (http://acreg.uwe.ac.ukrf.asp). To be eligible for an award accredited by the Royal Aeronautical Society the Individual Project modules must be passed outright with no provision for condonation. (Academic Regulations G2.3R refers).

Part 7: Student Learning

Teaching, learning and assessment strategies to enable learning outcomes to be achieved and demonstrated

At UWE, Bristol there is a policy for a minimum average requirement of 12 hours/week contact time over the course of the full undergraduate programme. This contact time encompasses a range of face to face activities as described below. In addition a range of other learning activities will be embedded within the programme which, together with the contact time, will enable learning outcomes to be achieved and demonstrated.

Class Activities
The mode of delivery of a module is determined by its Module Leader, and typically involves a combination of one or more lectures, tutorials, laboratory classes, group activities and individual project work.

Academic Support
Academic advice and support is the responsibility of the staff delivering the module in question. Staff are expected to be available outside normal timetabled hours, either by appointment or during published "surgery" hours, in order to offer advice and guidance on matters relating to the material being taught and on its assessment.

Developing graduate skills
In year 1 students benefit from extra-curricular talks introducing them to the aerospace industry and the standards required of professional engineers. Year 2 provides extensive opportunities toward placement and career planning, including sessions from university careers and placements office and from industrial recruitment personnel toward application and CV writing, and good interview techniques. In Years 3 and 4 students engage with developing graduate skills through project work and their project supervisor.

PAL

Part 7: Student Learning

The Peer Assisted Learning (PAL) scheme provides additional learning support for students by students. PAL leaders are recruited from the level 2, 3 and MEng Masters cohorts each year and are trained in both facilitating learning and study skills. PAL leaders support taught modules by taking on problem classes and some laboratory demonstration classes for the lower level students.

Mathematics Support

Additional support in mathematics outside of timetabled classes is available throughout the academic year via:

(i) PAL sessions,
(ii) the drop-in mathematics helpdesk, "espressomaths" which is open every day in social learning spaces.
(iii) the Mathematics Resource Centre which is accessible by students using their swipe card and has take-away leaflets, text books, module handbooks and reference material
(iv) on-line support and electronic learning resources such as that Maths 1st Aid Kit leaflets, HELM booklets and http://www.mathcentre.ac.uk/
(v) Mathematical software such as Maple (which students may download for home use) and Matlab.

Technology Enhanced Learning

All modules on the aerospace programme are available on the university's Virtual Learning Environment.

- computer based e-assessment is implemented in a number of modules, so that students can take regular short tests with automated computer generated feedback.
- Recordings of some lectures (audio and video) are made available after classes via the university's Virtual Learning Environment and YouTube

Working Environment

Throughout the department there are areas for students to work together informally. A large, well-equipped project room is also provided during the weekdays with staff support. The Project room houses printing, computing, binding and scanning facilities, sells stationery, stocks learning materials and past dissertations.

Engineering Facilities

Students on Engineering programmes can access a suite of newly refurbished specialist laboratories for teaching demonstrations and supporting student projects including laboratories for Thermofluids, Structures, Materials, Dynamics, Mechatronics, Electronics and Electrical engineering. PCs with data acquisition hardware (and software for general experimental use) are set up next to all experimental rigs where data logging is required. A machine tool workshop is also available.

Computing Facilities

The Department offers specialised computing facilities alongside the general University and Faculty provisions. The specialist laboratories are equipped with specific software to support the Department's students in their taught programmes. Simulation and planning software are well catered for with industry-standard computer-aided design, computational fluid dynamics, finite element analysis, meshing, material and processes selection packages, and post-processing software. There is an extensive PC network including laboratories with high performance workstations and high resolution graphics. A 24-core 204GB memory high performance cluster is available for large-scale computing. Mathematical based software such as Matlab, Simulink, and Maple, and a mathematics resource room are available. The Faculty ensures during term-time that the computer laboratories in N-block are available to students on extended opening hours including at weekends. The Faculty provides a user support Helpdesk.

Pastoral Care.

The Faculty offers pastoral care through its Student Advisers, a team of staff who provide comprehensive, full-time student support service on a drop-in basis or by appointment. The

Part 7: Student Learning

Adviser will, when necessary, advise the student to seek advice from other professional services including the University's Centre for Student Affairs or from members of academic staff. This support is supplemented by the Academic Personal Tutor, the Award leader and, through the student representatives to the Student-Staff Liaison Group committee.

Additional Features

For the aerospace students, the Induction programme includes team building exercises, and also some specific academic and faculty instruction for direct entrants (e.g. in computer packages). Second year students undertake a flight test course in UFMFKK-15-2 “Flight” where they can take in-flight measurements. This activity is combined with an assignment using the university flight simulator and with reference to aerospace theory. The presence of a flight test course within the degree structure in which students fly in a real aircraft is a requirement for accreditation with the RAeS.

Industrial expertise is also brought into the course through seminars from industrial visitors and in group projects. Some modules also have sponsored assignments from industry. Such opportunities provide the students with further industrial understanding and experience in applying their knowledge to a real industrial problem. Through the student individual project, there is the potential to involve industry and/or link to research ongoing in the Department.

The Placement Year

A placement year provides opportunities for real-world, industrially based final year projects. The student will in most cases be on a formal contract in which they are paid for their employment. He or she will have the opportunity to explore career possibilities, make new business contacts for the future and prepare for the final year at University. Students are responsible for finding their own placement, however, many opportunities are published through the University Placements Office, and the process of finding a placement is supported in year 2 of the Graduate Development Scheme. Once on placement, students retain access to the support network of the University and will be visited in their place of work at least once by a Visiting Tutor. Placement students gain credit for their work through submitting a portfolio, which reduces the amount of credit required to be taken in their final year by 15 credits.

Part 8: Reference Points and Benchmarks

Description of ***how*** the following reference points and benchmarks have been used in the design of the programme:

The reference points from the QAA academic infrastructure reports and other benchmarks are detailed in Part 1: Contextual Documentation for Validation. They include The QAA Framework for Higher Education Qualifications in England, Wales and Northern Ireland (2008) and the QAA Subject Benchmark Statement for Engineering (2010)

Subject reference points

Undergraduate engineering programmes must demonstrate through their teaching and assessment methods that graduates have reached the desired threshold level of each of the Output Criteria as specified in the UK-SPEC document Accreditation of Higher Education Programmes (www.engc.org.uk/ecukdocuments/internet/document%20library/UK-SPEC.pdf).
The UWE aerospace programme, including each subject pathway, is constructed to ensure it complies with the General and Specific Learning Outcomes, Methods of Assessment (EAB/ACC2/B) and Output Standards (EAB/ACC2/C).

The guidelines for the SEEC level descriptors are also closely followed in this programme. (SEEC Credit Level Descriptors for Further and Higher Education, January 2003)

Part 8: Reference Points and Benchmarks

UWE's Learning & Teaching Strategy has informed the Faculty's policy for the delivery of its programmes, whose main features are described in section 7.

This specification provides a concise summary of the main features of the programme and the 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 learning outcomes, content and teaching, learning and assessment methods of individual modules can be found in module specifications, available on the University's website.

For Office Use Only

First CAP Approval Date	22 May 2013			
Revision CAP Approval Date	16 Nov 2016 31 Jan 2017 22 Mar 2017	Version	3	Link to RIA (option LM modules) Link to RIA (level 2 modules) Link to RIA (new level 1 module) Link to RIA (new option module) Link to RIA (module title change)
Next Periodic Curriculum Review due date	2019			
Date of last Periodic Curriculum Review				

University of the West of England
BRISTOL

ACADEMIC SERVICES

PROGRAMME SPECIFICATION

Part 1: Basic Data			
Awarding Institution	University of the West of England, Bristol		
Teaching Institution	University of the West of England, Bristol		
Delivery Location			
Study abroad / Exchange / Credit recognition	N/A		
Faculty responsible for programme	Faculty of Environment and Technology		
Department responsible for programme	Department of Engineering Design and Mathematics		
Modular Scheme Title			
Professional Statutory or Regulatory Body Links			
Highest Award Title	BEng(Hons) Aerospace Engineering with Pilot Studies BEng(Hons) Aerospace Engineering with Pilot Studies (Design) BEng(Hons) Aerospace Engineering with Pilot Studies (Systems) BEng(Hons) Aerospace Engineering with Pilot Studies (Manufacturing)		
Default Award Title	BSc(Hons) Engineering		
Fall-back Award Title	BSc(Hons) Engineering		
Interim Award Titles	BEng Aerospace Engineering with Pilot Studies BEng Aerospace Engineering with Pilot Studies (Design) BEng Aerospace Engineering with Pilot Studies (Systems) BEng Aerospace Engineering with Pilot Studies (Manufacturing) Diploma of Higher Education Aerospace Engineering with Pilot Studies Diploma of Higher Education Aerospace Engineering with Pilot Studies (Design) Diploma of Higher Education Aerospace Engineering with Pilot Studies (Systems) Diploma of Higher Education Aerospace Engineering with Pilot Studies (Manufacturing) Certificate of Higher Education Aerospace Engineering		
UWE Progression Route			
Mode(s) of Delivery	Full Time /Part Time, Sandwich		
Codes	**UCAS: H404**	**JACS: H400**	
	ISIS2: H404	**HESA: H400**	
Relevant QAA Subject Benchmark Statements	Engineering		
First CAP Approval Date	22 May 2013	Valid from	September 2013
Revision CAP Approval Date	Feb 2014 v1.1 Jan 2015 v1.2 Feb 2016 v1.3 March 2016 v2.1 16 November 2016 v3	Valid from	September 2017
Version	3		

Part 2: Educational Aims of the Programme

The aims of the programme are:

The aim of the Faculty's B.Eng.(Hons.) programmes is to respond to the need for effective engineering practitioners by offering programmes that are an intellectually challenging mix of taught engineering science and experiential learning. The practitioner approach is intended to produce engineers with a strong orientation towards problem solving, underpinned by theoretical knowledge.

This programme will produce graduates with a broad understanding of Aerospace Engineering, combining sound knowledge of the technological fundamentals of the subject with awareness of engineering practice, information technology, management and marketing issues. Graduates from this programme will be equipped to solve multi-disciplinary problems in the domain of Aerospace Engineering.

The Aerospace Engineering course will produce graduates with a wide range of expertise relevant to aerospace design, systems and/or manufacture. The recruitment from local industries of UWE aerospace graduates over the last 20+ years indicates a solid demand for graduates with a broad-based approach to engineering problem solving and a sound understanding of multi-disciplinary projects. This is particularly evident in the aerospace industry where engineering projects invariably involve multi-disciplinary teams working on long-term design and product development programmes. It is anticipated that graduates from the course will play a major role in such projects, whether in the management and co-ordination, or the specification of high-tech manufacturing and design solutions.

Students on this degree programme will be encouraged to take up opportunities to study and work abroad, gaining valuable inter-cultural skills, which are highly prized by the aerospace companies. These companies rely more and more on internationally integrated teams. They will also take pilot studies including ground school training and a minimum of 20 hours flight training with an approved Flying school (approved by CAA, EASA, FAA etc)

The aims are that graduates shall be able to:

- Have a firm understanding and training in piloting skills to the level of a Private Pilot License.
- Apply established and novel engineering concepts to the solution of problems involving the design, operation and manufacture of aircraft;
- Model aerospace engineering systems so as to be able to specify and assess the technical design;
- Understand the manufacturing, financial and marketing implications of design proposals;
- Identify the links between design, manufacturing and production management
- Investigate problems and identify constraints including environmental and sustainability limitations, health and safety and risk assessment issues
- Operate effectively either as individuals or as members of a multi-disciplinary team;
- Communicate effectively both orally and in written form;
- Make considered judgments and decisions on complex engineering issues in which not all facts and consequences are accurately known;
- Effectively pursue independent study and undertake enquiry into novel and unfamiliar concepts and implementations.

The pilot studies part of the course is in two parts.

The first part of pilot sudies is ground school study. Students may learn through online or classroom material, Passing the Ground School examination is a requirement for this degree.

The second part of the piloting study is to complete at least 20 hours flight instruction from a professional flight instructor in a real aircraft. It is not a requirement for this degree that the student completes the Private Pilots License although it is envisaged that this is a likely outcome of the flight instruction. The flight hours are intended to be undertaken in the summer and students are expected to complete the flight training before commencing their final year of study in order to be eligible to graduate with Pilot Studies.

Part 2: Educational Aims of the Programme

Programme requirements for the purposes of the Higher Education Achievement Record (HEAR)

The Aerospace Engineering degree is an applied engineering degree which combines theory, experiment and practice. This ensures students have a firm engineering foundation and have experience in applying their new knowledge and skills to real world aerospace problems. Problem solving is a particular developed skill in the degree and in contact with and setting parts of the degree in an industrial context. The degree has a new of specialist opportunites. Students are required to choose to develop their knowledge in one of 3 routes: design, systems and manufacturing. The pilot studies option develops a practical aviation skill which further supports the learning in this degree.

Part 3: Learning Outcomes of the Programme

The award route provides opportunities for students to develop and demonstrate knowledge and understanding, qualities, skills and other attributes in the following areas:

Learning Outcomes	**Teaching, Learning and Assessment Strategies**
A Knowledge and Understanding	
A Knowledge and understanding of	**Teaching/learning methods and strategies:**
13. The principles governing the behaviour of aerospace components and systems. 14. Mathematical methods appropriate to aerospace engineering and related fields. 15. The properties, characteristics and selection of materials used in aerospace components and systems. 16. Core engineering science and technologies with greater depth in areas pertinent to aero/mechanical systems. 17. The principles of information technology and data communications from a user's perspective. 18. Management principles and business practices, including professional codes of conduct such that critical ethical considerations can be made 19. The complexity of large-scale engineering manufacturing systems and projects. A student will opt for a particular aerospace specialisation where emphasis is made in design, manufacturing or systems engineering. The above skills meet the SEEC Level Descriptors for level 1, 2 and 3 learning outcomes.	Acquisition of 1 to 7 is through a combination of formal lectures, tutorials, laboratory work, guided project work, group assignments, independent projects and case studies. The programme of study is designed to introduce basic knowledge and understanding of the technologies underpinning engineering, design and product development through a range of level 1 modules. This basic knowledge is developed through a range of taught and project modules at level 2, and further integrated through group design and project work at levels 3 and M. This approach satisfies outcomes 1-5. Advanced tools and technologies are studied in the final years of the programmes. The programme as a whole is integrated for the M.Eng students through their individual project started at level 3 and continued at level M to enable deeper analytical and reflective abilities to be developed. This satisfies outcomes 4. Outcome 6 is achieved through the business practice modules of UFMFHA-15-2 Project Management and UFMFM7-15-3 Business Environment. Throughout the student is encouraged to undertake independent reading both to supplement and consolidate what is being taught/learnt and to broaden their individual knowledge and understanding of the subject.

Part 3: Learning Outcomes of the Programme	
	Assessment: Testing of the knowledge base is through assessed course work, through tasks undertaken under examination conditions, through oral presentations and assessed practical work done in various laboratories.
B Intellectual Skills	
Intellectual Skills Students will develop: 15. The ability to produce novel solutions to problems through the application of engineering knowledge and understanding 16. The skills of selecting and applying scientific principles in the modelling and analysis of aero processes and the inter-relations between systems processes and products. 17. The ability to use a broad spectrum of technologies/techniques to solve complex design problems. 18. The capability to use scientific/technological principles in the development of engineering solutions to practical problems in the domain of aerospace engineering. 19. The ability to select and apply appropriate computer based methods for modelling and analysing problems in fields relating to the manufacture components and systems, with particular emphasis on the requirements of the aero industries. 20. The ability to understand issues relating to the marketing of products and the management processes associated with their design and manufacture. 21. A professional attitude to the responsibilities of engineering practitioners. 22. The ability to use independent thinking and analysis in the development of engineering solutions. 23. The capability to critically review available literature on topics related to aerospace engineering 24. The capability to critically evaluate evidence to support conclusions, reviewing its	**Teaching/learning methods and strategies:** At all levels students are required to bring together knowledge and skills acquired in several modules and hence determine new ways of working. As the student progresses, the need to synthesise ever greater volumes of information and approaches into a coherent approach is developed and consequently so is their critical thinking. At level 1 analysis, evaluation and problem solving are developed on small-scale problems in various programming activities in a number of modules. Here the focus is on understanding the problem and then solving it free from the environmental implications of real world problems and without the need to examine alternatives and to balance conflicting goals. At level 2 there is a move away from small-scale problems to the design of larger scale systems. With this comes the need to evaluate alternative methods and designs and to balance conflicting objectives. Level 3 sees the move to specific application examples and with it the need to appreciate problem contexts is developed as well as striking the right balance when facing conflicting objectives.. The development of engineering solutions requires demonstration of all of the intellectual skills. At level 1 the focus is on the skills of Analysis, Evaluation and Problem Solving. At levels 2 and 3 this branches out to include all the remaining skills. Independent reading is used to enable students to both broaden and deepen their subject knowledge. **Assessment:**

Part 3: Learning Outcomes of the Programme	
reliability, validity and significance. Also to be able to investigate contradictory information and identify reasons for contradictions. The above skills satisfy the SEEC descriptors for levels 1, 2 and 3.	Aerospace engineering work requires demonstration of a very wide range of skills. These skills are assessed through a combination of coursework on cross-disciplinary integrating assignments, integrating projects; and examinations.
C Subject, Professional and Practical Skills	
C Subject, Professional and Practical Skills 1 Students will be able to: 14. Use appropriate methods for modelling and analysing problems especially in their chosen specialisation area (systems, manufacture or design). 15. Use relevant design, test and measurement equipment. 16. Use experimental methods in the laboratory relating to engineering manufacture and test. 17. Demonstrate practical testing of engineering ideas through laboratory work or simulation with technical analysis and critical evaluation of results. 18. Use a wide range of computing and information technology systems. 19. Demonstrate the ability to apply engineering techniques taking account of industrial and commercial constraints especially in their chosen aerospace specialism domain of manufacturing, systems or design engineering. 20. Act autonomously, with minimal supervision or direction, within agreed guidelines. 21. Operate in complex and unpredictable contexts, requiring selection and application from a wide range of innovative or standard techniques. 22. Execute and manage multi-disciplinary projects. In addition to the above mentioned skills which satisfy SEEC descriptors at levels 1, 2 and 3, students at level M will be able to meet the following M level SEEC descriptors: 23. To operate in complex, unpredictable and specialised contexts, establishing an overview of the issues governing good	**Teaching/learning methods and strategies:** Throughout the programme, the skills listed are developed through a combination of theoretical discussion, practical laboratory based work, classroom based tutorial exercises and directed self-study. Skills 1-5 are introduced at level 1 and then drawn into sharper focus at levels 2 and 3. The general teaching/learning approach is therefore to impart these practical/professional skills by a process of moving from an overview of what is required to a specific application of an individual skill at a higher level. The more specific skill 6 is introduced at level 3. Skill 7 is developed from level 1 upwards e.g. for individual understanding of lecture material and software, and operating laboratory equipment. Skills 8 through 11 are introduced at level 2 through the Project Management module (UFMFHA-15-2). These skills introduced above level 1 are underpinned by the more generalised capabilities that are practiced throughout the levels in most of the modules that contribute to the award. **Assessment:** The possession of these skills is demonstrated by the development of practical laboratory work, coursework, presentations and examinations. The practical nature of the skills to be acquired means that some are specifically addressed by particular modules, whilst the more generic skills are assessed across a range of modules.

Part 3: Learning Outcomes of the Programme	
practice 24. To be able to exercise initiative and personal responsibility in professional practice. 25. To work smoothly with precision and effectiveness. 26. To adapt skills and design, or develop new skills and procedures for new situations.	
D Transferable Skills and other attributes	
D Transferable Skills and other attributes 1. Communication skills: To communicate orally or in writing, including, for instance, the results of technical investigations, to peers and/or to "problem owners". 2. Self-management skills: To manage one's own time; to take responsibility for the quality of the work; to meet deadlines; to work with others having gained insights into the problems of team-based systems development. 3. IT Skills in Context: To use software in the context of problem-solving investigations, and to interpret findings. 4. Problem formulation: To express problems in appropriate notations. 5. Progression to independent learning: To gain experience of, and to develop skills in, learning independently of structured class work. For example, to develop the ability to use on-line facilities to further self-study. 6. Comprehension of professional literature: To read and to use literature sources appropriate to the discipline to support learning activities. 7. Group Working**:** To be able to work as a member of a team; to be aware of the benefits and problems which teamwork can bring. 13. Information Management: To be able to select and manage information, competently undertaking reasonably straight-forward research tasks with minimum guidance. 14. Self-evaluation: To be confident in application of own criteria of judgement and can challenge received opinion and reflect on action. Can seek and make use of	Teaching/learning methods and strategies: 13. Skill one is developed through a variety of methods and strategies including the following: • Students maintain laboratory log books • Students participate in workshops and group work presentation sessions. • Students participate in discussion tutorials • Students present research topic findings in tutorials • Students participate in individual tutorials 14. Skill two is developed through a variety of methods and strategies including the following: • Students conduct self-managed practical work • Students participate in practically-oriented tutorial • Students work through practical work-sheets in teams • Students practice design and programming 15. Skill three is developed widely throughout the programme. 16. Skill four is developed through a variety of methods and strategies including the following: • Students develop problem solving programs • Students practice design and programming • Students express problems in mathematical notation. 17. Skill five is developed through a variety of methods and strategies including the following: • Students are encouraged to practice programming to extend their skills • Students develop problem-solving programs

Part 3: Learning Outcomes of the Programme	
feedback. The above mentioned skills satisfy SEEC descriptors at levels 1, 2 and 3.	• Students are encouraged to research relevant topics • Students are encouraged to use online facilities to discover information 18. Skill six is developed through a variety of methods and strategies including the following: • Students are encouraged to access a range of material including both printed and online sources • Students are expected to include a literature review in the Individual Project 19. Skill seven is developed through a variety of methods and strategies including student involvement in group projects in a number of modules across the programme. 20. Skill eight is widely developed and tested through modules of different aerospace topics. It is also integrated strongly into the individual project. 21. Skill 9 is developed across the aerospace topics through a variety of assignments, presentations and vivas. Feedback to students from staff is frequent and specific to the individual.
	Assessment: The skills are demonstrated in a variety of contexts including: examination; poster presentation; individual and group projects; practical assignments; portfolio of exercises. In addition skill two is assessed by both peers and tutors. In particular, a variety of transferable skills are assessed in modules: UFMFHA-15-2 Project Management UFMFM7-15-3 Business Environment UFMFX8-30-3 Individual Project

Part 4: Programme Structure

This structure diagram demonstrates the student journey from Entry through to Graduation for a **full time student**, including: level and credit requirements, interim award requirements, module diet, including compulsory and optional modules

ENTRY ↓	**level 1**	**Compulsory modules** • UFMFH3-30-1 Stress and Dynamics • UFMFN3-30-1 Design, Materials & Manufacturing • UFMFJ9-30-1 Engineering Mathematics • UFMFF3-15-1 Energy & Thermodynamics From September 2018/19 students take: • UFMFDK-15-1 Pilot Studies and Aeronautics (Transitional structure: In 2017/18 students take: • UFMFDH-15-1 Introduction to Aeronautics)		**Interim Awards:** Certificate of Higher Education Aerospace Engineering
		Progression statement: **A student who does not pass the module UFMFDK-15-1 Pilot Studies & Aeronautics will be required to withdraw from this award and will be transferred to the standard BEng Aerospace Engineering award retaining their chosen pathway (either design, manufacturing or systems).**		

	level 2	**Compulsory modules** **From September 2019/20 students take:** • UFMFRK-15-2 Fundamental Aerodynamics • UFMFFK-15-2 Flight • UFMFK9-15-2 Engineering Mathematics 2 (Transitional structure: In 2017/18 and 2018/19 students take: • UFMF9C-30-2 Pilot Studies and Aerodynamics) • UFMFHA-15-2 Project Management • UFMFX6-15-2 Aero-Structures	**Optional modules** Students must opt for one of the following three pathways: <u>Aerospace Engineering with Pilot Studies (Design)</u> • UFMFD8-30-2 Design, Materials & CAD/CAM • UFMFQA-15-2 Stress Analysis <u>Aerospace Engineering with Pilot Studies (Manufacturing)</u> • UFMFD8-30-2 Design, Materials & CAD/CAM • UFMFR9-15-2 Mechatronics <u>Aerospace Engineering with Pilot Studies (Systems)</u> • UFMFB7-30-2 Aircraft Systems, Avionics & Control • UFMFR9-15-2 Mechatronics	**Interim Awards*:** Diploma of Higher Education Aerospace Engineering with Pilot Studies Diploma of Higher Education Aerospace Engineering with Pilot Studies (Design) Diploma of Higher Education Aerospace Engineering with Pilot Studies (Systems) Diploma of Higher Education Aerospace Engineering with Pilot Studies (Manufacturing)
		Progression statement **A student who does not pass the module UFMF9C-30-2 Pilot Studies and Aerodynamics cannot proceed further on this award and should be transferred to the standard BEng Aerospace Engineering award, retaining their chose pathway (either design, manufacturing or systems).** A student who has failed any of the compulsory modules in the specialist aerospace streams at level 2 is permitted to take alternative module(s) from the other two aerospace specialisms as long as: • The pre-requisites are met • The student is able to continue with the programme at level 3 towards completing the course credit requirements, or towards exiting with an interim award • The student is able to attend all timetabled sessions on the alternative module • A B.Eng. student may transfer to the B.Sc. Engineering degree if unable to progress through the B.Eng. degree as long as he/she successfully completes the level 1 modules. • That all aspects of UKSpec are achieved through the student's programme of study so that the student satisfies the criteria for accreditation.		
	Year out	For students wishing to take a sandwich year, the module "UFMF89-15-3 Industrial Placement" must be taken. Students may wish to take a placement abroad or in the UK. An Erasmus year may also be taken which will be detailed on the student's Transcript of Grades. This is not a credit bearing activity unless the programme of study at the visiting university is deemed by UWE aerospace staff to cover all the learning outcomes of the particular year in this degree programme at UWE.		

	Year 3	**Progression statement** A student who has failed any of the compulsory modules in the specialist aerospace streams at level 3 is permitted to take alternative module(s) from the other two aerospace specialisms as long as: • The pre-requisites are met • The student is able to complete the course towards exiting with an interim award • The student is able to attend all timetabled sessions on the alternative module(s) • That all aspects of UKSpec are achieved through the student's programme of study so that the student satisfies the criteria for accreditation.

	level 3	**Compulsory modules** • UFMFW6-15-3 Aero-Propulsion • UFMFX8-30-3 BEng Individual Project Note that UFMFY8-30-3 M.Eng. Individual Project Part A is also an accepted module on the programme such that any M.Eng. student requiring to stop at B.Eng. can have their dissertation accepted on this programme.	**Optional Modules** One of: • UFMFM7-15-3 Business Environment, or • UFMF89-15-3 Industrial Placement, or • UFMFCL-15-3 Engineering and Society Students then continue with their chosen specialist pathway <u>Aerospace Engineering with Pilot Studies (Design):</u> • UFMFE9-30-3 Structural Design & Inspection • UFMFSA-15-3 Systems Engineering And one of: • UFMFH7-15-3 Applied Aerodynamics • UFMFCH-15-3 Spaceflight <u>Aerospace Engineering with Pilot Studies (Systems):</u> • UFMFSA-15-3 Systems Engineering • UFMFL7-30-3 Avionics & Control 3 And one of: • UFMFH7-15-3 Applied Aerodynamics • UFMFCH-15-3 Spaceflight <u>Aerospace Engineering with Pilot Studies (Manufacturing)</u> • UFMFE9-30-3 Structural Design and Inspection • UFMFWF-15-3 Managing Advanced Manufacturing • UFMFC9-15-3 Machine Vision	**Interim Awards*:** BEng Aerospace Engineering with Pilot Studies BEng Aerospace Engineering with Pilot Studies (Design) BEng Aerospace Engineering with Pilot Studies (Systems) BEng Aerospace Engineering with Pilot Studies (Manufacturing) Credit requirements 300 credits, min. 60 credits at Level 3 and a further 100 credits at Level 2 or above and 280 credits at Level 1 or above. *provided the student has completed all the required modules and dependent on the route taken.

→ **GRADUATION for B.Eng. students.**

Part 4: Programme Structure: Part Time				
This structure diagram demonstrates the student journey from Entry through to Graduation for a **full time student**, including: level and credit requirements, interim award requirements • module diet, including compulsory and optional modules				
ENTRY	Year 1.1	Compulsory Modules UFMFN3-30-1 Design, Materials & Manufacturing UFMFJ9-30-1 Engineering Maths	Optional Modules	Interim Awards None available
	Year 1.2	Compulsory Modules UFMFH3-30-1 Stress & Dynamics UFMFF3-15-1 Energy & Thermodynamics From 2018/19 students take: UFMFDK-15-1 Pilot Studies and Aeronautics (Transitional structure for 2017/18 students take: UFMFDH-15-1 Introduction to Aeronautics)	Optional Modules	Interim Awards Certificate of Higher Education Aerospace Engineering
	Year 2.1	Compulsory Modules UFMFK9-15-2 Engineering Mathematics 2 UFMFHA-15-2 Project Management	Optional Modules <u>Aerospace Engineering (Design)</u> • UFMFD8-30-2 Design, Materials & CAD/CAM <u>Aerospace Engineering (Systems)</u> • UFMFB7-30-2 Aircraft Systems, Avionics & Control <u>Aerospace Engineering (Manufacturing)</u> • UFMFD8-30-2 Design, Materials & CAD/CAM	Interim Awards As stated at level 1.2

	Year 2.2	Compulsory Modules UFMFX6-15-2 Aero-Structures **From 2019/20 students take:** UFMFRK-15-2 Fundamental Aerodynamics UFMFFK-15-2 Flight (Transitional structure for 2017/18 and 2018/19 students take: UFMF9C-30-2 Pilot Studies and Aerodynamics)	Optional Modules Students must opt for one of the following three pathways: <u>Aerospace Engineering with Pilot Studies (Design)</u> • UFMFQA-15-2 Stress Analysis <u>Aerospace Engineering with Pilot Studies (Systems)</u> • UFMFR9-15-2 Mechatronics <u>Aerospace Engineering with Pilot Studies (Manufacturing)</u> • UFMFR9-15-2 Mechatronics	Interim Awards* Diploma of Higher Education Aerospace Engineering with Pilot Studies Diploma of Higher Education Aerospace Engineering with Pilot Studies (Design) Diploma of Higher Education Aerospace Engineering with Pilot Studies (Systems) Diploma of Higher Education Aerospace Engineering with Pilot Studies (Manufacturing)
	Year 3.1	Compulsory Modules UFMFW6-15-3 Aero-Propulsion	Optional Modules 15 credits from UFMFM7-15-3 Business Environment or UFMF89-15-3 Industrial Placement or UFMFCL-15-3 Engineering and Society Plus <u>Aerospace Engineering with Pilot Studies (Design)</u> • UFMFSA-15-3 Systems Engineering <u>Aerospace Engineering with Pilot Studies (Systems)</u> • UFMFSA-15-3 Systems Engineering <u>Aerospace Engineering with Pilot Studies (Manufacturing)</u> • UFMFWF-15-3 Managing Advanced Manufacturing	Interim Awards As stated at level 2.2

<table>
<tr>
<td rowspan="3"></td>
<td rowspan="3">level 3.2</td>
<td>Compulsory modules

UFMFX8-30-3 B.Eng. Individual Project

Note that UFMFY8-30-3 M.Eng. Individual Project Part A is also an accepted module on the programme such that any M.Eng. student requiring to stop at B.Eng. can have their dissertation accepted on this programme.</td>
<td rowspan="3">Optional Modules

Students then continue with their chosen specialist pathway

Aerospace Engineering with Pilot Studies (Design):

• UFMFE9-30-3 Structural Design & Inspection

And one of:
• UFMFH7-15-3 Applied Aerodynamics
• UFMFCH-15-3 Spaceflight

Aerospace Engineering with Pilot Studies (Systems):

• UFMFL7-30-3 Avionics & Control3

And one of:
• UFMFH7-15-3 Applied Aerodynamics
• UFMFCH-15-3 Spaceflight

Aerospace Engineering with Pilot Studies (Manufacturing)

• UFMFE9-30-3 Structural Design and Inspection
• UFMFC9-15-3 Machine Vision</td>
<td rowspan="3">Interim Awards*:

B.Eng. Aerospace Engineering with Pilot Studies

B.Eng. Aerospace Engineering with Pilot Studies (Design)

B.Eng. Aerospace Engineering with Pilot Studies (Systems)

B.Eng. Aerospace Engineering with Pilot Studies (Manufacturing)

*provided the student has completed all the required modules and dependent on the route taken.</td>
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GRADUATION for B.Eng. students.

Part 5: Entry Requirements
The university's minimum requirements for entry to a degree apply to this programme. In addition for entry to year 1 of the BEng(Hons) Aerospace Engineering degree, the tariff point requirement is normally 300 points. This should include the equivalent of A level Mathematics Grade C plus another science or technology subject. Equivalent qualifications include Scottish Highers, the European Baccalaureate, the International Baccalaureate; and other European and international qualifications which are nationally recognised. Students with a BTEC National Diploma must have passed Further Mathematics, and those with

Part 5: Entry Requirements

the 14 – 19 Diploma must also offer the Additional Specialised Learning in Mathematics.

For the University's general entry requirements please see http://www.uwe.ac.uk/study/entryReqs.shtml

Part 6: Assessment

The programme will adhere to the standard assessment regulations of the University as specified in the Academic Regulations and Procedures (http://acreg.uwe.ac.ukrf.asp). To be eligible for an award accredited by the Royal Aeronautical Society the Individual Project modules must be passed outright with no provision for condonation. (Academic Regulations G2.3R refers).

Part 7: Student Learning

Teaching, learning and assessment strategies to enable learning outcomes to be achieved and demonstrated

At UWE, Bristol there is a policy for a minimum average requirement of 12 hours/week contact time over the course of the full undergraduate programme. This contact time encompasses a range of face to face activities as described below. In addition a range of other learning activities will be embedded within the programme which, together with the contact time, will enable learning outcomes to be achieved and demonstrated.

Class Activities
The mode of delivery of a module is determined by its Module Leader, and typically involves a combination of one or more lectures, tutorials, laboratory classes, group activities and individual project work.

Academic Support
Academic advice and support is the responsibility of the staff delivering the module in question. Staff are expected to be available outside normal timetabled hours, either by appointment or during published "surgery" hours, in order to offer advice and guidance on matters relating to the material being taught and on its assessment.

Developing graduate skills
In year 1 students benefit from extra-curricular talks introducing them to the aerospace industry and the standards required of professional engineers. Year 2 provides extensive opportunities toward placement and career planning, including sessions from university careers and placements office and from industrial recruitment personnel toward application and CV writing, and good interview techniques. In Years 3 and 4 students engage with developing graduate skills through project work and their project supervisor.

PAL
The Peer Assisted Learning (PAL) scheme provides additional learning support for students by students. PAL leaders are recruited from the level 2, 3 and MEng Masters cohorts each year and are trained in both facilitating learning and study skills. PAL leaders support taught modules by taking on problem classes and some laboratory demonstration classes for the lower level students.

Mathematics Support
Additional support in mathematics outside of timetabled classes is available throughout the academic year via:
(vi) PAL sessions,

Part 7: Student Learning

(vii) the drop-in mathematics helpdesk, "espressomaths" which is open every day in social learning spaces.
(viii) the Mathematics Resource Centre which is accessible by students using their swipe card and has take-away leaflets, text books, module handbooks and reference material
(ix) on-line support and electronic learning resources such as that Maths 1st Aid Kit leaflets, HELM booklets and http://www.mathcentre.ac.uk/
(x) Mathematical software such as Maple (which students may download for home use) and Matlab.

Technology Enhanced Learning
All modules on the aerospace programme are available on the university's Virtual Learning Environment. Additionally:

- computer based e-assessment is implemented in a number of modules, so that students can take regular short tests with automated computer generated feedback.
- Recordings of some lectures (audio and video) are made available after classes via the university's Virtual Learning Environment and YouTube

Working Environment
Throughout the department there are areas for students to work together informally. A large, well-equipped project room is also provided during the weekdays with staff support. The Project room houses printing, computing, binding and scanning facilities, sells stationery, stocks learning materials, past dissertations, and contains the coursework hand-in desk.

Engineering Facilities
Students on Engineering programmes can access a suite of newly refurbished specialist laboratories for teaching demonstrations and supporting student projects including laboratories for Thermofluids, Structures, Materials, Dynamics, Mechatronics, Electronics and Electrical engineering. PCs with data acquisition hardware (and software for general experimental use) are set up next to all experimental rigs where data logging is required. A machine tool workshop is also available.

Computing Facilities
The Department offers specialised computing facilities alongside the general University and Faculty provisions. The specialist laboratories are equipped with specific software to support the Department's students in their taught programmes. Simulation and planning software are well catered for with industry-standard computer-aided design, computational fluid dynamics, finite element analysis, meshing, material and processes selection packages, and post-processing software. There is an extensive PC network including laboratories with high performance workstations and high resolution graphics. A high performance cluster is available for large-scale computing. Mathematical based software and a mathematics resource room are available. The Faculty ensures during term-time that the computer laboratories in N-block are available to students on extended opening hours including at weekends. The Faculty provides a user support Helpdesk.

Pastoral Care.
The Faculty offers pastoral care through its Student Advisers, a team of staff who provide comprehensive, full-time student support service on a drop-in basis or by appointment. The Adviser will, when necessary, advise the student to seek advice from other professional services including the University's Centre for Student Affairs or from members of academic staff. This support is supplemented by the Academic Personal tutor, the Award Leader and, through the student representatives to the Student-Staff Liaison Group committee.

Additional Features
For the aerospace students, the Induction programme includes team building exercises, and also some specific academic and faculty instruction for direct entrants (e.g. in computer packages). Second year students undertake a flight test course in UFMFKK-15-2 "Flight" where they can take in-flight measurements. This activity is combined with an assignment using the university

Part 7: Student Learning

flight simulator and with reference to aerospace theory. The presence of a flight test course within the degree structure in which students fly in a real aircraft is a requirement for accreditation with the RAeS.

Industrial expertise is also brought into the course through seminars from industrial visitors and in group projects. Some modules also have sponsored assignments from industry. Such opportunities provide the students with further industrial understanding and experience in applying their knowledge to a real industrial problem. Through the student individual project, there is the potential to involve industry and/or link to research ongoing in the Department.

The Placement Year

A placement year provides opportunities for real-world, industrially based final year projects. The student will in most cases be on a formal contract in which they are paid for their employment. He or she will have the opportunity to explore career possibilities, make new business contacts for the future and prepare for the final year at University. Students are responsible for finding their own placement, however, many opportunities are published through the University Placements Office, and the process of finding a placement is supported in year 2 of the Graduate Development Scheme. Once on placement, students retain access to the support network of the University and will be visited in their place of work at least once by a Visiting Tutor. Placement students gain credit for their work through submitting a portfolio, which reduces the amount of credit required to be taken in their final year by 15 credits.

Part 8: Reference Points and Benchmarks

Description of ***how*** the following reference points and benchmarks have been used in the design of the programme:

The reference points from the QAA academic infrastructure reports and other benchmarks are detailed in Part 1: Contextual Documentation for Validation. They include The QAA Framework for Higher Education Qualifications in England, Wales and Northern Ireland (2008) and the QAA Subject Benchmark Statement for Engineering (2010)

Subject reference points

Undergraduate engineering programmes must demonstrate through their teaching and assessment methods that graduates have reached the desired threshold level of each of the Output Criteria as specified in the UK-SPEC document Accreditation of Higher Education Programmes (www.engc.org.uk/ecukdocuments/internet/document%20library/UK-SPEC.pdf).
The UWE aerospace programme, including each subject pathway, is constructed to ensure it complies with the General and Specific Learning Outcomes, Methods of Assessment (EAB/ACC2/B) and Output Standards (EAB/ACC2/C).

The guidelines for the SEEC level descriptors are also closely followed in this programme. (SEEC Credit Level Descriptors for Further and Higher Education, January 2003)

UWE's Learning & Teaching Strategy has informed the Faculty's policy for the delivery of its programmes, whose main features are described in section 7.

The programme is also aligned with the requirements of the Royal Aeronautical Society and other professional engineering organisations that offer accreditation.

This specification provides a concise summary of the main features of the programme and the 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 learning outcomes, content and teaching, learning and assessment methods of individual modules can be found in module specifications, available on the University's website.